# SECTION 16742

# VIDEO DETECTION SYSTEM

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

This specification sets forth the minimum requirements for a Video Imaging Vehicle Detection System (VIVDS) that monitors vehicles on a roadway via processing of video images and provides detector outputs to a traffic controller or similar device.

A video detection system for a single intersection shall consist of the following components: variable focal length color camera, VIVDS processor(s), and all associated equipment required to setup and operate in a field environment including one color video monitor, connectors, communication cable, and camera mounting hardware.

The system software shall be able to detect either approaching or departing vehicles in multiple traffic lanes. A minimum of 4 detector outputs per video processor module card and each output shall have a minimum of 48 detection zones. Each zone and output shall be user-definable through interactive graphics by placing lines and/or boxes in an image on a video monitor. The user shall be able to redefine previously defined detection zones.

### 1.02 UNIT PRICES

A. Measurement
This item shall be measured by each intersection including four (4) color cameras, mounted including fittings, conductors, brackets, appurtenances, video processor(s), cables, cabinet & communication interfaces, programming, communications software, and other associated equipments required for installation.

B. Payment
This item shall be paid by each installation at an intersection.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. VIVDS PROCESSOR AND RACK-MOUNTED INTERFACE UNIT

The VIVDS processor is an electronic unit that converts the video image provided by the cameras, generates vehicle detection for defined zones and collects vehicular data as specified.

The VIVDS processor may be housed in either the cabinet or camera housing. While not required, the City of Houston prefers that the VIVDS processor unit to fit inside each camera housing. The processor can fit directly into NEMA TS1 and TS2 type racks as well as Type 170/2070 input files. The video output from the unit shall be in color with active detection zones overlaid on full motion video.

The VIVDS processor unit shall be designed to operate reliably in the adverse environment found in the typical roadside traffic cabinet. It shall meet the environmental requirements set forth by the latest NEMA (National Electrical Manufacturers Association) TS1 and TS2 standards as well as the environmental requirements for Type 170, Type 179 and 2070 controllers. Operating temperature shall be from -25°F to +160°F at 0% to 95% relative humidity, non-condensing.

The VIVDS shall have a modular electrical design. The VIVDS shall be powered by 89-135 VAC, 60 Hz single-phase. Power to the VIVDS shall be from the transient protected side of the AC power distribution system in the traffic control cabinet in which the VIVDS is installed. If the VIVDS processor is located in the controller cabinet, then, the system shall be powered by 12-24 VDC and draw less than 2 amperes.

The field communications wiring between each camera and the traffic controller cabinet shall be either 18 AWG, 6 twisted-wire-pair with an overall shield or coaxial cable. While not required, the City prefers the twisted-wire-pair.

The VIVDS Processor System (VPS) at each intersection shall be able to be networked using a 2-TWP interconnect back to the Master Cabinet for future communication to, Houston TranStar, the traffic management center.

Serial communications to the field setup computer shall be through an RS-232 serial port. This port shall be able to download the real-time detection information needed to show detector actuations. A connector

on the front of the VIVDS processor unit shall be used for serial communications.

The VIVDS processor unit software and/or the supervisor software shall include diagnostic software to allow testing the VIVDS functions. This shall include the capability to set and clear individual detector outputs and display the status of inputs to enable setup and troubleshooting in the field.

B. VIDEO DETECTION CAMERA

The video detection system shall use medium resolution, color image sensors as the video source for real-time vehicle detection. The cameras shall be approved for use with the VIVDS processor unit by the supplier of the VIVDS. As a minimum, each camera shall provide the following capabilities:

- Images shall be produced with a Charge Coupled Device (CCD) sensing element with horizontal resolution of at least 380 lines and vertical resolution of at least 350 lines. Images shall be output as a video signal conforming to RS170A or CCIR.

- Useable video and resolvable features in the video image shall be produced when those features have luminance levels as low as 0.1 lux at night.

- Useable video and resolvable features in the video image shall be produced when those features have luminance levels as high as 10,000 lux during the day.

The camera and lens assembly shall be housed in an environmental enclosure that provides the following capabilities:

- The enclosure shall be waterproof and dust-tight to the latest NEMA-4 specifications.

- The enclosure shall allow the camera to operate satisfactorily over an ambient temperature range from -25°F to +160°F while exposed to precipitation as well as direct sunlight.

- The enclosure shall allow the camera horizon to be rotated in the field during installation.

- The enclosure shall include a provision at the rear of the enclosure for connection of power and video signal cables

fabricated at the factory. The input power to the environmental enclosure shall be nominally 120 or 240 VAC 50/60 Hz and the power consumption shall be 35 watts or less under all conditions.

- A thermostatically controlled heater shall be at the front of the enclosure to prevent the formation of ice and condensation, as well as to assure proper operation of the lens's iris mechanism. The heater shall not interfere with the operation of the camera electronics, and it shall not cause interference with the video signal.

- The enclosure shall be light-colored or unfinished and shall include a sun shield to minimize solar heating. The front edge of the sunshield shall protrude beyond the front edge of the environmental enclosure and shall include provision to divert water flow to the sides of the sunshield. The amount of overhang of the sun shield shall be adjustable to block the view of the horizon to prevent direct sunlight from entering the lens. Any plastics used in the enclosure shall include ultra violet inhibitors.

- The total weight of the image sensor in the environmental enclosure with sunshield shall be less than 20 lbs.

- When operating in the environmental enclosure with power and video signal cables connected, the image sensor shall meet FCC class B requirements for electromagnetic interference emissions.

The video output of the cameras shall be isolated from earth ground. All video connections for the cameras to the video interface panel shall also be isolated from earth ground. Connections for both video and power shall be made to the image sensor using waterproof, quick disconnect connectors.

Camera mounting hardware shall allow for vertical or horizontal mounting to the camera enclosure.

Each camera enclosure shall be equipped with a water-proof connector mounted to the rear bulkhead of the camera enclosure. The connector on the rear of the camera enclosure and the mating connector on the end of the cable shall conform to the MIL-C-26482 Series 1 standard. To guarantee that the cable connector and backshell form a waterproof connection, each backshell shall be filled with an epoxy-potting compound. After the potting compound has set up, the backshell shall be covered with a shrink tubing boot that extends down about 2 inches onto the outer jacket of the cable and filled with epoxy potting

compound, also. After the potting compound has set up, the shrink boot shall be heated to form a 100% waterproof connection between the cable connector and the cable.

## 2.02 FUNCTIONAL CAPABILITIES

### A. VIVDS PROCESSOR UNIT

The VIVDS shall provide real-time vehicle detection (within 112 milliseconds (ms) of vehicle arrival). The VIVDS processor unit shall be capable of simultaneously processing information from various video sources, including CCTV video image sensors and video tape players. The video sources may be, but are not required to be, synchronized or line-locked. The video shall be processed at a rate of 30 times per second by the VIVDS processor unit.

The system shall be capable of providing twenty-four (24) or more detector outputs from up to eight (8) camera/video processor units. The VIVDS processor system should provide compressed color video through the DB-9 RS-232 data stream with active detection zones overlaid.

Detection zones shall be provided that are sensitive to the direction of vehicle travel. The direction to be detected by each detection zone shall be user programmable. The VIVDS processor unit shall compensate for minor camera movement (up to 2% of the field of view at 400 ft.) without falsely detecting vehicles. The camera movement shall be measured on the unprocessed video input to the VIVDS processor unit. The camera shall operate while directly connected to VIVDS Processor Unit. Once the detector configuration has been downloaded or saved into the VIVDS processor unit, the video detection system shall operate with the monitoring equipment (monitor and/or laptop) disconnected or on-line.

The camera/processor unit shall be provided with count, presence, directional presence, speed, stopped vehicles, and queue types of detection zones. An adjustable cycle timer shall be available for dealing with stopped vehicles. The Windows software shall be able to display the traffic parameters on the screen of an SVGA monitor on a per vehicle basis for each detection station by lane. It shall also be possible to view and sort the stored data for selected time intervals. When the monitoring equipment is directly connected to the VIVDS processor unit, it shall be possible to view vehicle detections in real-time as they occur on the field setup computer's color VGA display or the video monitor.

B. VEHICLE DETECTION

The video detection system shall provide flexible detection zone placement anywhere within the combined field of view of the image sensors. Preferred presence detector configurations shall be lines or boxes placed across lanes of traffic or lines placed in-line with lanes of traffic. A single detector shall be able to replace one or more conventional detector loops. Detection zones shall be able to be fully overlapped. In addition, detection zones shall have the capability of implementing "AND" and "OR" logical functions including presence, extension and delay timing. These logical functions may be excluded if provisions are made to bring each detector separately into the controller and the controller can provide these functions.

Placement of detection zones shall be by means of a graphical interface using the video image of the roadway. The monitor shall show images of the detection zones superimposed on the video image of traffic while the VIVDS processor is running.

The detection zones shall be created by using the mouse or keypad to draw detection zones on the monitor. The detection zones shall be capable of being sized, shaped and overlapped to provide optimal road coverage and detection. It shall be possible to save the detector configurations on disk to download detector configurations to the VIVDS processor unit and to retrieve the detector configuration that is currently running in the VIVDS processor unit.

The mouse or keypad shall be used to edit previously defined detector configurations so as to fine-tune the detection zone placement size and shape. Once a detection configuration has been created, the system shall provide a graphic display of the new configuration on its monitor. While this fine-tuning is being done, the detection shall continue to operate from the detector configuration that is currently called for.

When a vehicle occupies a detection zone, the detection zone on the live video shall indicate the presence of a vehicle, thereby verifying proper operation of the detection system. With the absence of video, the card shall have an LED that will indicate proper operation of the detection zones.

Detection zones shall be provided that is sensitive to the direction of vehicle travel. The direction to be detected by each detection zone shall be user programmable.

The video detection system shall reliably detect vehicle presence in the design field of view. The design field of view shall be defined as the sensor view when the image sensor is mounted 24 ft. or higher above the roadway, when the camera is adjacent (within 15 ft.) to the edge of the nearest vehicle travel lane, and when the length of the detection area is not greater than 10 times the mounting height of the image sensor. Within this design field of view, the VIVDS processor unit shall be capable of setting up a single detection zone for point detection (equivalent to the operation of a 6 ft. by 6 ft. inductive loop). A single camera, placed at the proper mounting height with the proper lens, shall be able to monitor up to and including 5 traffic lanes simultaneously.

Detection accuracy of the video detection system shall be comparable to properly operating inductive loops. Detection accuracy shall include the presence of any vehicle in the defined detection zone regardless of the lane, which the vehicle is occupying. Occlusion produced by vehicles in the same or adjacent lanes shall not be considered a failure of the VIVDS processor unit, but a limitation of the camera placement. Detection accuracy (a minimum of 95%) shall be enforced for the entire design field of view on a lane by lane and on a time period basis.

Equipment failure, either camera or VIVDS processor unit, shall result in constant vehicle detection on affected detection zones.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. The supplier of the video detection system shall supervise the installation and testing of the system. A factory certified representative from the supplier shall be on-site during installation. Up to 2 days of training shall be provided to personnel of the City of Houston in the operation, setup and maintenance of the video detection system. Instruction and materials shall be provided for a maximum of 20 persons and shall be conducted at a location selected by the City.

B. The cabling shall comply with the National Electric Code, as well as local electrical codes. Cameras may acquire power from the luminaire if necessary.

C. The video detection system shall be installed by supplier factory certified installers and as recommended by the supplier and documented in

installation materials provided by the supplier. Proof of factory certification shall be provided.

3.02 MAINTENANCE AND SUPPORT

A. The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the video detection system. These parts shall be available for delivery within 30 days of placement of an acceptable order at the supplier's then current pricing and terms of sale for said parts.

B. The supplier shall maintain an ongoing program of technical support for the video detection system. This technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order at the supplier's then current pricing and terms of sale for on site technical support services.

C. A factory-authorized representative shall provide installation or training support.

D. All product documentation shall be written in the English language.

3.03 WARRANTY

All material, workmanship and labor furnished shall be covered by Supplier(s)/Manufacturer(s) guarantee and/or warranty for a minimum period of twenty-four (24) months. Warranty period shall begin the day the video detection system is activated by the City of Houston, either as new order or warranty repair. The City of Houston's preference is for all non-warranty service to be charged a singular flat rate.

Successful bidder shall bear all expenses connected with return of any material, which the City deems necessary to return for adjustments during warranty period.

Successful bidder shall bear all labor cost associated with warranty items and maintenance in a timely manner; the quality of timely service is determined by the City's Traffic Engineer and shall not exceed twenty-four (24) hours from the Time of Notification (TON) to initial field response by the successful bidder or their representative. In essence, the successful bidder shall provide maintenance and field service (i.e. trouble calls) during the warranty period.

Supplier(s)/Manufacturer(s) shall make all engineering data, diagrams, software changes or improvements, which increases performance of

equipment purchased under this bid, available to the City of Houston at no additional cost.

Supplier(s)/Manufacturer(s) shall have field engineers or technicians available on request to assure satisfactory initial operation, and to consult with City's Traffic Engineer, or his representative, on any special circuitry that may be required in certain applications.

END OF SECTION