Document Control

Issue Date	Comments	Revisions	Revision #
3/3/99	Draft		
7/23/99	Draft 2		
12/28/99	Revisions to Configuration Computer and VDS Server per David Spinney; Change SVPU to video detection system processor Revise minimum sensitivity of video camera sensitivity Revise "configuration computer server" to "configuration computer system" in Measurement and Payment sections. Also change pay item description to "configuration computer hardware and software interface" Add rqmt. for integration into a TMS for VDS certification	937.2C 937.2D 937.2A 937.4H, 937.5E 937.3.06A	1
1/12/00	Project: CM-00TS(10) Ct. 1 Fulton County P.I. No. 713155 Project: CM-00TS(10) Ct. 2 DeKalb And Fulton County P.I. No. 713157		
2/3/00	Project: CM-056-1(57) Fulton County P.I. No. 721950		
3/23/00	Delete separate payment for horizontal wire, pullboxes, and electrical service pole Revise equipment submittal from 30 days from NTP to start of Demo Test #1 Add submittal rqmts and chart Revise mounting heights to 70' max.	937.4.A 937.1.03.B 937.1.03 937.1.01; 937.3.05.C.2	2
3/30/00	Revise mounting height to 70' (not 70' max)	937.3.05.C.2	
4/5/00	Delete reference to camera mounting height and distance from pavement	937.1.01; 937.3.05.C.2	3
6/13/00	Delete rqmt for test lab results for camera; add test lab results for processor. Modify to refer to acceptance, not "final" acceptance. Revise warranty start time (delete reference to partial acceptance).	937.1.03 937.3.05.A 937.3.07.A	4
9/5/00	Reduce days for Training Plan submittal, per SPCR 33R1	937.1.03.F	5
12/6/00	Add "calendar" days to liquidated damages; Remove "Days from NTP" from submittal table; submittals due at Demo Test #1.	937.3.06.B, 937.3.07.A; 937.1.03	6
12/6/00	Project: CM-285-1(360) DEKALB COUNTY P.I. NO. 713410		
2/9/01	Correct reference to Type 1 cabinet to Type A cabinet		7

Document Control

Issue Date	Comments	Revisions	Revision #
2/9/01	NAV01-051		1.0
2/14/01	Entered into CM Document Control		1.0
3/21/01	SCR # 187 SCR # 189	937.3.06.B 937.3.05.D.1.d	1.1
3/22/01	Revisions QA'd by Betsy Williams		2.0
3/14/01	Revisions to change hardware specific requirements, based on comments received from manufacturers and Department input. SCR #90	937.1.01; 937.1.03.A; 937.1.03.B; 937.1.03.C; 937.2.A; 937.2.B; 937.2.B.3.c; 937.2.B.3.d; 937.2.B.4; 937.2.B.5 (deleted); 937.2.C; 937.2.E.1; 937.2.E.3; 937.2.E.4; 937.2.F; 937.2.G; ; 937.2.H.1; 937.2.H.2; 937.3.05.A; 937.3.05.C; 937.4.E; 937.5.B	2.1
4/4/01	Revise based on CAR team comments. Replace Quality Assurance section with re-write by M. Demidovich. SCR #90	937.1; 937.1.01; 937.1.02.B; 937.1.03.C; 937.1.03.D; 937.2.A; 937.2.B; 937.2.C; 937.2.E.1; 937.2.F.1; 937.2.F.3.b; 937.3.05.A; 937.3.06	2.2
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9/24/02	Published to server		4.0
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10/9/03	Revised per SCR #402	Detail Drawing 937.1	5.1
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DEPARTMENT OF TRANSPORTATION
State of Georgia

SPECIAL PROVISION

PROJECT: [INSERT PROJECT NUMBER(S)]
[INSERT COUNTY NAME(S)] COUNTIES
P.I. NO. [INSERT P.I. NUMBER(S)]

SECTION 937 – VIDEO DETECTION SYSTEM

Section 937 - Video Detection System

The text included herein is written in the imperative mood (sentences often begin with commands). All commands and references in, or in connection with, the text in this document are written to imply **Contractor responsibility for action** unless otherwise specified.

General Description

This Work includes the procurement and installation of a video detection system (VDS) that is controllable from the NaviGAtor system.

The system is a data gathering system using the analysis of video images to detect, count, classify, sense speed, and determine other characteristics of motor vehicles and to generate alarms for certain abnormal conditions. Components comprising the VDS include, but are not limited to, camera image sensor(s), and video detection system processor. The Work also includes testing, training, warranties, and guarantees as designated in the Specifications.

The video detection system processors communicate, through an Ethernet interface and TCP/IP (transmission control protocol/Internet protocol) connection to multiple Traffic Control Central computers.

937.1.01 Definitions

Alarm: a function where output is triggered when an abnormal situation is detected (such as continuous presence on a detector or detection against the flow of traffic), used to warn NaviGAtor operators of wrong way vehicles or stopped vehicles.

Category I installation: a local site installation overlooking the roadway where the video camera sensor is mounted 30 ft (10 m) or higher above the roadway, when the image sensor is over or adjacent to the desired coverage area, and when the length of the detection area or field of view (FOV) is not greater than four (4) times the mounting height of the image sensor.

Category II installation: a local site installation that is greater than 10 ft (3 m) (horizontally) from the edge of the pavement. The video camera sensor is mounted at the height above the travel lanes and at the distance from the roadway as shown in the Plans.

Density: average flow divided by space mean speed expressed in vehicles/mile or vehicles/kilometer.

Flow Rate: vehicles per hour per lane.

Headway: average time interval in seconds between vehicles passing a fixed point along the roadway by lane or approach (user selectable).

Level of Service: an expression of the flow of traffic measured in levels A through F, as defined by the Highway Capacity Manual. Level of service (LOS) shall be calculated by the average speed or occupancy of the lane or approach (user selectable), with user-definable thresholds for each grade and the default being defined by the current edition of the Highway Capacity Manual.

Occupancy: individual lane occupancy measured in percent of time.

Speed: time mean and space mean vehicle speed in mph or km/h per lane or approach (user selectable).

Stopped vehicle: a vehicle on a shoulder that has not moved for a user-definable length of time.

Vehicle Classification: number of vehicles in each of at least three categories: 1) automobiles/vehicles less than 25 ft (7.6 m) long, 2) single unit trucks greater than 25 ft (7.6 m) long and less than 45 ft (13.7 m), and 3) tractor-trailer trucks longer than 45 ft (13.7 m).

Volume: number of vehicles detected during the specified time interval per lane or approach (user selectable).

937.1.02 Related References

A. Georgia Specifications

Section 150 – Traffic Control

Section 922 – Electrical Wire and Cable

Section 639 – Strain Poles for Overhead Sign and Signal Assemblies

Section 939 – Communications and Electronics Equipment

Section 940 – NaviGAtor Advanced Transportation Management System Integration

B. Referenced Documents

EIA-170A

FCC Part 15, Subpart J, Class A device requirements

Highway Capacity Manual (current edition)

Manual on Uniform Traffic Control Devices (current edition)

NEC 210-19 a., FPN No. 4

NEMA TS 1-1989 (R1994, R2000), Section 2.1.5.2, Section 2.1.12

NEMA TS1-1989 (R1994, R2000)

NEMA TS2-2003 Type 2, Type 170 and Type 179 standards

NEMA TS2-2003

NEMA 250 Type 4 enclosure standards

937.1.03 Submittals

The following chart provides the Contractor with an outline of the submittal requirements for the equipment and components for this pay item. This chart is to be used as a guide and does not relieve the Contractor from submitting additional information to form a complete submittal package.

Submit submittal data for all equipment, materials, test procedures, and routine maintenance procedures required for these items as required in these Specifications.

Section 937 Submittal Requirements							
Material	**Specification Reference**	**Catalog Cuts**	**Mfg. Spec.**	**Materials Cert.**	**Lab. Test Reports**	**Install. Proced.**	**Maint. Proced.**
Video Camera	937.2 A	X	X	X		X	X
Video Detection System Processor (All Types)	937.2 B	X	X	X	X	X	X
Central Computer	937.2 C	X	X			X	X
Cabinet Eqpt	937.2 E	X	X			X	

Submit to the Engineer for approval, six (6) copies of the manufacturer's descriptive literature (catalog cuts), technical data, operational documentation, service and maintenance documentation and all other materials required within these specifications.

Provide submittal data that is neat, legible, and orderly. Neatly organize each package of submittal data and separate by hardware item. Use the "Materials Certification Package Index and Transmittal Form", contained in Section 105.02 of the Special Provisions, for each pay item to document and list all material and components that are included in the submittal package. Any submittal data submitted without the Index/Transmittal form or that is incomplete will be rejected.

A. VDS Certification Document

Submit four copies of the VDS Certification Document to the Engineer (See Subsection 937.3.06.A). Include in the Certification Document the location of the existing system, the date the system became operational, the name of the government agency using the system, a contact name and phone number of a person responsible for monitoring the system, and a brief description of how the system operates, data the system generates and how the government agency uses the data. Include in the submittal catalog specification sheets of the individual components for approval.

B. VDS Items Certification

Provide six copies of complete and thorough submittal data for all components and materials of a VDS system at the same time the VDS Certification Document is submitted. Furnish the submittal data to the Engineer. Include in the submittal data complete technical and performance specifications on all hardware, materials and installation wiring/cabling to be performed at the VDS field site. Neatly organize each package of submittal data and separate by hardware item. Include an index of all submittal data documents given in the package. The index shall name each submittal data document, what video detection system component (including the associated 937 subsection) the document is submitted for, and the specific manufacturer model, part and revision number of the subject hardware or software item exactly as that item is proposed to be provided. Any submittal data document or documentary item that is not listed in the index will not be accepted for review. For each package of submittal data, address all of the components and materials necessary for a complete video detection system; separate submissions for individual components and materials are not permissible. Typical submittal data which is required for all video detection system components includes but is not limited to manufacturer's specifications, operating/maintenance/troubleshooting manuals, schematic wiring diagrams with detailed parts lists, materials lists and assembly drawings for the equipment cabinet assembly, and detailed warranty and guaranty information for each component.

C. Demonstration Tests #1 and #2

Submit four copies of the Test Plan to the Engineer at the beginning of Demonstration Test #1 (see Subsection 937.3.06.B).

For Demonstration Test #1 and #2, submit a written request to the Engineer for each test a minimum of 14 calendar days in advance of each desired demonstration test date. Allow the Engineer to adjust the proposed schedule of the demonstration tests by up to seven (7) calendar days, at no cost to the Department, to allow for availability of Department representatives.

D. System Acceptance Test Plan

Submit four copies of the System Acceptance Test schedule and plan to the Engineer at least 14 calendar days before the desired test date (see Subsection 937.3.06.C). Obtain approval from the Engineer of the System Acceptance Test Plan before beginning the System Acceptance Test.

Request in writing the acceptance test a minimum of 14 calendar days in advance of the desired test date. Allow the Engineer to adjust the proposed schedule of the acceptance test by up to seven (7) calendar days, at no cost to the Department, to allow for availability of Department representatives.

E. System Acceptance Test Report

Submit four copies of the System Acceptance Test Report to the Department within fourteen (14) calendar days of the completion of the test (see Subsection 937.3.06.C).

F. Training Plan

Prior to training, submit resume and references of instructor(s). Also submit an outline of the training course in a Training Plan. Submit the Training Plan within 90 days of Contract Notice-to-Proceed. Obtain approval of the Plan from the Engineer. Explain in detail the contents of the course and the time schedule of when the training will be given.

G. As-Built Documentation

Provide as-built documentation of the video camera sensor assembly, including but not limited to cabinet mounting location, power service point, power service conduit routing, cabinet location, and mounting height.

H. Cabinet Equipment

Submit materials submittal data for all materials and hardware necessary for cabling, conduit, and power service. These items include but are not limited to wire and conduit materials; surge suppression and termination description and performance specifications; and all miscellaneous hardware and accessories.

937.2 Materials

A. Video Camera Sensor

As a minimum, meet the following requirements for each video camera sensor installation Use a video camera sensor that is compatible with the video detection system processor and meets the following requirements:

Lens: Equip the video camera sensor with an 8-48 mm motor driven variable focal length lens.

Input power: 120 VAC, 60 Hz. Size power conductors from the power source to the camera input so that no more than a 3% voltage drop is experienced (NEC 210-19 a., FPN No. 4). Include a provision at the rear of the camera enclosure for waterproof connection of power and video signal cables.

Electromagnetic interference (EMI): Apply FCC Part 15, Subpart J, Class A device requirements for the video camera sensor and associated connected equipment in their installed condition.

Video camera sensor enclosure: Install the video camera sensor in a light colored enclosure to limit solar heating. Meet NEMA 250 Type 4 enclosure standards for the enclosure and pressurize the enclosure to at least 5 psi ± 1 psi (35 kPa ± 7 kPa) to prevent sand, dirt, dust, salt, and water from entering. Provide a sun shield visor on the front of the enclosure which is sufficiently adjustable to divert water away from the video camera sensor lens and also prevent direct sunlight from entering the iris when mounted in its installed location. Install the sun shield so that it does not impede operation or performance accuracy of the video camera sensor or require removal of the video camera sensor enclosure for adjustment. Use an enclosure that allows the video camera sensor horizon to be rotated in the field during installation.

Weight: 10 lbs. (4.5 kg) maximum with mount, shield, and camera.

Mounting: Ensure that the video camera sensor assembly and associated enclosure and sun shield are capable of being mounted without special tools, fixtures, or holding devices. The video camera sensor horizon shall be adjustable without removing the camera, mounting bracket and enclosure, or sun shield.

B. Video Detection System Processor

1. Mounting

Ensure that the video detection system processor is rack mountable in a standard 19-inch rack assembly space conforming to EIA Standard RS-310-C, 1982, attaches to both sides of the rack , is not more than 10 inches (254 mm) deep, and is not more than 7 inches (178 mm) high. The video detection system processor shall be designed for mounting in an enclosed cabinet without blower fans and mounting without insulation from other electronic devices such as power supplies, communications equipment, etc. The video detection system shall meet NEMA TS-2 temperature requirements.

2. Electrical

Power the video detection system processor by 120 VAC, 60 Hz, single phase, and draw a maximum of 1.0 A. Size power conductors from the power source for the video detection system processor input so that no more than a 3% voltage drop is experienced (NEC 210-19 a., FPN No. 4). The video detection system processor shall have transient protection that meets the requirements of NEMA TS1-1989 (R1994) and NEMA TS2-1992 standards. Power to the video detection system processor shall be from the cabinet equipment outlet.

PerformTCP/IP communications to the control center through an Ethernet port for downloading traffic data stored in non-volatile memory. The port connector shall be on the front of the video detection system processor for easy access.

Ensure that the video detection system processor software is stored in non-volatile memory within the video detection system processor. Perform software updates through the Ethernet port.

The video detection system processor front panel shall include a visual display of the status of each video input and the status of the video detection system processor in general. Indicators shall display, at a minimum, the status of video detection system processor communications, the status of the video detection system processor and whether or not each video camera sensor is actively detecting.

Include an Embedded HTTP Server in the video detection system processor. The Embedded HTTP Server shall allow a remote user with a standard web browser to gain remote access, collect data, control, and configure the VDS.

a. Video Detection System Processor Type A

Provide two (2) RS-170A black and white composite video inputs on the video detection system processor such that signals from up to two (2) video camera sensors or other synchronous or non-synchronous video sources can be processed in real time. Use BNC connectors on the front or back of the video detection system processor for all video inputs. Use a BNC connector on the front or back of the video detection system processor for video output.

b. Video Detection System Processor Type B

Provide four (4) RS-170A black and white composite video inputs on the video detection system processor such that signals from up to four (4) video camera sensors or other synchronous or non-synchronous video sources can be processed in real time. Use BNC connectors on the front or back of the video detection system processor for all video inputs. Use a BNC connector on the front or back of the video detection system processor for video output.

3. Remote Data Collection and Storage

a. Detection Parameters: Provide a video detection system processor that independently computes the following traffic parameter data, as defined in Section 937.1.01, in each lane of detection:

- Volume
- Speed
- Occupancy

- Flow Rate
- Headway
- Density
- Level of Service
- Vehicle Classification
- Alarms

b. Interval Duration: Provide a video detection system processor capable of computing and storing all traffic parameters by lane in user selectable time intervals of 10, 20, or 30 seconds, and 1 minute.

c. Memory: Store all traffic parameter data in non-volatile memory within the video detection system processor. This data shall be capable of being retrieved using the NaviGAtor Server or a web browser though the Embedded HTTP Server at a later time. Provide non-volatile memory capable of storing all detector data for seven days.

d. Data Retrieval: Transfer traffic parameter data from the video detection system processor's non-volatile memory to the NaviGAtor Server via the Ethernet or local communications port.

4. Operation During Detector Configuration

a. Simultaneous Operation: Display individual vehicle actuations, in real time as they occur, on the web browser display connected to the Embedded HTTP Server. Updating of other video detection system processors connected to the NaviGAtor server cannot be delayed while configuration is occurring. Continue to transmit data from other video detection system processors to the NaviGAtor server at a minimum rate of once every twenty (20) seconds.

b. Storage Format: Store collected traffic parameter data that is retrieved from the video detection system processor in readily accessible ASCII format. Provide software on the Embedded HTTP Server that gives a means for retrieving, reporting, and filing the collected traffic parameter data.

c. Data Display Format: Allow for displaying the collected traffic parameter data of the last complete time interval in numeric format on the Embedded HTTP Server. Accomplish selection of the data to be viewed by means of a web browser.

d. Image Capture: Allow still image capture (snapshot) from all of the video detection system processor's active video inputs and provide for downloading the image to a NaviGAtor server for display or storage as a picture file. Capture and transmit the still image in JPEG format to the NaviGAtor Server at 15 second intervals.

e. Communications: Perform communications to video detection system processors for detector configuration via the Ethernet port.

f. The VDS Embedded HTTP Server shall include multilevel password protection for a minimum of 10 users. The VDS shall also keep an access log that records user and time of access.

C. Cabinet Equipment

1. Wiring, Conductors and Terminal Blocks

Use terminal blocks and strips with voltage and current ratings greater than the voltage and current ratings of the wires that are terminated on the blocks or strips. Use quick-clamp type wire terminals (Cinch QC-1 or approved equivalent) optionally on TB10. TB10 shall have at least 8 terminal positions (see Detail Drawing 937.2). Do not use compression-type or tubular clamp terminal blocks except for service entrance block SE. Do not use spade lug terminals for any terminal block.

2. Surge Suppression

For surge suppressor SS16, use a panel mount fast response (<5 nanosecond) MOV surge suppressor and thermal fuse components (EDCO FAS-120AC or approved equivalent).

For surge suppressors SS17-SS22, use a shielded solid-state surge suppressor with 6-volt line-to-ground clamping and BNC coaxial connectors (EDCO CX06-BNCY or approved equivalent).

D. System Functional Requirements

Certain major functional capabilities are required for use of particular VDS equipment and software in addition to the functional output requirements for the VDS system as a whole. As a minimum, provide these features and capabilities that directly affect the overall operational performance and goals of the NaviGAtor System.

1. Functional Detection

Provide a VDS that performs the following functions as defined in Section 937.1.01:

- Vehicle counting
- Vehicle speed measurement
- Vehicle classification
- Per vehicle data acquisition
- Per lane data acquisition

2. Functional Output Parameters

Provide a VDS that outputs the following functional detection parameters on a per lane basis (with the exception of level of service): volume, speed, occupancy, flow rate, headway, density, level of service, vehicle classification, and alarm.

3. VDS Software

Include in the VDS, software provisions for setup, control, and alarm reporting of multiple abnormal traffic conditions and stopped-vehicle detection zones over a wide area from multiple locations. These capabilities directly represent the tools necessary for the Department to improve traffic flow, detect and respond to unusual traffic conditions in a timely manner, and to respond to periodic major traffic-related events. Provide VDS software that allows NaviGAtor server reconnection without the necessity of a manual restart of the VDS process. Provide VDS software packages that are capable of communicating simultaneously with multiple NaviGAtor Server processes.

4. Video Detection System Processor Equipment and Software

Provide video detection system processor equipment that gives an operator the capability to define multiple detection zones within each individual video camera sensor's field of view at the video detection system processor via the configuration software. Provide flexibility in definition of the zones and response and processing time of each zone..

E. System Technical Requirements

Follow these minimum requirements for system equipment and software that monitors vehicles on a roadway via processing of video images and provides detector outputs to NaviGAtor.

1. System Hardware

Provide the system equipment with multiple video detection system processors, each having the capability to accept input from at least four video sources and transfer data from those inputs to NaviGAtor server.

2. System Software

Provide a system capable of detecting and storing discrete lane data for either approaching or receding vehicles in at least 7 lanes plus 2 shoulder/emergency lanes. Provide software with the capability to define detectors through interactive graphics by placing lines and/or boxes in each video camera image locally and remotely through a web browser. Allow the user to redefine previously defined detection zones. Ensure that the video detection system processor calculates traffic parameters as required in Sections 937.1.01 and 937.3.06.D in real-time and provides local non-volatile data storage for later downloading

and analysis. Provide one detector configuration GUI that supports all models and versions of the video detection system processors supplied under this Contract.

3. Real-Time Detection

a. Video Sources: Provide a video detection system processor capable of simultaneously processing data and images from at least four (4) video inputs.

b. Number of Zones: Ensure that the video detection system processor is able to collect the full range of data as defined in Sections 937.1.01 and 937.3.06.D in each of at least seven lanes and presence and alarm data as defined in Section 937.1.01 and 937.3.06.D in two shoulders/emergency lanes within the FOV of each video camera sensor.

c. Detector Functions: Allow different detector types to be selectable locally and remotely via Embedded HTTP server through a web browser. At a minimum the detectors shall calculate the parameters defined in Subsection 937.3.06.D. Provide accuracy as defined in Subsection 937.3.06.D. Report processed information from the video detection system processor by individual lane.

d. Autonomous Detection: Use the video detection system processor to compute traffic parameters and store them in non-volatile memory without a continuous connection to a NaviGAtor Server. The video detection system processor shall then detect vehicles as a stand-alone unit, calculate traffic parameters in real-time, and store traffic parameters in its own non-volatile memory.

e. Detection Compensation: Ensure that the video detection system processor is capable of compensating for camera movement attributable to temperature effects, wind shifting, pole sway, pole expansion, or vibration of the mounting when attached to bridges or other structures.

F. Programming Requirements

1. Detection Zone Placement

Allow vehicle detection zones to be placed anywhere within the field of view of the video camera sensors. Detection zones shall be lines or boxes drawn in each visible lane or area of desired detection. Provide the user the ability to assign logical functions such as AND, OR, and NAND to one detector or a group of detectors.

2. Detection Zone Programming

a. Detection Zone Placement and Manipulation: Provide remote programming by means of an Embedded HTTP Server to allow the user by means of a web browser to draw detections zones with a mouse interface. Ensure that the computer's monitor can display the detection zones superimposed on the video camera sensor's images. For local programming, provide a means for drawing detection zones through direct computer and monitor connection to the video detection system processor. Ensure that the monitor can display the detection zones superimposed on the video camera sensor's images.

   Allow the user to create detection zones of varying size and shape to allow best coverage of the viewable roadway lanes, ramps, and shoulders. Once drawn, save all the detection zones in a particular video camera sensor image as a detector configuration file on the NaviGAtor Server for immediate or future downloading to the video detection system processor. Allow the user to retrieve the currently active detector configuration file from the video detection system processor.

b. Detection Zone Editing: Allow the user to edit existing detector configuration files.

c. Confirmation: When viewing vehicle actuations in real time on the Embedded HTTP Server by means of a web browser, make each detection zone visibly indicate the passage or presence of each vehicle detected by that particular zone.

G. Environmental

1. Video Detection System Processor

Provide a video detection system processor that operates reliably in a typical roadside traffic cabinet environment. Provide internal cabinet equipment and a video detection system processor that meet the environmental requirements of NEMA TS1-1989 (R1994).

2. Video Camera Sensor

a. Operating ambient temperature range: -30°F to 140°F (-34°C to 60°C). Additionally, include a heater to prevent the formation of ice and condensation in cold weather. Do not allow the heater to interfere with the operation of the video camera sensor electronics, or cause interference with the video signal.

b. Humidity: 5-95% humidity per NEMA TS1-1989 (R1994), Section 2.1.5.2.

c. Vibration: Do not allow vibration to impair performance when the camera is mounted on 96 ft (29 m) or shorter pole. Provide a video camera sensor and enclosure that maintains its functional capability and physical integrity when subjected to a vibration of 5 to 30 Hz up to 0.5 gravity applied to each of three mutually perpendicular axes (NEMA TS1-1989(R1994), Section 2.1.12).

d. Shock: Ensure the video camera sensor & enclosure can withstand a 10G±1G shock. Neither permanent physical deformation nor inoperability of the video camera sensor and enclosure can be sustained as a result from this shock level.

e. Acoustic Noise: Provide a video camera sensor and enclosure that can withstand 150 dB for 30 minutes continuously, with no reduction in function or accuracy.

937.2.02 Delivery, Storage, and Handling

Not applicable

937.3 Construction Requirements

937.3.01 Personnel

Provide instructors for training that are qualified in their respective field as determined by the Engineer. Obtain approval of the instructor(s) from the Engineer.

937.3.02 Equipment

Not applicable

937.3.03 Preparation

Not applicable

937.3.04 Fabrication

Use a maximum of two conductors on quick-clamp type terminals for the cabinet equipment. (Terminals are described in Subsection 937.2.C.1) When using fork terminals crimp them with a calibrated ratchet tools; install a maximum of two fork terminals at a given screw terminal position. Protect all conductors and terminals that could be hazardous to maintenance personnel with suitable insulating material. The insulating material shall be easily removed by hand for access to the conductors and terminals.

937.3.05 Construction

A. Installation

Install all video camera sensors, video detection system processors, and associated enclosures and equipment at the locations specified in the Plans. Install all rack-mounted equipment with one rack unit space between adjacent equipment. Make all necessary adjustments and modifications to the total VDS system prior to obtaining TMC recommendation for system acceptance.

Apply for, obtain and pay for all utility services and pole attachment permits that are necessary for the VDS installation and operation as required in the Plans. Maintain these utility services until acceptance of the VDS. Upon acceptance of the VDS,

make an orderly and uninterrupted transfer of these services and permits to the maintaining agency that will be responsible for subsequent maintenance and operation.

B. Functional Output Protocol

Use a communication protocol that is network-independent and allows communication with the GDOT NaviGAtor server through a high-level TCP/IP network protocol interface. The GDOT NaviGAtor VDS application shall be able to open up more than one connection with the VDS (e.g., open one connection to perform real-time video detection system processor requests, and open another connection to receive polled data from the VDS). Ensure that the VDS can process polling requests from the NaviGAtor Server to maintain a minimum 20 second polling cycle which contains the full complement of detection parameters described in Subsection 937.3.06.D. The VDS shall, in the event of any disconnection between NaviGAtor Server, provide error handling capability for automatic reconnection between NaviGAtor Server and VDS without manual intervention.

C. Camera Sensor Operating Locations

Adjust the video camera sensor lens to match the width of the road and minimize lane vehicle occlusion. Mount the camera at the top of the specified pole or structure for that location as shown on the plans.

D. Cabinet Equipment

1. General

a. Wiring, Conductors and Terminal Blocks: Use stranded copper for all conductors, including those in jacketed cables, except for earth ground conductors, which may be solid copper. Neatly arrange all wiring, firmly lace or bundle it, and mechanically secure the wiring without the use of adhesive fasteners. Route and secure all wiring and cabling to avoid sharp edges and to avoid conflicts with other equipment or cabling. Route camera control wiring, and 120 VAC power wiring separately. Terminate all wiring on a terminal block, strip, bussbar, or device clamp or lug; do not splice any wiring. Use a minimum #12 AWG for all conductors of 120 VAC circuits.

   Label coaxial cables for VDS cameras between SS17-SS22 and the VDS video input “CX” where the “X” indicates the surge suppressor identifier (e.g., cable C9 connected to SS17, cable C10 connected to SS18.)

   Number all terminal blocks, terminal strips, circuit breakers and bussbar breakers and have each item and each terminal position numbered and named according to function as shown in the “quoted labels” in the Detail Drawings. Label terminal blocks, terminal strips, circuit breakers and bussbars with silk-screened lettering on the mounting panel.

b. Surge Suppression: Protect all copper wiring and cabling entering the cabinet housing, except for the earth ground conductor, by surge suppression devices as specified. Terminate all wiring between cabinet devices and the transient surge suppressors, except for the video signal coaxial feed, on terminal strips. Use a minimum #16 AWG grounding of each surge suppression device, or larger if recommended by the surge suppression device manufacturer. Use insulated green wire and connect the ground wire directly to the ground bussbar. Do not “daisy chain” with the grounding wires of other devices including other surge suppressors. Dress and route grounding wires separately from all other cabinet wiring. Install grounding wires with the absolute minimum length possible between the suppressor and the ground bussbar. Label all surge suppressors with silk-screened lettering on the mounting panel.

   Use minimum #18 AWG insulated black wiring between the surge suppression device sockets and the terminal blocks for the protected circuits.

   Furnish and install a surge suppressor (SS17 through SS22 as required) for each video signal coaxial line. For each cabinet housing, include surge suppressor SS16 for the VDS camera power lines installed on TB2.

c. Component Installation: Fasten all components of the cabinet assembly to be mounted on cabinet side panels with hex-head or phillips-head machine screws. Install the screws into tapped and threaded holes in the panels. These components include but are not limited to terminal blocks, bussbars, panel and socket mounted surge suppressors, accessory and equipment outlets, and DC power supply chassis. Fasten all other cabinet components with hex-head or phillips-head machine screws insulated with nuts (with locking washer or insert) or into tapped and threaded holes. All fastener heads and nuts (when used) shall be fully accessible within a complete cabinet assembly, and any component shall be removable without requiring removal of other components, panels, or mounting rails. Do not use self-tapping or self-threading fasteners.

2. Type D Cabinet Equipment

Install cabinet equipment as shown in Detail Drawing 937.1

E. Cables, Conduit and Power Service

Furnish and install electrical cables used for video, control, communications signaling and power supply as shown in the Detail Drawings. Do not splice any cable, shield or conductor used for video, control, communications signaling, or power supply. Identify all conductors of all cables by color and number. Identify the conductor function in as-built documentation included in the cabinet documentation (see 937.3.05.F). Terminate cable used for video signaling in BNC connectors. After terminating and dressing the cables in the cabinet, neatly coil and store a minimum of 2 ft (0.6 m) of cable slack in the bottom of the cabinet. Cut unused conductors to a length that can reach any appropriate terminal. Bend back unused conductors over their outer jackets and individually tape them.

Provide electrical cables for video, communications signaling and power supply between the cabinet and the device as required below and install them as shown in the Detail Drawings.

Beginning at individual video camera sensors, carry video signals from the camera to the pole-mounted junction/splice cabinet via coaxial cable to the video detection system processor located in the field cabinet. Transmit the vehicle traffic data from the video detection system processor to a traffic control center via the Ethernet network system.

Install cabling inside new hollow metal or concrete support poles unless otherwise specified. Use weather heads on all nipple and conduit openings. Neatly install and route cabling to minimize movement in the wind and chafing against the pole, device or bracket. Form a drip loop at the weather head and route cabling to minimize water entry into the cable connector.

F. As-Built Drawings

Furnish an as-built cabinet wiring diagram, identified by location, for each VDS cabinet. Include all wiring, cabling, connections, and camera mounting height. Place all documentation in a weatherproof holder in the cabinet.

937.3.06 Quality Acceptance

A. Certification

Within ninety (90) days after the issuance of the Notice to Proceed, certify that the proposed product has been sold, installed, integrated with a centralized transportation management system, and successfully operated within the last twenty-four (24) months. Submit a system for certification that consists of non-intersection applications of a minimum ten (10) video camera sensors and three (3) video detection system processors. Include in the Certification Document the requirements specified in Subsection 937.1.03.A. TMC staff will verify the information provided by the Contractor, and if successful, will issue a letter stating approval of the Certification to the Contractor (via the GDOT project engineer).

B. Software/Protocol Development

Within 90 days following Notice to Proceed, provide the Department the Application Programming Interface (API) protocol of the VDS. Liquidated damages in the amount of six hundred dollars ($600) will be assessed each day after the 90th day if the protocol is not received by the Department.

The Department will write the required client software for the NaviGAtor system to accept the data from the VDS and verify the ability to receive the required data in an acceptable form and in the required polling times. The Department will complete the client software within 90 days of receiving the protocol information from the Contractor.

After the Department notifies the Contractor that it has completed the client software development, the Department will provide software expertise for ten (10) consecutive working days to modify and debug the API if necessary. Should the API not be operationally acceptable at the end of this ten-day period, liquidated damages in the amount of six hundred dollars ($600) per day will be assessed until the Department deems the interface acceptable.

The Department will notify the Contractor once the API has been deemed operationally acceptable. At this point, the next phase of testing may commence.

C. Demonstration Test #1

Following receipt of the certification verification letter, demonstrate and operate a test system. Do not begin the test until approval of the submittal data outlined in Section 937.1.03 for components and materials has been received from the Department. Demonstrate system equipment and software (or subcomponents) and verify operational performance on-site in the presence of GDOT TMC representatives. Include in the demonstration both Category I- and Category II-type field installations. Perform this demonstration test for a minimum of 30 days, commencing on a date specified by the Department. Perform this demonstration test using equipment and software exactly as presented in the submittal data for the product. Perform the demonstration tests using the equipment and software (or sub-components) that will be installed.

In this phase of testing, demonstrate the successful transmittal of video from the video camera sensor to the video detection system processor and the subsequent transmittal of freeway traffic data from the video detection system processor to the NaviGAtor server and to a traffic control center workstation using a web browser. Perform this test over existing GDOT communications/data links under weather conditions encountered at the test site.

Begin no test on any Georgia or Federal holiday.

Test Setup Procedures

- The Department will select two existing system cameras for use in this test; a Category I camera (located over the lanes of travel) and a Category II camera (located more than 10 ft (3 m) off the edge of pavement).

- Use the video signals from the selected existing GDOT cameras for the test. The Department will advise the Contractor of the location of this field cabinet. This field cabinet will be the setup location for the field portion of Demonstration Test #1.

- Install one (1) video detection system processor in the field cabinet as directed by TMC personnel.

- With TMC personnel present, locate the coaxial video cables that correspond to the two selected cameras. For each selected camera, remove the cable from the existing video detection system processor input and split the signal so that one video signal can be placed back into the existing video detection system processor, and two additional cables with the same video signal are available for the test. During the test, maintain all previously existing functionality of video detection on the two selected cameras. Amplify the video signal if necessary.

- Connect the two additional coaxial video cables from the Category I camera to the video detection system processor. Connect the two additional coaxial video cables from the Category II camera to the video detection system processor. This setup simulates a fully-loaded processor with four incoming video signals.

- Connect the video detection system processor to an available port, as directed by GDOT, on the cabinet Field (Ethernet) Switch. In test documentation, note which port is used.

- From the traffic control center, remotely configure the video detection system processor to detect traffic in each of seven (7) travel lanes and two shoulders. Collect the full range of traffic parameters required in section 937.2.B.3.a for the seven travel lanes, and configure presence and stopped vehicle detectors only for the two shoulders. Configure these traffic detectors, in the presence of TMC personnel, on each of the four video inputs.

- NOTE: If there are less than seven (7) travel lanes visible on the given video camera sensor image, configure two detection zones in a lane as many times as necessary to simulate detectors in seven (7) lanes. Similarly, if there is only one shoulder present in the image, configure two shoulder detectors on the one visible shoulder. There must be a minimum of seven (7) complete, full-range traffic data collection detectors plus two (2) shoulder/presence detectors configured in all eight video inputs in order for the test to proceed.

- Once all the detectors have been configured on all camera inputs, commence the collection and transmittal of data. Use a traffic control center workstation with a web browser to show all of the incoming traffic data every 20 seconds. Perform this step in the presence of TMC personnel.

- Prepare a single-page log spreadsheet for TMC personnel to use to monitor the progress of the test. At a minimum, use the following column headings on the spreadsheet:

  DATE WORKING? INITIALS

- Provide at least 30 rows on the spreadsheet to correspond to the 30 days of the test. TMC personnel will monitor the test each day and note/witness whether the equipment is working or not.

- To test the ability of the system to automatically reconnect after loss of communications, simulate a communications break or loss on the first day of the test. Perform this by physically disconnecting the NaviGAtor server from the network at the traffic control center. Leave the cable unplugged for a minimum of 60 seconds. Reconnect the cable. The system must reconnect automatically (with no user intervention) and resume collection of traffic data within 2 minutes.

- Following completion of the 30-day test, leave the equipment in place use in Demonstration Test #2.

D. Accuracy Test

This phase of testing involves accuracy of the video detection system. Each of the parameters described in Section 937.3.06.D.2 will be tested for specification adherence.

1. Test Procedures

- Record on video tape eight hours of traffic video from each of the two cameras used in Demonstration Test #1. Ensure that an accurate date- and time-stamp appears on the recorded image at all times. Record the following hours of traffic video:

- 6:00 AM through 10:00 AM on a weekday morning

- 5:00 pm through 9:00 PM on a weekday evening

- (In May, June, July or August, use 6:00 PM to 10:00 PM for evening times)

- Record no video on a Georgia or Federal holiday.

- Record the video using a standard VHS video cassette recorder (provided by the Contractor). Ensure that data is being collected and stored by the video detection system processor for the time periods that are being video recorded. Ensure that data, once archived, can be retrieved in fifteen (15) minute intervals or increments. It is not necessary to store each 20-second interval of data for this test.

- Provide four completed video tapes to TMC personnel, arranged as follows:

  Tape 1: morning video from Category I camera

  Tape 2: evening video from Category I camera

  Tape 3: morning video from Category II camera

  Tape 4: evening video from Category II camera

- Label each tape with the project number, camera ID, date and hours of recording.

- Following completion of recording, return to the traffic control center and upload and compile traffic data from the date and time periods matching the recordings. Perform this step in the presence of TMC personnel. Create organized spreadsheets containing the traffic data from the two video camera sensors being tested. Organize the data in 15-minute groupings of data, with each individual lane of traffic in a separate column on the spreadsheet (accuracy requirements are tested by lane, not by camera sensor location as a whole). Provide two separate spreadsheets, or spreadsheet tabs – one with Category I camera sensor traffic data and the other with Category II camera sensor traffic data. Label clearly. Provide only the data that corresponds to the hours of the video recordings.

- TMC personnel will verify accuracy of the system using the above provided video tapes and spreadsheets by manually counting the vehicles on the video by lane and comparing those counts to the collected traffic data provided in the spreadsheet. TMC personnel will check accuracy to ensure the product meets the below requirements.

2. Accuracy requirements

The following specified accuracies are stated as the minimum acceptable values. Provide detection accuracy of these values or better.

a. Volume: For the Category I location, the volume (count) of vehicles in each lane collected by the video detection system must be within (+/-) five percent (5%) of the manually counted volume for that lane. For the Category II location, the volume (count) of vehicles in each lane collected by the video detection system must be within (+/-) ten percent (10%) of the manually counted volume for that lane. A minimum of three hundred (300) vehicles must be used as a sample size in each lane for volume counting accuracy checking. Each of the seven lanes will be individually tested for accuracy. For instances in which a vehicle is significantly occluded (hidden) by a vehicle in another lane, do not use that vehicle in the calculation of the volume counting accuracy test. For purposes of this test, "significant occlusion" is defined as a vehicle that is more than 50% hidden by the other vehicle.

b. Vehicle Classification: For both the Category I and II locations, at least eighty percent (80%) of the vehicles must be correctly classified by the system into one of three bins (categories). A minimum of 200 vehicles must be used as a sample size in each lane for the classification portion of the accuracy test. The tester (TMC personnel) will count and classify one lane of traffic at a time using the video tape. The tester will classify the vehicles into cars, light trucks or tractor trailers (based on length). This will be done in each of the seven travel lanes. The manually collected data will be compared to the data collected by the system and the percent error will be calculated.

c. Stopped Vehicle Alarms: For both the Category I and II locations, detect at least 95% of all stopped vehicles that stop on the shoulder detectors. Do not use the video tape for this portion of the accuracy testing. TMC testers will send a test vehicle to the two sites and purposefully stop a vehicle on the shoulder, at the location of the detectors, as confirmed via radio to TMC personnel. Personnel at the TMC viewing the detectors on the NaviGAtor server will verify and note whether the system detected the presence of the stopped vehicle. Perform this test twenty (20) times for each camera location.

d. Speed: For Category I locations, provide an average vehicle speed measurement within 10% (+/-) of actual speeds. For Category II locations, provide an average speed measurement within 15% (+/-) of actual speeds. Provide these levels of accuracies for traffic traveling between 10 and 75 mph (16 and 120 km/h). Provide these levels of accuracy during both day and night conditions. TMC personnel testing for these accuracies will use either radar detectors or probe vehicles, at their discretion, to conduct this portion of the accuracy testing. Accuracy checking data for speed are to be based on the average speed of all the lanes in a camera's field of view, not on a lane-by-lane or vehicle-by-vehicle basis.

e. Other parameters (Occupancy, Flow Rate, Headway, Density, Level of Service): If the measurements of 1) and 4) above fall within acceptable specified limits of accuracy, the remaining traffic parameters will be analyzed by TMC personnel to determine that they have been calculated and reported correctly. No vehicle-by-vehicle study will be performed for these parameters. Provide TMC personnel with the formulas/algorithms used by the system to calculate these remaining traffic parameters. If the formulas/algorithms are correct and the system has passed the volume and speed accuracy tests, the system will be deemed to have passed the accuracy test for occupancy, flow rate, headway, density, and level of service.

E. Demonstration Test #2

Using the test equipment as set up in Demonstration Test #1, expand the test to include the data link between the VDS and the NaviGAtor Server. Request to view the commencement of this test if desired.

During this phase of testing, the Department will determine if the traffic data is being received from the VDS in the proper format and at the require polling intervals by NaviGAtor Server. Any failure of this test that is attributable to the API protocol information as provided in Section 937.3.06.B, or attributable to the VDS, will constitute failure of the test. If the test fails, make the necessary API corrections and resume the test within five (5) working days. If Demonstration Test #2 fails a second time, liquidated damages in the amount of six hundred dollars ($600) per day will be assessed until the test is completed successfully. If the test is not completed successfully within thirty (30) days of the second failure, the video detection system will be rejected by the Department.

The Department will notify the Contractor upon successful completion of Demonstration Test #2.

F. Post-Installation Acceptance Test

Perform this test after all components of the system have been installed. Perform this test under the observation of TMC personnel. This test must be passed for the Department to accept the video detection system installation. Perform the test for a minimum of thirty (30) days, commencing on a date specified by the Department.

Begin no test on a Georgia or Federal holiday.

Test Procedures

- Ensure that the video detection system installation is complete and that all detectors have been configured for all video camera sensors. Ensure that the Department has configured the client application at the control center to recognize the new processors prior to beginning the test.

- The Department will select ten percent (10%) of the Category I locations and ten percent (10%) of the category II locations at random for this test. At least one camera selected for the test will be a ramp camera (camera that detects ramp traffic).

- To begin the test, ensure that all data elements from all processors in the project are flowing correctly into the NaviGAtor system. Check this by viewing the incoming data at the NaviGAtor Server in the presence of TMC personnel at the control center. TMC personnel must concur with any declaration that all data is flowing into the system. Correct any deficiencies at this point before proceeding with this test.

- After it has been determined that data from all processors is flowing into the NaviGAtor system, begin fully testing the cameras selected by the Department for this test. The full post-installation acceptance test consists of the same accuracy testing as defined in Section 937.3.06.D. Collect recorded video (eight hours - 4 morning and 4 evening) from each camera site and turn the video tapes over to the TMC personnel for their use in checking accuracy. TMC personnel will use the same minimum number of vehicles for the sample sizes.

- TMC personnel will issue a report with the accuracy results within seven (7) working days of the completion of the testing. Correct any noted specification violations in regards to accuracy levels and retest within five (5) working days. To retest, provide a new video tape of the corrected camera sensor to TMC personnel, who will check for accuracy again.

- Once all selected cameras have passed the post-installation acceptance test, TMC personnel will issue a letter to the GDOT project engineer stating such fact.

937.3.07 Contractor Warranty and Maintenance

A. Warranty

Provide the complete video detection system equipment and software with a minimum (2) year warranty. Begin the two (2) year warranty period when the project has received final acceptance from the Department OR after requesting and receiving the Department's acceptance of the VDS system. When the Department detects a failure of any component of the system during the warranty period, the Department will notify the Contractor in writing of the problem. Correct the problem within seven calendar days after receiving the notification or else pay liquidated damages in the amount of $600 per calendar day until the problem is corrected. Repair or replace the defective device(s) and ensure that all vehicle detection affected by the problem is brought within original accuracy parameters. Once the Department has verified accuracy, the problem will be considered resolved.

B. Maintenance

Department personnel will perform normal, routine maintenance (camera lens cleaning, periodic inspections, etc.). However, should malfunction conditions occur which affect overall detection performance (which can be attributed to a specific component or item-level components of the VDS e.g., video detection system processor, video camera sensor, or software), repair these conditions under warranty at no cost to the Department as detailed in Subsection 937.3.07.A.

C. Support

During the warranty period, supply any software upgrades of the video detection system processor to the Department at no charge. In addition, provide phone consultation as needed at no cost during the warranty period for operating questions or problems that arise.

D. Future Support

If the Department desires, it may enter into a separate agreement with the suppliers for technical support and software upgrades. Make available such a program to the Department after the original warranty period.

937.3.08 Training

Provide maintenance training and configuration training to Department personnel. Provide a location for holding the courses near the project area. If requesting that the training be conducted away from the project area, pay all costs associated with travel and accommodation of all the students. Provide a member of the Contractor staff with intimate experience with this Contract at the courses to answer any inquiries. Furnish a training notebook in a labeled 3-ring binder to each trainee.

Provide maintenance training for five people. Include in this training both classroom training and hands-on training. Conduct all training in half-day sessions. Two half-day sessions may be held on the same day. The total of the training shall consist of at least eight (8) clock hours of training for each participant. Include in the course content, at a minimum, troubleshooting and maintenance for the following: video camera sensor, housing, video detection system processor, and communications specific to the VDS.

Provide configuration training for five people. Include in this training at least eight (8) clock hours of training for each participant in either half-day or full-day sessions. Include in the course content, at a minimum, system configuration, zone configuration, and calibration.

Coordinate training with installation schedules as approved by the Engineer.

937.4 Measurement

A. Video Camera Sensor Assembly

Video camera sensor assemblies paid for are the number actually installed, complete, functional, and accepted. Unless otherwise specified in the Plans, furnish and install the following minimum items for a video camera sensor assembly.

- Camera, environmental enclosure, and mounting assembly with all associated hardware.
- Cabinet equipment, including but not limited to wiring, conductors, terminal blocks, surge suppression and the sliding drawer.
- All weather heads, vertical conduit risers, and conduit hardware on the VDS support pole for power service, grounding, communications, and control. If VDS and CCTV are mounted on the same pole, install common weather heads, conduit risers, and conduit hardware under Section 936 of the Specifications.
- All hardware and materials necessary to provide electrical power service to the VDS field location as shown in the Plans, including but not limited to vertical sections of conduit, conduit hardware, wire, circuit breakers, disconnect closures, and grounding. The Department will pay for horizontal sections of conduit separately.
- All cables, connectors, hardware, interfaces, supplies, and any other items necessary for the proper operation and function of any VDS system component to carry video signals to the video detection system processor.

B. Video Camera Sensor (Furnish Only)

Video camera sensors are measured for payment by the number actually furnished and accepted.

C. Video Camera Sensor Lens (Furnish Only)

Video camera sensor lenses are measured for payment by the number actually furnished and accepted.

D. Video Camera Sensor/Lens Housing (Furnish Only)

Video camera sensors/lens housings are measured for payment by the number actually furnished and accepted.

E. Video Camera Sensors/Lens/Housing (Furnish Only)

Video camera sensor/lens/housing assemblies are measured for payment by the number actually furnished and accepted.

F. Video Camera Sensor Mount (Furnish Only)

Video camera sensor mounts are measured for payment by the number actually furnished and accepted.

G. Video Detection System Processor, Type A

Video detection system processors paid for are the number actually installed, complete, functional, and accepted. Unless otherwise specified in the Plans, furnish and install an video detection system processor to include, at a minimum, the following:

- Video detection system processor equipment with two video inputs.
- System software provided within the video detection system processor

H. Video Detection System Processor, Type B

Video detection system processors paid for are the number actually installed, complete, functional, and accepted. Unless otherwise specified in the Plans, furnish and install an video detection system processor to include, at a minimum, the following:

- Video detection system processor equipment with four video inputs.
- System software provided within the video detection system processor

I. Testing

Testing is measured as a lump sum for full delivery of testing and acceptance requirements.

J. Training

Training is measured as a lump sum for all supplies, equipment, materials, handouts, travel, and subsistence necessary to conduct the training.

937.4.01 Limits

Not applicable

937.5 Payment

A. Video Camera Sensor Assembly

Video camera sensor assemblies, complete in place and accepted by the Department, are paid for at the Contract Unit Price. Payment is full compensation for furnishing and installing the video camera sensor assembly.

Payment for camera sensors is made under:

Item No. 937	Video Camera Sensor Assembly	Per Each

B. Video Detection System Components

VDS components are paid for at the Contract Unit Price. Payment is full compensation for furnishing each component.

Payment is made under:

Item No. 937	Video Camera Sensor	Per Each
Item No. 937	Video Camera Sensor Lens	Per Each
Item No. 937	Video Camera Sensor/Lens Housing	Per Each
Item No. 937	Video Camera Sensor/Lens/Housing Assembly	Per Each
Item No. 937	Video Camera Sensor Mount	Per Each

C. Video Detection System Processor Type A

Video detection system processors, complete in place and accepted by the Department, are paid for at the Contract Unit Price. Payment is full compensation for furnishing and installing the video detection system processor.

Payment for video detection system processor is made under:

Item No. 937	Video Detection System Processor Type A	Per Each

D. Video Detection System Processor Type B

Video detection system processors, complete in place and accepted by the Department, are paid for at the Contract Unit Price. Payment is full compensation for furnishing and installing the video detection system processor.

Payment for video detection system processor is made under:

Item No. 937	Video Detection System Processor Type B	Per Each

E. Testing

The Department will pay for testing performed as prescribed by this Item, measured as provided under Measurement at the Lump Sum Contract bid price.

Payment for testing is made under:

Item No. 937	Testing	Lump Sum

F. Training

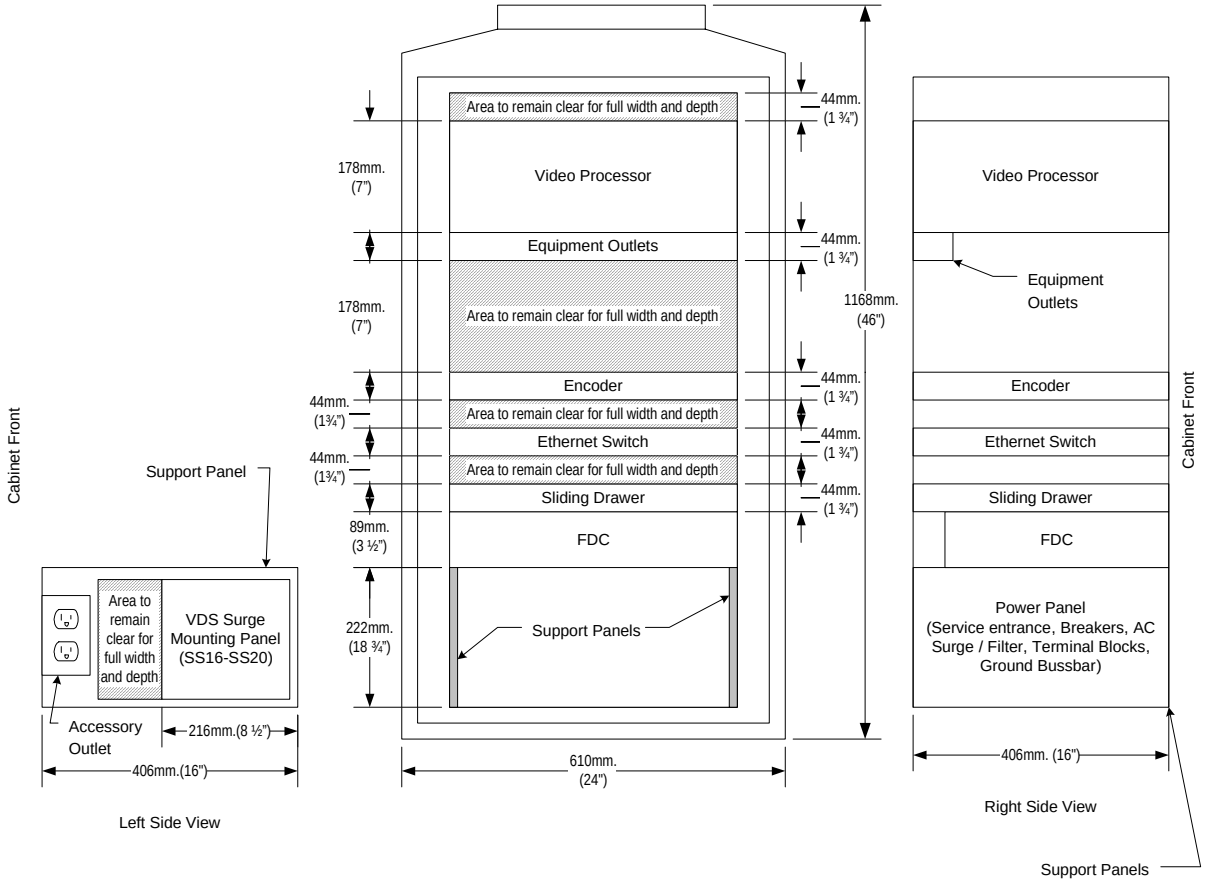
The Department will pay twenty-five (25%) of the total Lump Sum Contract bid amount for training upon approval of the Training Plan. The Department will pay the remaining seventy-five (75%) after completion of all training as described in Subsections 937.3.08. The total sum of all payments cannot exceed the original contract amount for this item.

Payment for Training is made under:

Item No. 937	Training	Lump Sum

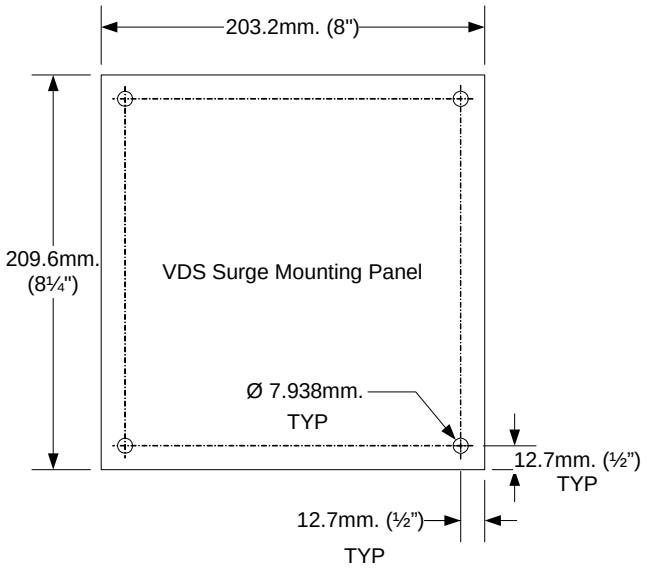
937.5.01 Adjustments

Not applicable.



Notes:
1. All dimension and scale are approximate.
2. FDC (Fiber Distribution Center) required and paid for in Section 935
3. Support Panels shall be mounted inside the cabinet rack cage.
4. Removal of a Support Panel or Mounting Panel shall not require the removal of any other cabinet component

Detail Drawing 937.1
Type D Equipment Cabinet Assembly With VDS Equipment



Note:

1. All linear dimensions +\- 0.005" tolerance.
2. Drawing not to scale
3. Mounting Panel shall be 0.125" 5052 Aluminum

Detail Drawing 937.2
VDS Surge Mounting Panel, Type D Cabinet

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