# VIDEO VEHICLE DETECTION SYSTEM

D3 Revised 08-30-2023

Description. This work shall consist of furnishing and installing a Video Vehicle Detection System for traffic signals without remote access capabilities.

Materials. Materials shall be according to the following.

Item Article/Section

1. Video Sensor………………………………………………………..………………….….Note 1
2. Communications Interface Panel……………………………………….…………….…Note 2
3. Wired Input/Output Card…………………………………………………….…………….Note 3
4. Management Software………………………………………………………...…………Note 4
5. Video Monitor………………………………………………………………………………Note 5

Note 1. The video sensor shall integrate a high-definition camera with an embedded processor for analyzing the video and performing detection. The camera shall include a color complementary metal oxide semiconductor (CMOS) imaging array and optical zoom. The integrated processor shall provide direct, real time iris and shutter speed control. The optical zoom shall satisfy across-the-intersection detection objectives, including stop line and advance detection.

The camera and processor shall be housed in a sealed weatherproof enclosure with an integral aiming sight and all necessary mounting hardware. The faceplate of the enclosure shall be glass and have a hydrophilic coating on the exterior surface to reduce debris accumulation and maintenance and a thermostatically controlled heater applied directly on the interior surface to keep the faceplate clear of condensation, snow, ice, and frost. An adjustable aluminum visor shall shield the faceplate from the sun and extraneous light sources.

Power and communications for the video sensor shall utilize a broadband-over-power connection using cables approved by the manufacturer of the video sensor. The video sensor shall operate over an input voltage range of 89 to 265 V AC at 50 or 60 Hz. Typical power consumption shall be no more than 16 watts. All surge suppression shall be located inside the controller cabinet.

Note 2. The communications interface panel shall manage communications between the video sensors, and the traffic cabinet itself. The communications interface panel shall provide connection points for all video sensors.

The broadband-over-power communications shall provide a throughput of 70 to 90 megabits per section (Mbps) and shall support a minimum of 1,000 feet of cable to the video sensor. Each video sensor connection shall include a power switch, a power indicator, a communication status indicator, a resettable fuse, and high-energy transient protection.

Two ethernet ports capable of 10/100/1000 Mbps shall be provided for maintenance. The communications interface panel shall proxy all network requests that arrive on the ethernet ports to avoid unwanted network traffic from reaching the broadband-over-power network between the communications interface panel and the video sensors. All communications to the video detection system through the ethernet ports shall be to a single IP address. The maintenance port shall support dynamic host configuration protocol to automatically assign an IP address to the user's computer.

An 802.11g Wi-Fi access point (WAP) shall allow a wireless connection to the video detection system. All communications to the video detection system through the WAP shall be to a single IP address. The WAP shall support Dynamic Host Configuration Protocol to automatically assign an IP address to the user's computer. A momentary pushbutton shall allow the user to turn the WAP on or off. The WAP shall turn itself off automatically after a period of inactivity from connected devices and include a LED to indicate when the WAP is enabled. The WAP shall operate simultaneously with the maintenance port and the TMC connection. The WAP shall require a customizable password for connection by a user's computer.

The communications interface panel shall provide one connection to communicate to the traffic controller through the cabinet. The traffic controller connection shall support a TS2 Type 1 compatible Software Development Life Cycle (SDLC) interface. The traffic controller connector shall be a 15-pin female metal shell D sub-miniature type connector to support a standard NEMA TS2 or TEES SDLC cable. The traffic controller connection shall support a protocol interface to SDLC-capable traffic controllers (NEMA or TEES). The traffic controller connection shall support the NEMA TS2 SDLC protocol to include up to 64 detector outputs and 32 inputs.

The traffic controller connection shall be able to connect to a wired input/output card, which supports wired 1/0 in cabinets without a SDLC capable controller. The wired 1/0 data communications link shall support at least 24 outputs and 16 inputs. It shall be possible to connect and use both SDLC communications and communications to the wired input/output card simultaneously.

The communications interface panel shall include two USB 2.0 ports. It shall be possible to reinstall all system and application software from a USB memory stick without removal of the communications interface panel from the cabinet. Video recording of up to 2 cameras simultaneously shall commence automatically when an appropriately configured USB memory stick is installed in either USB port.

The communications interface panel shall accept input voltage in the range of 89 to 265 V AC, 50 to 60 Hz power from the transient-protected side of the cabinet. The communications interface panel shall be protected by two slow blow fuses. Two spare fuses shall be attached to the panel.

Note 3. A input/output card with real-time detection shall reside in a standard detector rack or shelf-mount enclosure with power module.

The wired input/output card shall comply with the form factor and electrical characteristics to plug directly into a NEMA Type C or D detector rack. The card shall provide four detector outputs on a rear-edge connector. A front connector shall provide communication to the communications interface panel and allow 16 inputs and 24 contact closure detector outputs for wiring into the cabinet. A front panel LED for each of the 16 inputs and 24 outputs shall indicate the state of the input or output.

The wired input/output card shall support optional expansion cards in other slots. Each expansion card shall support 4 outputs to the rear edge of the card. The wired input/output card shall support optional harnesses for connection to Input Files or C1, C4, C11, and C12 ports to support Type 170 or Type 2070 controllers.

Note 4. Management software shall be a Windows-based application and communicate with the video detection system via ethernet. The management software shall automatically determine all video sensors and communications interface panels available on the local network and populate a list of all devices and provide a means to add video sensors and communications interface panels on routed networks by the communications panel's wide area network IP address.

The management software shall provide the user a means to name individual video sensors and communications interface panels, zoom the camera optics while viewing a live video stream, calibrate distances in the field of view to create a 3-dimensional mapping of the complete field of view, and to create 4-sided detection zones in the field of view using either a still snapshot or live video.

The management software shall detect the presence of vehicles in defined zones and turn on the assigned output when a vehicle or bicycle is present in the zone. Each detection zone shall be displayed over the background image. It shall be possible for the user to place detection zones anywhere in the field of view, set the desired color of both the "on" and "off" states of the overlay for individual detection zones, set the desired color for the “on” state for different types of vehicles, alter the size and shape of any previously created zone, click and drag any of the four sides of a zone to automatically scale the length of the side consistent with the 3-dimensional field of view, to move an entire zone without automatic rescaling, create a new zone by selecting an existing zone and duplicating it on either the left or right side or specifying a new zone with a specific distance from the selected zone, rotate a zone by selecting any of its four corners and dragging, flip the zone direction 180 degrees from its current orientation, name each zone, assign each zone to detect vehicles, bicycles or both, and to specify different outputs for each type.

It shall be possible for the user to specify the output of a zone as a presence, pulse, or snappy type output (presence during red and pulse during green signal phase state). The pulse output shall be usable for both approaching and receding traffic and have a user programmable duration from 100 to 400 milliseconds. It shall be possible for a zone to have multiple output types (presence, pulse, snappy) on separate output channels, for the user to tie the presence outputs of multiple zones as well as signal phase state together with Boolean logic and assign the same output to multiple zones such that the output will be on if any of the zones are detecting a vehicle or bicycle. It shall be possible for the user to assign a single zone to more than one output such that if a vehicle or bicycle is detected, all the assigned outputs shall be turned on. The management software shall be capable of creating at least 99 detection zones per video sensor, retrieving all configuration parameters from video sensors or communications interface panels. It shall be possible for the user to save all the settings for a video sensor or a communications interface panel and read or import all the settings from a previously saved configuration file for a video sensor or a communications interface panel.

For detection zones placed at the stop line, the probability of not detecting the presence of a vehicle shall be 1% or less when aggregated over a 24-hour period when the video sensor is installed and configured properly and the probability of falsely detecting a vehicle that is not present shall be 3% or less when aggregated over a 24-hour period when the video sensor is installed and configured properly. To ensure statistical significance for the above detection performance specifications, data shall be collected over 24-hour time intervals and shall contain a minimum of one hundred (100) vehicles per lane. The calculations of detection performance shall not include turning movements where vehicles do not pass through the detectors, vehicle lane-change anomalies, or where they stop short or stop beyond the combined detection zones.

The video detection system shall be capable of detecting receding vehicles in day or night conditions when the video sensor is installed and configured properly.

The management software shall be able to download a new version of the application software into a communications interface panel and its attached video sensors. The management software shall provide the current time in the video sensor image, a user-configurable title or name, the version number of the video sensor software, and configurable text as defined by the user. Undo/Redo functions shall be available for operations during detection zone setup and programming. It shall be possible for the user to turn the overlay graphics on or off with a single setting.

The management software shall provide a live video output to the video monitor. The user shall be able to select if a single video output or four video outputs are displayed simultaneously. It shall be possible for the user to configure the order that the sensor videos appear in the quad-view. The real-time quad-view video stream shall be capable of displaying the overlay graphics for all four sensors simultaneously.

While monitoring the video of a single video sensor or of the quad-view, it shall be possible for the user to request a "snapshot" or single-frame image to save to a named file on a laptop. It shall be possible for the user to record a period of the video to save to a named file.

The management software shall provide three failsafe options during optical contrast loss. The default shall be maximum recall. The user may also choose to use minimum recall or fixed recall in which a user-defined number of seconds may be implemented to hold call during green. The video sensor shall continuously monitor the overall contrast in the video. If the overall contrast falls below a preset level or if a video sensor goes offline the sensor shall enable the chosen failsafe mode. When sufficient contrast is restored in the video or the video sensor comes online, the sensor shall exit the failsafe mode.

The management software shall maintain a time-stamped operations log of routine and special events in non-volatile memory.

The management software shall provide the following methods to synchronize the time-of-day clocks in the communication interface panel and the video sensors: set the time to the current time on the computer where the management software is running; automatically obtain the time from the NEMA TS2 protocol on the SDLC channel; and allow the communications interface panel to automatically obtain the time from up to five Network Time Protocol (NTP) sources.

Note 5. The video monitor shall have a minimum screen size of 12 inches and be located in the controller cabinet. The video monitor shall include a live video stream from the video sensor with indications of detection in real time by changing the color of the detection zone. A standard mouse and keyboard shall be provided in the cabinet with the video monitor.

CONSTRUCTION REQUIREMENTS

General. This work shall be according to applicable portions of Sections 812, 817, and 873 of the Standard Specifications for Road and Bridge Construction.

The Video Vehicle Detection System shall be capable of communicating with the software systems shown on the plans.

The Video Vehicle Detection System shall be integrated to the controller inside the traffic signal cabinet.

Removed amplifiers shall be returned to the Engineer.

Training. The contractor shall provide one day of training by a factory representative on the software for up to ten people.

Installation. The manufacturer shall recommend the height and location of the video camera(s) for detection and monitoring of all legs from 10 feet in front of the stop bar until the advance detection distance shown in the plans. The Video Vehicle Detection System shall use as many cameras as needed to provide proper detection for all legs and all cable necessary for successful operation. The video camera(s) shall either be mounted on the luminaire arm, the mast arm, or a 6-foot video detection pipe extension mounted on the mast arm to withstand 100 mph wind. The extension shall not exceed 6 feet in length.

Warranty, Service and Support. The manufacturer shall warrant the video detection system for a minimum of five years. Ongoing software support by the manufacturer shall include software updates of the video sensor, communications interface panel, and management software. These updates shall be provided free of charge during the warranty period. The manufacturer shall provide a technical support website, email address and a phone number.

**Basis of Payment.** This work will be paid for at the contract unit price per each for VIDEO VEHICLE DETECTION SYSTEM. Each intersection will be paid for separately.

DESIGNER NOTES

ITEMS TO INCLUDE ON THE PLANS

* ADVANCE DETECTION DISTANCE (250 FEET OR 600 FEET) – GET DISTANCE FROM OPERATIONS, AND PROVIDE VALUE IN THE SIGNAL PLANS / NOTES.
* SOFTWARE SYSTEM THE SYSTEM MUST COMMUNICATE WITH (CENTRAC OR TACTIC) – GET APPROPRIATE SYSTEM FROM OPERATIONS AND PROVIDE THE INFORMATION IN THE SIGNAL PLANS / NOTES.