

**TEXAS DEPARTMENT OF TRANSPORTATION  
SPECIAL SPECIFICATION TO-6295  
WIRELESS VIDEO IMAGING VEHICLE DETECTION SYSTEM**

**1.0 GENERAL**

This specification sets forth the minimum requirements for a Wireless Video Imaging Vehicle Detection System (WVIVDS) that provides a video signal to a Video Detection Processor (VDP) for vehicle detection processing. The camera shall capture video images of vehicles on a roadway. The video signal is transmitted from the camera location to a roadside traffic control cabinet without the need for coaxial cables. The VDP provides detector outputs to a traffic controller or similar device. This configuration enhances system portability and reduces installation time and expense.

**2.0 SYSTEM HARDWARE**

The wireless camera system shall consist of one or more variable focus video cameras, one or more transmitters, a single channel or multi-channel receiver, and appropriate cabling for camera, transmitter and receiver power. The WVIVDS power cabling shall be no greater than 16 AWG three conductor and shall comply with the National Electric Code.

**3.0 FUNCTIONAL CAPABILITIES**

- 3.1 The WVIVDS shall provide real-time vehicle detection (within 112 milliseconds (ms) of vehicle arrival).
- 3.2 The system shall be able to detect the presence of vehicles in a minimum of 12 detection zones per camera, within the combined field of view of all cameras.
- 3.3 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.
- 3.4 The WVIVDS processor unit shall compensate for minor camera movement (up to 2 percent of the field of view at 400 feet) without falsely detecting vehicles. The camera movement shall be measured on the unprocessed video input to the WVIVDS processor unit.
- 3.5 The camera shall operate while directly connected to WVIVDS Processor Unit.
- 3.6 Once the detector configuration has been downloaded or saved into the WVIVDS processor unit, the video detection system shall operate with the monitoring equipment (monitor and/or laptop) disconnected or on-line.
- 3.7 When the monitoring equipment is directly connected to the WVIVDS processor unit, it shall be possible to view vehicle detection in real-time as they occur on the field setup computer's color VGA display or the video monitor.
- 3.8 Once the WVIVDS processor unit has been properly set up using the field setup computer or video monitor, it shall be possible to disconnect the field setup computer. The WVIVDS processor unit shall then detect vehicles as a stand-alone unit.

- 3.9 The WVIVDS processor unit shall be capable of simultaneously processing information from up to four (4) 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 WVIVDS. Single and/or double video-input cards may be used to meet this requirement.
- 3.10 The system shall be able to detect the presence of vehicles in a minimum of 48 detection zones, within the combined field of view of all cameras.
- 3.11 Wireless camera system shall be able to transmit a National Television Standards Committee (NTSC) video signal, with minimal signal degradation for all signal applications (diamond interchanges, 4-approach system and high speed detection). The minimal distance of transmitting a video signal shall be 800 feet.
- 3.12 The wireless transmission equipment shall be available in 1, 2 or 4 channel configurations, enabling cost-effective use for various applications.
- 3.13 The wireless transmission equipment shall operate in an unlicensed microwave frequency range, such as 2.4 Ghz or 5.8 Ghz, enabling system portability and reusability.
- 3.14 The associated Video Detection Processor (VDP) shall default to a safe condition, placing a constant call on each active detection channel, in the event of unacceptable interference with the video signal.

#### **4.0 CAMERA HARDWARE**

- 4.1 The video camera used for traffic detection shall be furnished by the VDP supplier and shall be qualified by the supplier to ensure proper video detection system operation.
- 4.2 The camera shall produce a useable video image of the bodies of vehicles under all roadways lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime (0.1 lux) to daytime (10,000 lux).
- 4.3 The camera shall use a Charge Coupled Device (CCD) sensing element and shall output video.
- 4.4 The camera shall automatically adjust for lighting conditions.
- 4.5 The camera shall include a variable focal length with variable focus and zoom that can be adjusted without opening up the camera housing to suit the geometry. Portable handheld equipment, which facilitates focusing and zooming of cameras shall be available.
- 4.6 The camera electronics shall produce a satisfactory image at night.
- 4.7 The camera shall be housed in an environmentally sealed enclosure, waterproof and dust-proof according to the latest NEMA 4 specifications.
- 4.8 The camera enclosure shall be equipped with a sun shield that prevents sunlight from directly entering the lens. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera field of view. The camera enclosure with sunshield, and transmitter if transmitter is integrated into the camera housing, shall be no greater than 6 inches diameter, 15 inches long and shall weigh less than 6 pounds when the camera and lens are mounted inside the enclosure.

- 4.9 The camera enclosure shall include a thermostatically controlled heater to assure proper operation of the lens at low temperatures and prevent moisture condensation on the optical faceplate of the enclosure.
- 4.10 When mounted outdoors in the enclosure, the camera shall operate in a temperature range from -34°C (-30°F) to +60°C (+165°F) and a humidity range from 0% RH to 100%RH.
- 4.11 The camera shall be capable of working with 120VAC 60Hz or 12 VDC (when specified in plans or Invitation for Bid). Camera powers consumption shall be less than 18 watts, if transmitter is integrated into the camera housing, under all conditions.
- 4.12 If called for, the 12 VDC camera shall include a cabinet that houses an on-board, solid state, charge control circuit to insure proper charging on the system battery bank. The photovoltaic module shall provide 12 VDC and be capable of recharging the system to full capacity, after six (6) hours of continuous operation, in three (3) hours +/- .5 hours during optimum sun conditions. The gel cell battery shall be spill proof and should have the ability to be installed in any position. The batteries shall be sized to allow twelve (12) days autonomy. Depth of Discharge (DOD) for the system shall not exceed 80%. Mounting hardware shall be supplied for solar panel and cabinet.
- 4.13 The camera enclosure shall be equipped with separate, weather-tight connectors for power and video antenna cables at the rear of the enclosure to allow diagnostic testing and viewing video at the camera while the camera is installed on a mast arm or pole.
- 4.14 The video signal output by the camera shall be in RS-170 (NTSC) format.
- 4.15 The video signal shall be fully isolated from the camera enclosure and power cabling.
- 4.16 The video detection system shall use medium resolution, monochrome image sensors as the video source for real-time vehicle detection. The supplier of the WVIVDS shall approve the cameras for use with the WVIVDS processor units. As a minimum, each camera shall provide the following capabilities:
  - 4.16.1 Images shall be produced with a CCD sensing element with horizontal resolution of at least 525 lines and vertical resolution of at least 350 lines. Images shall be output as a video signal conforming to RS-170.
  - 4.16.2 Usable video and resolvable features in the video image shall be produced with those features having luminance levels as low as 0.1 lux at night.
  - 4.16.3 Usable video and resolvable features in the video image shall be produced with those features having luminance levels as high as 10.000 lux during the day.
  - 4.16.4 The camera shall include an electronic shutter or auto-iris control based upon average scene luminance and shall be equipped with an electronic shutter or auto-iris with variable focal length and variable focus that can be adjusted without opening up the camera housing to suit the site geometry.

**5.0 WVIVDS HARDWARE**

- 5.1 The WVIVDS processor unit shall be rack mountable.
- 5.2 WVIVDS Processor Unit - Environmental Requirements

- 5.2.1 The WVIVDS 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.
- 5.2.2 Operating temperature shall be from -34 (-30°F) to +74 (+165°F) degrees C at 0 percent to 95 percent relative humidity, non-condensing.
- 5.3 WVIVDS Processor Unit - Electrical
  - 5.3.1 The WVIVDS shall have a modular electrical design.
  - 5.3.2 The WVIVDS shall be powered by 89-135 VAC, 60 Hz single phase. Power to the WVIVDS shall be from the transient protected side of the AC power distribution system in the traffic control cabinet in which the WVIVDS is installed.
  - 5.3.3 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 WVIVDS processor unit shall be used for serial communications.
  - 5.3.4 The equipment shall be provided with both TS1 and TS2 interfaces.
    - 5.3.4.1 TS1 interface: The two-channel WVIVDS processor cards shall be equipped with a NEMA TS1 detector interface for a minimum of 4 detector outputs. Logic output levels shall be compatible with the NEMA TS1. (If required for additional detector outputs, a "D" subminiature connector on the front of the WVIVDS processor card or extension modules can be used for interfacing to these outputs).
    - 5.3.4.2 TS2 interface: The WVIVDS processor unit shall be equipped with a NEMA TS2 Type 1 detector interface, where detector information is transmitted serially via an RS-485 data path. The two-channel WVIVDS processor card shall plug into existing TS2 detector racks for a minimum of 4 detector outputs. (If required for more detector outputs, a "D" subminiature connector on the front of the WVIVDS processor card or extension modules can be used for interfacing to these outputs).
  - 5.3.5 The WVIVDS processor unit shall be equipped with RS-170 (monochrome) composite video inputs, so that signals from image sensors or other synchronous or asynchronous video sources can be processed in real-time. BNC connectors on the front of the WVIVDS processor unit or video patch panel shall be used for all video inputs.
  - 5.3.6 The WVIVDS processor unit shall be equipped with a single RS-170 composite video output. This output shall be capable of being switched to correspond to any one of the four-video inputs, as selected remotely via the field setup computer or front panel switch. Multiple video outputs requiring external cable connections to create a combined single video output shall not be acceptable. A BNC connector shall be used for video output on the front of the processor unit.
  - 5.3.7 The WVIVDS 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.

## **6.0 OPERATION FROM CENTRAL CONTROL**

- 6.1 The central control shall transmit and receive all information needed for detector setup, monitor the vehicle detection, view the vehicle traffic flow at a rate of two (2) frames per second or greater for telephone, or five (5) frames a second or greater for ISDN lines (as specified by the plans), and interrogate all required stored data.
- 6.2 The remote communications link between the WVIVDS processor unit and central control may be dial-up (telephone or ISDN lines) or dedicated twisted wire pair communications cable which may be accompanied with coaxial cable or fiber-optic cable, as shown on the plans. Communications with the central control shall not interfere with the on-street detection of the WVIVDS processor.

## **7.0 INSTALLATION AND TRAINING**

- 7.1 The supplier of the video detection system shall supervise the installation and testing of the video and computer equipment. A factory-certified representative from the supplier shall be on-site during installation.
- 7.2 In the event that the field setup computer is furnished by the contracting agency, such installation and testing shall be done at the time that training is conducted.
- 7.3 Up to two (2) days of training shall be provided to personnel of TxDOT 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 TxDOT. TxDOT shall be responsible for any travel and room and board expenses for its own personnel.
- 7.4 Instruction personnel are required to be certified by the equipment manufacturer. The User's Guide is not an adequate substitute for practical, classroom training and formal certification by an approved agency.
- 7.5 Formal levels of factory authorized training are required for installers, contractors and system operators. The manufacturer must certify all training.

## **8.0 WARRANTY, MAINTENANCE AND SUPPORT**

- 8.1 The video detection system shall be warranted to be free of defects in material and workmanship for a period of five (5) years from date of shipment, from the supplier's facility. During the warranty period, the supplier shall repair with new or refurbished materials, or replace at no charge any product containing a warranty defect provided the product is returned FOB to the supplier's factory or authorized repair site. Product repair or replaced under warranty by the supplier will be returned with transportation prepaid. This warranty does not apply to products damaged by accident, improper operation, abused, serviced by unauthorized personnel or unauthorized modification.
- 8.2 During the warranty period, technical support shall be available from the supplier via telephone within four (4) hours of the time a call is made by a user, and this support shall be available from factory certified personnel or factory certified installers.
- 8.3 Ongoing software support by the supplier shall include updates of the WVIVDS processor unit and supervisor software (if a field setup computer is required for set up). These updates shall be provided free of charge during the warranty period. The update of the WVIVDS software to be NTCIP compliant shall be included.

- 8.4 The supplier shall maintain a program for technical support and software updates following expiration of the warranty period. This program shall be made available to TxDOT in the form of a separate agreement for continuing support.
- 8.5 The supplier shall maintain an ongoing program of technical support for the wireless camera system. This technical support shall be available via telephone or personnel sent to the installation site.
- 8.6 The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the wireless camera system.

**9.0 MEASUREMENT AND PAYMENT**

Work performed and materials furnished as prescribed by this special specification will be paid for on a per WVIVDS basis.