Document Control

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7/23/99	Draft 2		
9/5/00	Corrected surge suppression IDs	938.2.D.3	1
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	Detection; renumber Detail Drawings 938.5 and 938.6 to 938.1 and 938.2)	938.2.A; 938.3.05.A; 938.3.06.A; 938.4.A; 938.5.A; Detail Drawings 938.1, 938.2, 938.3, 938.4	
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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-938 DETECTION

Section 938 - Detection

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.

938.1 General Description

A. Not Applicable

B. Intersection Video Detection System

This work includes the procurement and installation of an Intersection Video Detection System (I-VDS) for use with a traffic signal controller in a traffic signal cabinet with card rack vehicle detector input files (for the cabinet type specified in the Plans). The I-VDS to be supplied analyzes video images to detect and count motor vehicles. Components comprising the I-VDS include, but are not limited to, video camera sensor(s), including the camera sensor housing and mounting hardware, intersection video detection system processor module(s) and output expansion module(s) which mount in the traffic signal controller cabinet input files, programming monitor(s), programming device(s) for system configuration through software (either pointing device or keyboard), cabling between camera sensor(s) and the cabinet, surge suppressors, terminations, and related equipment.

C. Microwave Radar Detection

This work includes furnishing and installing a microwave radar detection system that provides true presence detection, vehicle count, occupancy, and speed information to the Department's NaviGAtor advanced transportation management system.

938.1.01 Definitions

Traffic Signal Controller Cabinet Input File: A Traffic Signal Controller Cabinet Input File is a chassis within a traffic signal cabinet rack that has slots where a detector card provides detector output to the traffic signal controller through its edge card connectors. The backplane connector pin output of the edge connectors conforms to Georgia traffic signal controller cabinet standards for the cabinet type specified in the plans.

IVDSn: IVDSn refers to all of the specific I-VDS components necessary for operation and detection on one approach leg of an intersection. The "n" denotes the approach's through-movement controller phase in the nomenclature of a typical 8-phase dual-ring intersection operation (e.g., IVDS2, IVDS4, IVDS6, IVDS8). IVDSn is also used as a prefix to identify the individual I-VDS components of the "n" approach as follows:

- IVDSnVCS: the video camera sensor for approach “n”
- IVDSnJB: the wiring junction box mounted with the video camera sensor for approach “n”
- IVDSnCC: the coaxial cable from the wiring junction box to the controller cabinet for approach “n”
- IVDSnPC: the video camera sensor power cable from the wiring junction box to the controller cabinet for approach “n”
- IVDSnCSS: the coaxial cable surge suppressor in the controller cabinet for approach “n”
- IVDSnCJ: the coaxial jumper cable from the coaxial surge suppressor in the controller cabinet to the processor module or detector panel for approach “n”
- IVDSnPM: the processor module for approach “n”
- Occupancy: individual lane occupancy measured in percent of time

938.1.02 Related References

A. Georgia Specifications

Section 150 – Traffic Control

Section 639 – Strain Poles for Overhead Sign and Signal Assemblies

Section 922 – Electrical Wire and Cable

Section 925- Traffic Signal Equipment

Section 939 – Communications and Electronics Equipment

Section 940 – NaviGAtor Advanced Transportation Management System Integration

B. Referenced Documents

American National Standards Institute (ANSI)

American Society of Testing and Materials (ASTM)

Electronic Industries Association (EIA) - 170A

FCC Part 15, Subpart J, Class A device requirements

Manual on Uniform Traffic Control Devices (current edition)

National Electric Code (NEC) 210-19a., FPN No. 4

National Electrical Manufacturers Association (NEMA) TS1-1989 (R1994), Section 2.1.5.2, Section 2.1.12

NEMA TS-1-1989 (R1994)

NEMA TS2-1992 Type 2, Type 170 and Type 179 Standards

NEMA TS2-1992

NEMA 250 Type 4 enclosure standards

Underwriter’s Laboratory Incorporated (UL)

938.1.03 Submittals

Provide six copies of complete and thorough submittal data for all components and materials of a detection system within 30 calendar days of the Contract Notice-to-Proceed. 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 detection system site. Neatly organize each package of submittal data and separate by hardware item. Include an index of all submittal data documents contained within the package. Name each submittal data document, what detection system component the document is submitted for (including the associated 938.X subsection), 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 detection system; separate submissions for individual detection system components and materials are not permissible.

A. Not Applicable

B. Intersection Video Detection System

The following table outlines the Submittal Requirements for the equipment and components of an I-VDS. The table is a guide and does not relieve the Contractor from submitting additional information for a complete submittal package.

Section 938.1.03.B Submittal Requirements

Material	Specification Reference	Catalog Cuts	Mfg.	Shop.	Structural	Lab Test	Installation	Mainten.	Test	Test Plan	Test Reports	Training	Training	Submittal Due Date (Calendar Days after NTP)
Video Camera	938.2.B.1 938.2.B.10	X	X			X	X	X						30 Days
Video Camera Enclosure	938.2.B.1	X	X			X	X	X						30 Days
Variable Focus Lens	938.2.B.1	X	X			X	X	X						30 Days
Programming Monitor	938.2.B.2	X	X											30 Days
Programming Device	938.2.B.3	X	X											30 Days
Processor Module	938.2.B.4 938.2.B.10	X	X	X		X	X	X						30 Days
Output Expansion Module	938.2.B.5 938.2.B.10	X	X	X		X	X	X						30 Days
Processor Software	938.2.B.7 938.2.B.8	X	X				X	X						30 Days
Configuration Software	938.2.B.7 938.2.B.8	X	X				X	X						30 Days
Terminal Blocks	938.2.B.9	X	X											30 Days
Surge Suppression	938.2.B.9	X	X	X		X	X							30 Days
Wiring Cabling & Harnesses	938.2.B.9	X	X	X		X	X							30 Days
Training Plan	938.3.08											X	X	30 Days

1. Training Plan

Submit a Training Plan that includes, at a minimum, a detailed description of the contents of the course, an outline of the training course, resumes and references of the instructor(s), and the training notebook that the students will use during training. Submit a Training Plan within 30 calendar days of Contract Notice-to-Proceed. Obtain approval of the Plan from the Engineer.

Request in writing the training date(s) a minimum of thirty (30) calendar days in advance of the desired training date(s). Do not submit the request to schedule the training prior to receiving approval from the Engineer of the Training Plan. Allow the Engineer to adjust the proposed schedule of the training by up to seven (7) calendar days, at no cost to the Department, to allow for availability of Department personnel.

2. As-Built Documentation

Provide as-built documentation of the I-VDS installations within thirty (30) calendar days of the completion of the Field Tests (see Subsection 938.3.06.B.1).

C. Microwave Radar Detection

The following table outlines the Submittal Requirements for the equipment and components of a microwave radar detection system. The table is a guide and does not relieve the Contractor from submitting additional information for a complete submittal package.

Section 938.1.03.C Microwave Radar Detection Submittal Requirements

Material	Specification Reference	Catalog Cuts	Mfg. Spec.	Materials Cert.	Install. Proced.	Maint. Proced.	Submittal Due Date (Cal. Days after NTP)
Detector	938.2.C.1	X	X	X	X	X	60 Days
Housing	938.2.C.1	X	X	X		X	60 Days
Mounting Assembly	938.2.C.1	X	X	X			60 Days
Training Plan	938.3.06.C						60 Days

938.2 Materials

A. Not Applicable

B. Intersection Video Detection System

1. Video Camera Sensor

Send a video signal from the video camera sensor to the processor in RS170 format. Use high resolution, monochrome video camera sensors as the primary video source for real-time vehicle detection. Use optical filters and/or electronic circuitry in the video camera sensor to compensate for blooming at night caused by headlights and minor vibration caused by wind. Include a heater at the front of the enclosure to prevent the formation of ice and condensation in cold weather. Ensure that the heater does not interfere with the operation of the video camera sensor electronics, or cause interference with the video signal. As a minimum, meet the following requirements for each video camera sensor assembly installation:

- Charge Coupled Device: 1/4" to 1" interline or frame transfer charge coupled device (CCD)
- Active pixel elements: 768 Horizontal, 494 Vertical minimum
- Video standard: NTSC Standard, RS-170A Compliant (available as EIA-170A specification)
- Lens: 8-48 mm variable focal length lens that is adjustable from outside the camera enclosure. Provide an Electric Lens Adjustment Device and associated wiring to adjust the variable focal length lens
- Resolution: 380 Horizontal TVL, 350 Vertical TVL minimum

- Automatic gain control (AGC): 20 dB minimum; do not allow AGC to be applied until the automatic iris control has fully opened the aperture

- Electromagnetic interference: FCC Part 15, Subpart J, Class A device requirements apply for the video camera sensor and associated connected equipment in their installed condition

- Input power: Power the video camera sensors with 115 VAC+/-10%, 60 Hz nominal +/-3 Hz. Size the 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 connection of power and video signal cables. Provide power from the cabinet power source through a surge suppressor and then to the video camera sensor.

- 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 seal the enclosure to prevent sand, dirt, dust, salt and water from entering. Affix a sun shield visor to 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.

- Video camera sensor wiring: Provide outdoor-rated power, coaxial video, and lens adjustment (where applicable) wiring from the sensor enclosure to the sensor junction box in accordance with the manufacturer's recommendations. Seal the wiring connection at the housing from water or dust entry into the housing. For the standard video camera sensor mounting as shown in the details, provide approximately 4 ft (1 m) long wiring to enter the bottom of the junction box and terminate inside. Provide a male BNC connector with gold-plated body and center pin at the junction box end of the coaxial video cable. When providing a lens adjustment harness, ensure that the connector on the harness properly mates to the lens adjustment control unit.

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

- Size (HxWxL): 5" x 5" x 18" [130 mm x 130 mm x 460 mm] (maximum, including camera enclosure)

- Mounting bracket assembly: Mount the video camera sensor on a mounting bracket assembly as shown in the details such that its height and position provide a clear view of the approach. Mount the video camera sensor securely such that it is stable and steady. The mounting bracket assembly includes a video camera sensor mounting bracket, nipple pipe, cable-mount nipple clamp, and all associated hardware and materials. Mount the video camera sensor on a mounting bracket assembly which meets the following requirements:

    - Use stainless steel fastening hardware with lock washers on threaded fasteners

    - Use a video camera sensor enclosure mounting bracket that is non-rusting and is made from die cast aluminum, extruded aluminum, powder-coated galvanized steel or hot dipped galvanized steel. Provide a mounting bracket that permits vertical and horizontal adjustment of the video camera sensor. Provide a mounting bracket that securely fastens to the video camera sensor enclosure and mounts to the nipple pipe by threading onto the pipe or as a slip-fit, using a set-screw fastener in either above method.

    - Use a 1 ½" (38 mm) aluminum nipple pipe that is threaded on both ends.

    - Fasten the nipple pipe to the mast arm using a cable-mount nipple clamp with minimum 2 5/16" (58 mm) U-bolts. Use aircraft-grade galvanized steel cables with stainless steel fastening hardware and that make at least two wraps around the mast arm. Do not use banding straps.

- Video camera sensor junction box: Provide a wiring junction box with mounting hardware for termination/connection of the sensor housing wiring with the field cabling from the traffic signal controller cabinet as shown in the details. Provide a cast aluminum or 0.125" (3.175 mm) sheet aluminum box with minimum inside dimensions of 8" H x 8" W x 4" D (200 mm H x 200 mm W x 100 mm D). Do not use steel- or plastic-bodied junction boxes. Provide a box that is NEMA 4 rated dust-tight, raintight, and watertight and has a hinged and neoprene-gasketed door with stainless steel hinge pins and threaded fasteners for closing. Provide a 1 ½" (38 mm) slip hole with rubber grommet with poke-through diaphragm for cable entry in the bottom of the box; no other holes in the box body shall be permitted except as required for the mounting U-bolts as shown in the details. Provide a 3-position fully-enclosed compact terminal strip rated for minimum 15 A current and #14 AWG conductors. Internal connectors shall be nickel-plated threaded fasteners for securing the conductors. The terminal strip shall be fully enclosed and covered with no exposed current-carrying metal surfaces. Label the three positions on the terminal strip as "AC+", "AC-", and "GR" with fastener secured or epoxy-cement

permanent labels; do not use adhesive or self-stick labels. Provide a female-female BNC coupler with gold-plated body and center pin sockets, electrically isolated from the junction box by fastening to a non-conductive bracket mounted to the junction box side.

2. Programming Monitor, Type A

At a minimum, provide a 4-channel, 9" standard color or monochrome video monitor to view video output from the video camera sensors and to program the system through the Configuration Software on the Processor Module in conjunction with a Programming Device. Provide the ability to view one channel on the monitor at a time and to view all four channels on the monitor at the same time. Provide four BNC connectors on the back of the monitor for video input from four Processor Modules. Provide four 6-ft (2 m) factory-manufactured high-flex coaxial video cables with BNC connectors with each programming monitor.

3. Programming Device

Configure the I-VDS with a Programming Device that is either a keyboard or stationary track ball pointing device. Connect the Programming Device to the front of the processor module through a DB9 or PS/2 connector. Provide a Programming Device that is PC compatible.

4. Processor Module

Provide a processor module, which performs video image processing, that completely fits within the loop detector slots of the traffic signal controller cabinet input file and that provides a standard relay closure detector input to the controller. Provide one video camera sensor input for each processor module. Provide four detector outputs through the processor module which communicate through the edge card connector. Use a module that is not wider than two standard input file slots. Include detection indicators on the front panel of the processor module for each of the four channels of detection provided through that module to indicate detector output in real time when the system is operational. Include a BNC connector with gold plated center pin on the front panel for video output to the Programming Monitor, and include a DB9 or PS/2 connector on the front panel to connect the Programming Device.

Send the video signal over coaxial cable from the video camera sensor to the Processor Module using one of the two following methods:

1. Connect the coaxial cable from the video camera sensor to the surge suppressor and from the surge suppressor connect the coaxial jumper cable with a 90 degree elbow gold-plated BNC connector to BNC connector on the front panel of the Processor Module; or

2. Connect the coaxial cable from the video camera sensor to the surge suppressor and connect the coaxial jumper cable from the surge suppressor to the loop detector panel using a spade lug connection such that the video signal communicates from the loop detector panel to the Processor Module through the cabinet input file.

Provide power to the processor modules through the input file.

5. Output Expansion Module, Type A

Provide detector outputs, in addition to detector outputs provided through the processor module, through an output expansion module that mounts in the traffic signal controller cabinet input file and that provides a standard relay closure detector input to the controller. Provide 2 or 4 outputs through the edge card connector of each module. Connect the expansion module to the processor module with a cable that has standard modular connectors. Use a module that is not wider than 1 detector card per two additional detector outputs or that is not wider than 2 detector cards per four additional detector outputs. Include detection indicators on the front panel of the output expansion module for each channel of detection provided through that module to indicate detector output in real time when the system is operational.

Provide power to the expansion module through the input file.

6. I-VDS Functional Requirements

a. Functional Requirements: Provide vehicle count detection and presence detection in lieu of inductive loop detectors for a traffic signal system through the I-VDS. Process the video signal with the I-VDS in real time as vehicles cross a detection zone.

b. Accuracy Requirements: Provide I-VDS functional detection outputs that meet overall accuracy requirements specified herein under the following conditions.

During both day and night periods and transitions from dark to dawn and daylight to dusk, and

Under weather conditions ranging from bright sunlight to 2" (50 mm) per hour rainfall.

Meet the accuracy specifications presented below for the fundamental functional detection parameters. The following specified accuracies are stated as the minimum acceptable values. Provide accuracies of these values or better.

Volume: Provide average vehicle counts with 95% overall accuracy. Accomplish these accuracies with a minimum traffic volume of 250 vehicles per hour per lane (VPHPL). For instances in which a vehicle has been significantly occluded (with respect to the video camera sensor's FOV) by another vehicle, do not use that vehicle's count in the calculation of the overall accuracy. "Significant occlusion" defines a target vehicle's image that has been occluded by more than 50%.

Presence: Detect the presence of vehicles within a video camera sensor's FOV for each defined detector with an accuracy of 90%.

7. I-VDS Technical Requirements

This specification sets forth the minimum requirements for system equipment and software that monitor vehicles at an intersection via processing of video images and provide detector outputs to a traffic signal controller.

a. System Hardware: Provide an I-VDS that does not require any equipment external to the traffic signal controller cabinet input file (excluding the video camera sensor, video camera sensor power connection, circuit breakers and surge suppression for video or data). Mount the processor and expansion modules in the traffic signal controller cabinet input files, using the edge card connector to obtain power and provide contact closure outputs. Rewiring of the backplane or any other cabinet panel for the system is not permitted except for power and grounding for the interface panel, wiring from the video camera sensor to the loop detector panel for the video signal and wiring to obtain power for the video camera sensor.

Provide a system capable of providing a minimum of eight detector outputs per video camera sensor. Provide all detector outputs through edge card connectors of the processor module and output expansion module(s). Rewiring external to the edge connectors is not permitted for obtaining a minimum of eight outputs for one video camera sensor.

b. System Software

1) System Processing Software: On the processor module that mounts in the traffic signal controller cabinet input file, include the software that processes the video camera sensor signals and converts the signals into detector outputs. Detect either approaching or receding vehicles in multiple lanes within the field of view (FOV) of each video camera sensor. Provide the capability of detecting vehicles in a minimum of 24 detection zones per video camera sensor with the I-VDS. Allow the detection zones to be combined to form an output using the AND, OR and NOT logical functions.

2) Detection Compensation: Provide the capability for the processor to compensate for camera movement attributable to temperature effects, wind shifting, pole sway, pole expansion, or vibration of the mounting.

3) System Configuration Software: On the processor module, include the configuration software to program the I-VDS, including the detection zones. Perform programming by accessing the software through a Programming Monitor and a Programming Device. Do not require the use of a separate computer for programming.

8. Programming Requirements

Employ menus for the Configuration Software. Provide the capability through the Configuration Software for the user to define detection zones through interactive graphics by placing lines and/or boxes in an image on a Programming Monitor. Provide the capability for the user to redefine previously defined detection zones.

a. Detection Zone Placement and Manipulation: Allow a minimum of 24 detector zones to be defined through the software for each video camera sensor. Provide the capability to place vehicle detection zones anywhere within the field of view of the video camera sensors through the Configuration Software. Use detection zones that are lines or boxes drawn in each visible lane or area of desired detection. Provide the capability to use one detection zone to replace multiple

inductive loop detectors. Detectors may overlap if necessary. Provide the ability for the user to assign logical functions such as AND, OR and NOT to one detector or a group of detectors.

On the Programming Monitor, display the detection zones superimposed on the video camera sensor's images. Provide the capability to create detection zones of varying size and shape to allow best coverage of the viewable roadway lanes and ramps. Provide the capability to save the detection zone format on the processor module card once drawn for a particular video camera sensor image. Provide the capability for the user to view the currently active detector zone format of the processor module via a Programming Monitor.

b. Detection Zone Editing: Provide the capability to edit existing detector configurations using a Programming Monitor with the Programming Device used to perform the programming functions.

c. Confirmation: When viewing vehicle actuations in real time on the Programming Monitor, indicate the passage or presence of each vehicle detected by each detection zone by changing the color or intensity of that particular zone.

d. Detection During Reconfiguration: Provide the capability for the I-VDS to continue detecting vehicles on all existing zones during reconfiguration, except on the zone that is being reconfigured.

9. Field Cabling

a. General: Field cabling consists of the video coaxial cable and the camera sensor power cable from the camera sensor junction box to the I-VDS power and coax termination panels in the controller cabinet. Install field cabling in continuous lengths and terminate only on terminal strips or with cable connectors; do not splice any field cabling.

b. Use a video coaxial field cable (labeled as "IVDSnCC") that is double-shielded with tinned copper braid, #20 AWG solid copper center conductor, and polyethylene outer jacket approved for outdoor use (Belden 8281 or approved equivalent.) Terminate both ends of the coaxial cable with BNC connectors with gold-plated body and center pin and as recommended by the cable manufacturer.

c. Use a camera sensor power field cable (labeled as "IVDSnPC") that is a 3-conductor cable with #16 AWG stranded copper conductors. Use a cable that is ozone and UV resistant, suitable for wet use, with a 600 V and 105 degree rating, is UL listed for indoor and outdoor use, and with 120 VAC standard black/white/green solid colored conductor insulation.

10. Cabinet Equipment

a. General: Provide an I-VDS power termination panel assembly, an I-VDS coax termination panel assembly, and all associated materials in the controller cabinet for the installation of camera sensor power distribution, for the termination of field cabling from the video camera sensors, and for connection of the video jumper cable to the processor modules or loop detector panel as applicable. Fabricate and assemble the panel assembly with the specified equipment as shown in the details.

b. Coax termination panel: Fabricate a coax termination panel with the dimensions, shape, mounting, and silk screened labeling as shown in the details. Produce the panel from 0.125" (3.175 mm) 5052 sheet aluminum and use only threaded fastener holes for component mounting. Include on the coax termination panel a full-length hinge with stainless steel pin to permit opening of the panel a minimum of 90 degrees for interior cabinet access.

c. Power termination panel: Fabricate a power termination panel with the dimensions, shape, mounting, and silk screened labeling as shown in the details. Produce the panel from 0.125" (3.175 mm) 5052 sheet aluminum and use only threaded fastener holes for component mounting.

Provide a six-position fully-enclosed compact terminal strip rated for minimum 15 A current and #14 AWG conductors. Use internal connectors that are nickel-plated threaded fasteners for securing the conductors, and are capable of securing a minimum of two stranded conductors. Provide a terminal strip that is fully enclosed and covered with no exposed current-carrying metal surfaces. Alternately provide a fully-enclosed compact power distribution block with nickel-plated threaded fasteners for securing the conductors, and capable of terminating three sets of 5-position distribution (one supply and four load positions) with all positions suitable for terminating #14-16 AWG stranded conductors. Label the three conductor positions on the terminal strip or distribution block as "AC+", "AC-", and "GR" with fastener secured or epoxy-cement permanent labels or silk-screened labels directly on the panel; do not use adhesive or self-stick labels.

Provide a surface-mount mini or compact magnetic 2-pole 5 A 120 VAC overcurrent circuit breaker. Do not use a circuit breaker with a thermal trip mechanism. Provide a circuit breaker that permits manual circuit disconnection and is suitable for terminating #14-16 AWG stranded conductors. Alternately use a flush-mount circuit breaker in a surface-mount bracket housing. Mount the circuit breaker on the power termination panel to eliminate conflict with the cabinet shell. Enclose all exposed current-carrying metal surfaces from contact.

Provide cabinet power to the power termination panel with #14 AWG stranded copper conductors as shown in the details and in accordance with the requirements for traffic signal controller cabinet assemblies in Section 925 Traffic Signal Equipment. Neatly route and mechanically secure cabinet power wiring to avoid sharp edges and to avoid conflicts with other equipment or cabling. Do not use adhesive fasteners for securing the power wiring. Label cabinet power wiring within three inches of cabinet terminations using clear overwrapping self-laminating cable labels and the legend "I-VDS".

d. Coaxial cable surge suppressors: Use either common-ground or balanced-differential video signal surge suppressors in accordance with the I-VDS manufacturer's recommendations. Use surge suppressors that have solid-state, hybrid clamping technology, and have equipment-side and field-side BNC connectors on the top of the suppressor enclosure as shown in the details (EDCO RMCXI-05, RM CXI-06, or approved equivalent). Use surge suppressors that have maximum dimensions of 4.5" H x 1.75" W x 1.5" D (120 mm H x 45 mm W x 39 mm D), or alternately 3.0" H x 2.5" W x 1.5" D (77 mm H x 64 mm W x 39 mm D). The grounding lug shall be on any surface except the bottom surface that fastens to the surge suppressor mounting plate.

   Use surge suppressors that individually fasten to mounting plates which individually fasten to the I-VDS coax termination panel as shown in the details. Secure surge suppressors flush to the mounting plate with reusable fasteners such that suppressors can be replaced in the field by removing the mounting plate from the coax termination panel and then replacing the suppressor on the mounting plate.

   For grounding, use a minimum #16 AWG copper wire with green insulation for each surge suppression device and connect the ground wire directly between the suppressor ground lug to the equipment ground bussbar. Do not ground the surge suppressor solely through a bracket fastened to the mounting plate. Use a larger ground wire size if recommended by the surge suppressor manufacturer. Do not "daisy chain" with the grounding wires of other devices including other surge suppressors. Do not splice any grounding wire. Dress and route grounding wires separately from all other cabinet wiring including the I-VDS coaxial cables and in a manner that allows the I-VDS coax termination panel to hinge open. Install grounding wires with the absolute minimum length possible between the suppressor and the ground bussbar.

   Connect coaxial cabling, either the coaxial video field cables or the coaxial cable jumper cables, to the video signal surge suppressors only with female-female 90 degree elbow BNC couplers with gold-plated body and center pin sockets.

e. Coaxial Jumper Cable: Use a video coaxial jumper cable (labeled as "IVDSnJC") to connect the equipment (protected) terminal of the video signal surge suppressor directly to either the processor module or the loop detector panel as applicable. Use a video coaxial jumper cable that is a high-flex cable with double-shield tinned copper braid, #20-22 AWG stranded copper center conductor and polyethylene outer jacket (Belden 8281F or approved equivalent.) As applicable, terminate both ends or one end of the coaxial cable with BNC connectors with gold-plated body and center pin and as recommended by the cable manufacturer. Use coaxial jumper cables of the length necessary to route as shown in the details with no mechanical strain on the end connectors and no excess cable loops to be stored.

   Label coaxial jumper cables within three inches of end connectors using clear overwrapping self-laminating cable labels and the appropriate cable label identification ("IVDSnJC") for the video camera sensor and processor module as shown in the Plans.

11. Environmental

a. Video Camera Sensor

1) Provide video camera sensors that operate reliably in a roadside environment. Provide video camera sensors that meet the environmental requirements of NEMA TS1-1989 (R1994), Section 2.1.5.2. Provide video camera sensors that operate from -31 °F to 120 °F (-35 °C to +50 °C) from 5% to 95% relative humidity.

2) Vibration: Ensure that vibration does not impair performance when the camera is mounted on 50' (15 m) or shorter pole.

b. Processor and Expansion Modules: Provide processor and expansion modules that operate reliably in a typical roadside traffic cabinet environment. Provide equipment that meets the environmental requirements of NEMA TS1-1989 (R1994) and NEMA TS2-1992 standards and the environmental requirements for Type 170 controllers. Provide equipment that operates from -29 °F to 140 °F (–34 °C to +60 °C) from 0% to 95% relative humidity, non-condensing.

12. Documentation

Provide the following documentation in the documentation pouch of each traffic signal cabinet:

- One operation manual with programming instructions
- One maintenance manual with schematics
- Three legible wiring prints showing all IVDS components and connections with the cabinet

C. Microwave Radar Detection

1. Detector

Provide a microwave radar detector that meet the following minimum requirements:

- Provides presence, vehicle count, lane occupancy and time mean speed data on a minimum of six detection zones in a user-definable reporting period from 20 to 600 seconds.
- Transmits on a frequency band of 10.525 GHz or approved spectral band
- Transmitter power does not exceed 10 milli-watts
- Complies with the limits for a Class A digital device pursuant to Part 15 of the FCC rules
- Emits a noise level less than 55 dBA when measured one meter away from the device
- Operates from 95-135VAC at 60 Hz
- Uses one interface connector that provides power to the unit, contact closure wire pairs for each detection zone, and serial communication lines for programming, testing, or modem interface
- Coverage range between 10 and 200 feet
- Includes diagnostic self-test of all detector functions
- Serial data communications via an RS-232 interface at 9600 baud

Provide a microwave radar detector that operates under the following environmental conditions:

- Ambient temperature range of –29°F to 165°F (-37°C to 74°C)
- Relative humidity from 5 to 95 percent, non-condensing
- Power surge of ± 1kV surge (rise time = 1.2 µsec, hold = 50 µsec) applied in differential mode to all lines, power and output, as defined by IEC 1000-4-5 and EN 61000-4-5 standards
- Resistant to vibration in accordance with NEMA TS-1 (Section 2.1.12) or approved equivalent
- Resistant to shock in accordance with NEMA TS-1 (Section 2.1.13) or approved equivalent

2. Housing

Provide a microwave radar detector housing that meets the following requirements:

- Meets the requirements of a NEMA type 3R enclosure
- Outside dimensions, including fittings, do not exceed 10 inches x 10 inches x 10 inches

- Total weight (including detector) does not exceed 8 pounds.

3. Mounting Assembly

Provide a microwave radar detector mounting assembly that meets the following requirements:

- All painted steel, stainless steel, or aluminum construction
- Support a load of 20 pounds

4. Communications

Provide a microwave radar detector that communicates with the Department's NaviGAtor advanced transportation management system using a protocol and application programming interface (API) provided with the detector system.

Provide a microwave radar detector that includes the following functions:

- Is individually addressable in a multi-drop communications environment
- Responds to polled requests from NaviGAtor's remote communication process for detector status data
- Can be configured to disable automatic data transmission, if automatic data transmission is possible
- Acknowledges receipt and validity of all messages transmitted to the detector
- Remote set-up of detector stations
- Remote upload and download of detector configuration data

938.2.02 Delivery, Storage and Handling

Not applicable

938.3 Construction Requirements

938.3.01 Personnel

Provide a training instructor qualified in his/her respective field as determined by the Engineer. The instructor shall be trained by the equipment manufacturer and authorized by the manufacturer to perform training. Obtain approval of the instructor(s) from the Engineer.

938.3.02 Equipment

Not applicable

938.3.03 Preparation

Not applicable

938.3.04 Fabrication

Not applicable

938.3.05 Construction

A. Not Applicable

B. Intersection Video Detection System

1. General Installation Requirements

Install all video camera sensors, processor modules, output expansion modules, and associated equipment at the locations specified in the Plans. Mount the processor and output expansion modules within the traffic signal controller cabinet input files. No physical changes are permitted to the traffic signal controller cabinet input files. Make all necessary adjustments and modifications to the total I-VDS system prior to obtaining TMC recommendation for system acceptance.

2. Video Camera Sensor

Install a video camera sensor with mounting bracket assembly and junction box as shown in the Plans and in accordance with the manufacturer's recommendations. Install the video camera sensor in the vertical and horizontal positions as specified to provide the field of view and detection zones shown in the Plans. Make field adjustments to the positions specified in the Plans only with the Engineer's approval. Mount the junction box on the nipple pipe in a position that does not contact the video camera sensor housing and directly over the mast arm. Coil all spare cable inside the junction box, and dress and secure all cabling to provide strain relief, drip loops, and to minimize wind-blown movement and contact with the mast arm. Where a lens adjuster cable connector is provided in the junction box, loosely fasten it to the coaxial cables and away from the camera power terminal strip.

3. Programming Monitor

After all I-VDS programming is completed and accepted, deliver the programming monitor, associated materials such as the user manual and the packing container, and the video cables, to the Engineer at the project location or the Engineer's offices. Do not leave the monitor in the traffic signal cabinet.

4. Programming Device

After all I-VDS programming is completed and accepted, place the programming device with connector cord in a zipper- or snap-type resealable plastic bag in the cabinet documentation pouch.

5. Processor Module

Install the processor module in the cabinet input file and fully program and configure the module as shown in the Plans and in accordance with the manufacturer's recommendations. Ensure proper operation, including accurate detection, as programmed. Provide all equipment and materials necessary for programming and configuration, including a video display monitor.

6. Expansion Module

Install the expansion module in the cabinet input file and fully program and configure the module as shown in the Plans and in accordance with the manufacturer's recommendations. Ensure proper operation, including accurate detection, as programmed.

7. Field Cabling

Install the field cabling for each video camera sensor as shown in the Plans, in accordance with the manufacturer's recommendations, and in accordance with the requirements for signal cable in Section 647 Traffic Signal Installation. Ensure that cable installation is complete from the video camera sensor junction box to the coax and power termination panels in the controller cabinet. Label all field cabling within three inches of termination using clear overwrapping self-laminating cable labels and the appropriate cable label identification as defined in Section 938.1.01 and shown in the details. Label field cabling in the camera sensor junction box, in the controller cabinet, and in all pullboxes and pole bases. After terminating and dressing the video camera sensor coaxial and power cables in the controller cabinet, neatly coil and store a minimum of 2 ft (0.5 m) of cable slack in the bottom of the cabinet. Provide a label for each cable for each 2 ft (0.5 m) of cable slack.

8. Cabinet Equipment

Install cabinet equipment as shown in the details and as required to provide the controller operation as shown the Plans. Cabinet equipment shall include as a minimum an I-VDS power termination panel, an I-VDS coax termination panel, one or more coaxial cable surge suppressors, one or more coaxial jumper cables, and all associated wiring and incidental materials.

Exercise extreme caution when installing I-VDS equipment and materials at traffic signal installations. Repair any damage to existing traffic control equipment and materials which occurred during I-VDS installation to the Engineer's satisfaction at the Contractor's sole expense.

In 336S cabinets, locate the I-VDS power termination panel on the equipment rail in the lower left portion of the rear of the cabinet as shown in the details. Adjust the panel as far toward the cabinet sidewall as possible while still providing access to the circuit breaker. Notify the Engineer immediately if there is any conflict with existing cabinet equipment in this position. Ensure that there is no conflict with door-mounted components when the door is closed.

In 332 and 336S cabinets, locate the I-VDS coax termination panel in the lower open section of the cabinet equipment rack as shown in the details. Notify the Engineer immediately if there is any conflict with existing cabinet equipment in this position. Ensure that there is no conflict with door-mounted components when the door is closed. Dress and secure all coaxial cabling to and from the coax termination panel such that the panel can be hinged open a minimum of 90 degrees without binding or stressing any coaxial cable.

9. As-Built Drawings

Furnish as-built drawings, including but not limited to video camera sensor locations, video camera sensor mounting heights, details on the field cabling route through the intersection, and component lists with brand, model and serial numbers. Place one copy of the as-built drawings in the cabinet documentation pouch and submit another copy to the Engineer.

C. Microwave Radar Detection

1. Detector

Install the microwave radar detector on poles as shown in the plans using supplied materials and brackets. Install the microwave radar detector to achieve the field of coverage shown in the Plans. Make field adjustments to the locations shown in the Plans only with the Engineer's approval. Set up the detection zones using a laptop computer and software provided by and the property of the Contractor.

2. Cabinet Equipment

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 microwave radar detector control wiring and 120VAC 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 120VAC circuits. Install all wiring as shown in the Detail Drawings.

   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 and between the microwave radar detection unit and the surge protectors on terminal strips. Use a minimum #16 AWG grounding for 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 two (2) transient surge suppressors for the microwave radar detection units (SS24 and SS25).

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. The components include but are not limited to terminal blocks, bussbars, panel and socket mounted surge suppressors, circuit breakers, and accessory and equipment outlets. Fasten all other cabinet components with hex-head or phillips-head machine screws installed with nuts (with locking washer or insert) or into tapped and threaded holes. Fasten stud-mounted components to a mounting bracket providing complete access to the studs and mounting nuts. 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 of or self-threading fasteners.

d. As-Built Drawings: Furnish an as-built cabinet wiring diagram, identified by location, for each cabinet. Include all wiring, cabling, and connections. Place all documentation in a weatherproof holder in the cabinet.

3. Cables, Conduit and Power Service

Furnish and install electrical cables used for control, communications signaling and power supply as shown in the Detail Drawings. Do not splice any cable, shield or conductor used for 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. After termination and dressing the cables in the cabinet, neatly coil and store a minimum of 2 ft (.61m) 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 control signaling, communications signaling and power supply between the cabinet and the device as required below and install them as shown in the Detail Drawings.

Install cabling inside new hollow metal or concrete support poles unless otherwise specified. Where devices are installed on existing wood poles, install cabling on the wood poles in rigid metal conduit risers of minimum 2 in (5.08 cm) diameter. 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.

4. As-Built Drawings

Furnish as-built drawings, including but not limited to microwave radar detection locations, microwave radar detection mounting heights, and component lists with brand, model and serial numbers. Place one copy of the as-built drawings in the cabinet documentation pouch and submit another copy to the Engineer.

938.3.06 Quality Acceptance

A. Not Applicable

B. Intersection Video Detection System

For I-VDS components installed as part of a contract for the installation of a new traffic signal installation, perform the Field Tests specified in 938.3.06.B.1, and perform the Testing, Burn-In and Acceptance Testing requirements set forth for the traffic signal installation as specified in Section 647.

For I-VDS components that are not installed as part of a contract for the installation of a new traffic signal installation, perform the Field Tests, Burn-In, and Acceptance Tests specified in Subsections 938.3.06.B.1, 938.3.06.B.2, and 938.3.06.B.3. Do not conduct tests without prior approval from the Engineer. The Engineer reserves the right to witness all tests.

1. Field Tests

Conduct field tests prior to the “burn-in” test to demonstrate that the equipment is in full compliance with the contract documents. Begin no testing on any Georgia State or Federal holiday. Perform the field tests after installation of all I-VDS components, wiring, and cabinet equipment and following completion of system software configuration required for the I-VDS to be functional at each location.

Perform a visual inspection of all installed equipment.

Demonstrate to the engineer that

- the detection zones are set up on each processor module using a programming monitor,
- each I-VDS field site provides calls to the traffic signal through the traffic signal controller,
- each I-VDS field site provides the correct data on the correct data channels, and
- all components of the I-VDS function as specified.

2. Burn-in Period

General Requirements: Perform a 30-day burn-in for all equipment furnished and installed as part of an I-VDS. The burn-in consists of the field operation of the I-VDS providing all required data to the traffic signal controller in accordance with the accuracy requirements stipulated in Subsection 938.2.B.6. Perform the burn-in for at least thirty (30) calendar days, commencing on a date to be specified by the Department. If any of the I-VDS equipment malfunctions, stop the burn-in for the length of time that the equipment is defective. After repairing the equipment, repeat the test until obtaining thirty (30) days of continuous, satisfactory operation. The Department will grant Final Acceptance on the 30th day of continuous, satisfactory operation. If a piece of equipment malfunctions more than two times during the 30 day burn-in period, replace that equipment with a new unit.

3. Final Acceptance

The Department will make final acceptance of the I-VDS installation after satisfactory completion of the required burn-in period and approval of a comprehensive final field inspection of the I-VDS installation. Perform the final inspection of the I-VDS installation in the company of a Department representative and a responsible contractor representative. Request in writing the final inspection a minimum of fifteen (15) calendar days in advance of the desired inspection date. Allow the Engineer to adjust the proposed schedule of the inspection by up to seven (7) calendar days, at no cost to the Department, to allow for availability of Department representatives. The Department will notify the contractor in writing upon final acceptance.

C. Microwave Radar Detection

1. General

Provide a microwave radar detector with a mean time between failures of a minimum of 10 years.

Provide a microwave radar detection system that identifies vehicle presence in each detection zone with a minimum of 95 percent accuracy and that identifies vehicle speed with a minimum of 90 percent accuracy.

2. Field Tests

Conduct field tests prior to the “burn-in” test to demonstrate that the equipment is in full compliance with the contract documents. Begin no testing on any Georgia State or Federal holiday. Perform the field tests after installation of all microwave radar detection components, wiring, and cabinet equipment and following completion of system software configuration required for the microwave radar detection to be functional at each location.

Perform a visual inspection of all installed equipment.

Demonstrate to the engineer that

- the detection zones are set up
- each detection zone reports data within the accuracy requirements defined in Subsection 938.3.06.C.1

3. Burn-in Period

Perform a 30-day burn-in for all equipment furnished and installed as part of a microwave radar detection system. The burn-in consists of the field operation of the detection system providing all required data to the NaviGAtor system in accordance with the accuracy requirements stipulated in Subsection 938.3.06.C.1. Perform the burn-in for at least thirty (30) calendar days, commencing on a date to be specified by the Department. If any of the microwave radar detection equipment

malfunctions, stop the burn-in for the length of time that the equipment is defective. After repairing the equipment, repeat the test until obtaining thirty (30) days of continuous, satisfactory operation. The Department will grant Final Acceptance on the 30th day of continuous, satisfactory operation. If a piece of equipment malfunctions more than two times during the 30 day burn-in period, replace that equipment with a new unit.

4. Acceptance

The Department will accept the microwave radar detection installation after satisfactory completion of the required burn-in period and approval of a comprehensive final field inspection of the microwave radar detection installation. Perform the final inspection of the microwave radar detection installation in the company of a Department representative and a responsible contractor representative. Request in writing the final inspection a minimum of fifteen (15) calendar days in advance of the desired inspection date. Allow the Engineer to adjust the proposed schedule of the inspection by up to seven (7) calendar days, at no cost to the Department, to allow for availability of Department representatives. The Department will notify the contractor in writing upon final acceptance.

938.3.07 Contractor Warranty and Maintenance

A. Warranty

Provide a manufacturer's support (usual and customary warranties) period for all equipment and materials furnished and installed as part of the pay item for detection system equipment and materials or I-VDS assembly.

Transfer Manufacturer’s and Contractor’s warranties or guarantees to the agency or user responsible for the detection system maintenance. Make these warranties/guarantees continuous throughout their duration, and state in them that they are subject to such transfer. Provide warranties or guarantees which state that they are subject to transfer and that are continuous throughout their duration. Transfer the warranties or guarantees upon Contract Final Acceptance.

B. Support

During the warranty period, provide phone consultation as needed at no cost for operating and maintenance questions or problems that arise.

938.3.08 Training

Provide installation, operations, and maintenance 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.

As a minimum, include the following with detection system training:

Provide installation, operations and maintenance training for up to twelve (12) people. Include both classroom training and hands-on training. Limit in-shop and in-field training to group sizes of four (4) people at a time. Conduct all training in half-day sessions. Two half-day sessions may be held on the same day. Perform a total of at least eight (8) clock hours of training for each participant. Include as a minimum the following in the course content: installation of all detection system equipment, operations of all detection equipment, troubleshooting, and maintenance of all detection system components, discussion of all warrantee clauses, hands-on use of detection system equipment in signal shop environment for each trainee, and in-field maintenance training.

938.4 Measurement

A. Not Applicable

B. Intersection Video Detection System

1. Intersection Video Detection System Assembly

Intersection Video Detection System 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 an Intersection Video Detection System Assembly:

- Video Camera Sensor:
    - Camera, environmental enclosure, variable focal length lens, mounting bracket assembly, and junction box with all associated hardware and incidental materials
    - Electric Lens Adjustment Device; if more than one video camera sensor is installed at an intersection, provide one Electric Lens Adjustment Device for that intersection
    - Field cabling and cabinet equipment, including but not limited to power and video cabling from the video camera sensor to the controller cabinet, processor module, power and coax termination panels, surge suppressor, cabinet wiring, and all associated hardware and incidental materials. If more than one Intersection Video Detection Assembly is installed at an intersection, provide one power termination panel and one coax termination panel for that intersection
    - All weather heads, vertical conduit risers, and conduit hardware on the I-VDS support pole for power and video signal as shown in the Plans
- Processor Module:
    - Configuration and processor software on the processor module
    - Programming Device; if more than one Processor Module is installed in a cabinet at an intersection, provide one Programming Device for that cabinet
- Output Expansion Module

  Output expansion modules paid for are the number actually installed, complete, functional, and accepted. Unless otherwise specified in the Plans, furnish and install an Output Expansion Module to include, at a minimum, the following:
    - Output expansion module
    - Any cabling required to connect to the processor module or additional expansion modules

2. Programming Monitor

A Programming Monitor is measured for payment by the number actually furnished and accepted. Unless otherwise specified in the Plans, furnish a Programming Monitor to include, at a minimum, the following:

- Programming Monitor
- Any cabling required to connect the processing modules to the programming monitor

C. Microwave Radar Detection

Microwave radar detection 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 microwave video detection assembly:

- Microwave radar detector
- Housing
- Field cabling and cabinet equipment
- Mounting bracket(s)
- All weatherheads, vertical conduit risers, and conduit hardware on the support pole for power and detector signal as shown in the plans

- Configuration

D. Testing

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

E. Training

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

938.4.01 Limits

Not applicable

938.5 Payment

A. Not Applicable

B. Intersection Video Detection System

1. Intersection Video Detection System Assembly, Type A

Intersection Video Detection System 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 Intersection Video Detection System Assembly.

Payment for Intersection Video Detection System Assembly is made under:

Item No. 938	Intersection Video Detection System Assembly, Type A	Per Each

2. Output Expansion Module, Type A

Output Expansion Modules, 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 Output Expansion Module and associated cabling.

Payment for Output Expansion module is made under:

Item No. 938	Output Expansion Module, Type A	Per Each

3. Programming Monitor, Type A

A Programming Monitor is paid for at the Contract Unit Price. Payment is full compensation for furnishing a Programming Monitor.

Payment for Programming Monitor is made under:

Item No. 938	Programming Monitor, Type A	Per Each

C. Microwave Radar Detection Assembly

Microwave Radar Detection 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 Microwave Radar Detection Assembly.

Payment for Microwave Radar Detection Assembly is made under:

Item No. 938	Microwave Radar Detection Assembly	Per Each

D. Testing

The Department will pay for testing performed as prescribed by this Item, measured as provided under Measurement.

Payment for testing is made under:

Item No. 938	Testing	Lump Sum

E. Training

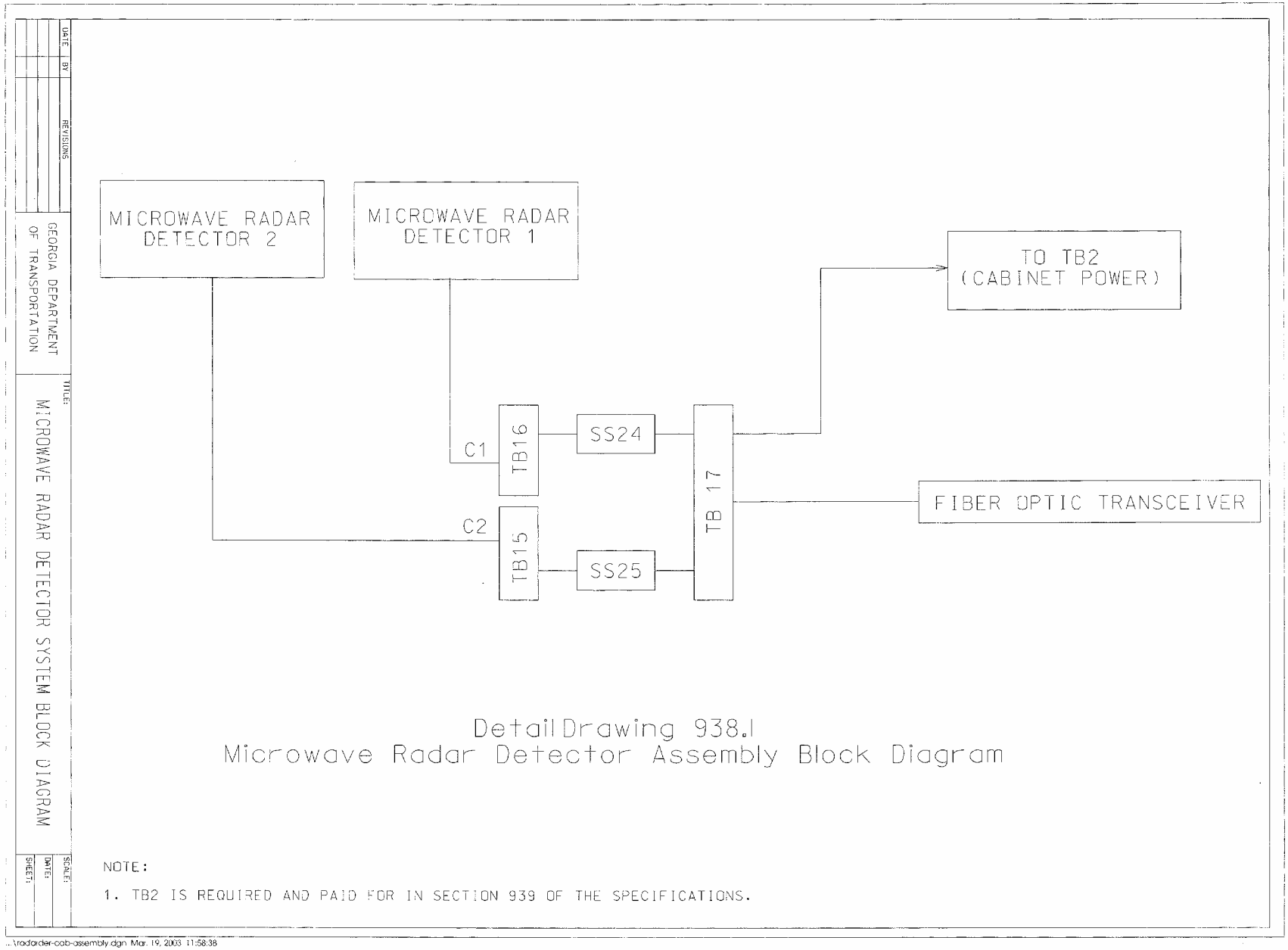
The Department will pay twenty-five (25%) of the total Lump Sum Contract bid amount for training upon approval of the Training Plan. The Department will pay the remaining seventy-five (75%) after completion of all training as described in Subsections 938.3.08. The total sum of all payments cannot exceed the original contract amount for this item.

Payment for training is made under:

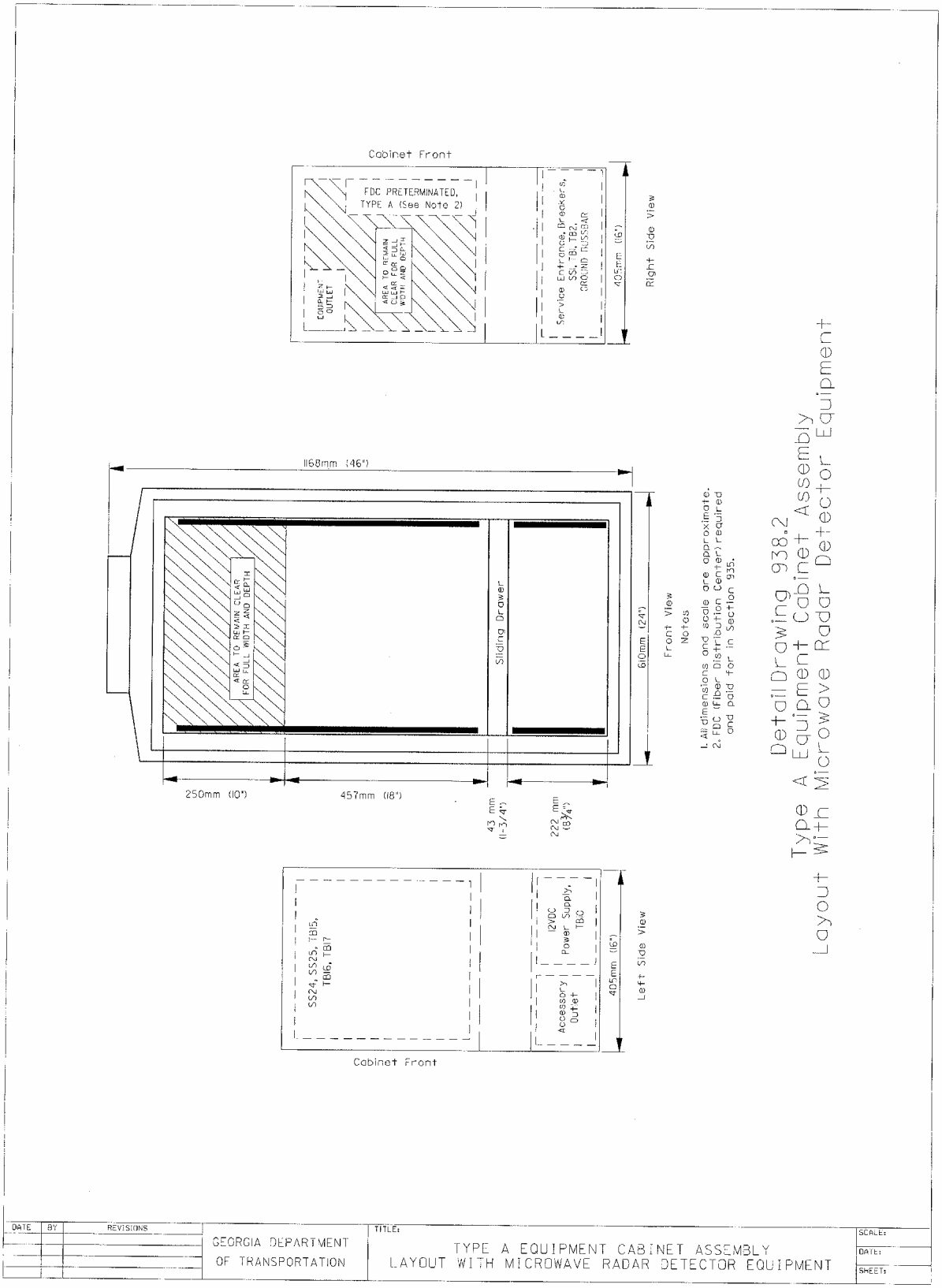
Item No. 938	Training	Lump Sum

938.5.01 Adjustments

Not applicable



Detail Drawing 938.1
Microwave Radar Detector Assembly Block Diagram


Cabinet Front
FDC PRETERMINATED, TYPE A (See Note 2)
AREA TO REMAIN CLEAR FOR FULL WIDTH AND DEPTH
COMPANY OUTLET
Service Entrance Breakers, SS1, TB1, TB2, GROUND BUSSBAR
405mm (16")
Right Side View
1168mm (46")
AREA TO REMAIN CLEAR FOR FULL WIDTH AND DEPTH
Sliding Drawer
610mm (24")
Front View
250mm (10")
457mm (18")
43 mm (1-3/4")
222 mm (8¾")
SS24, SS25, TB15, TB16, TB17
12VDC Power Supply, TBC
Accessory Outlet
405mm (16")
Left Side View
Cabinet Front
Notes
1. All dimensions and scale are approximate.
2. FDC (Fiber Distribution Center) required and paid for in Section 935.
Detail Drawing 938.2
Type A Equipment Cabinet Assembly
Layout With Microwave Radar Detector Equipment
DATE
BY
REVISIONS
GEORGIA DEPARTMENT OF TRANSPORTATION
TITLE:
TYPE A EQUIPMENT CABINET ASSEMBLY
LAYOUT WITH MICROWAVE RADAR DETECTOR EQUIPMENT
SCALE:
DATE:
SHEET: