SECTION 770 - TRAFFIC SIGNAL MATERIALS

Make the following amendments to said Section:

(I) Amend **Subsection 770.02 (A)(4) – Back Plates** line 288 to read as follows:

"minimum dimensions equal to signal head size plus five-inch border with slots to reduce wind load and a one-inch retroreflective border."

(II) Amend **Subsection 770.04 – Pedestrian Signal** from line 447 to line 600 to read as follows:

"**(A) Purpose.** The purpose of this specification is to provide the minimum requirements for the LED "walking person" and "hand" icon pedestrian signal modules with countdown. This specification is only for the nominal overall message-bearing surface of 16 x 18 in. This specification is not intended to impose restrictions upon specific designs and materials that conform to the purpose and the intent of practices described in "Pedestrian Traffic Control Signal Indications" published in the *Equipment and Materials Standards of the Institute of Transportation Engineers*, (referred to in this document as PTCSI) and in the Applicable Sections of the Manual on Uniform Traffic Control Devices (MUTCD) 2003 Section 4E.

(B) Features. Provide the following features:

(1) Elimination of sun phantom.

(2) Improved light output.

(3) Protection from vandalism.

(4) Simplified maintenance.

(5) Improved low-temperature operation.

(6) Simplified handling.

(7) Elimination of high-tension leads.

(8) Operation at 90-volt applied line voltage.

Maximum overall signal dimension shall be 19 inches wide, 19 inches high, and 9-1/4 inches deep, including egg-crate-type visor and hinge. Signal shall be furnished complete with transformers and tubing installed.

Installation and maintenance of signal shall be facilitated by designing signal door that provides front access to components

(C) Physical and Mechanical Requirements. The modules shall fit into existing pedestrian signal housings built for the PTCSI sizes stated in Section 1 of the "walking person" and "hand" icon pedestrian signal indications standard without modification to the housing and shall not require special tools for installation.

Installation of a retrofit replacement module into existing pedestrian signal housing shall only require the removal of the existing optical unit components, shall be weather tight and fit securely in the housing, and shall connect directly to existing electrical wiring. The LED module shall have a visual appearance similar to that of an incandescent lamp (i.e., smooth and non-pixilated). Screwed-on lenses are not allowed. Only modules with internal mask shall be utilized. No external silk-screen shall be permitted.

When not illuminated, the WALKING PERSON, UPRAISED HAND, and COUNTDOWN DIGITS shall not be readily visible. The countdown digits of the pedestrian signal module shall be located to the right of the associated UPRAISED HAND. The display of the number of remaining seconds shall begin only at the beginning of the pedestrian change interval. After the countdown displays zero, the display shall remain dark until the beginning of the next countdown. The walking person, hand icons, and countdown digits shall be incandescent-looking.

The units shall not have any external attachments, dip switches, toggle switches or options that will allow the mode to be changed from counting the clearance cycle to the full walk/don't walk cycle or any other modification to the icons or digits.

For each nominal module, use the corresponding minimum H (height) and W (width) measurements:

Module Size	Icon Height	Icon Width	Countdown Height	Countdown Width	Countdown Segment Width
16 in x 18 in	11 in	7 in	9 in	7 in	0.7 in

All exposed components of a module shall be suitable for prolonged exposure to the environment. As a minimum, the module shall be rated for use in the ambient operating temperature range, measured at the exposed rear of the module, of -40°C to +74°C (-400F to +165°F).

The module shall be a single, self-contained device, not requiring onsite assembly for installation into an existing pedestrian signal housing. The power supply shall be located inside the pedestrian signal module. The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

The front window shall be a transparent polycarbonate material with internal masking to prevent the icons and digits from being visible when not in operation. External masking or silk-screen technology shall not be permitted.

Each module shall be identified on the backside with the manufacturer's name, model, serial number, and operating characteristics. The operating characteristics shall include the nominal operating voltage and stabilized power consumption, in watts and/or Volt-Amperes.

(D) Photometric Requirements. For a minimum period of 60 months, maintained minimum luminance values for modules under operating conditions, when measured normal to the plane of the icon surface, shall not be less than:

- Walking person: 2,200 cd/m^2
- Hand: 1,400 cd/m^2
- Countdown digits: 1,400 cd/m^2

The luminance of the emitting surface, measured at angles from the normal of the surface, may decrease linearly to a value of 50% of the values listed above at an angle of 15 degrees. The LED module shall have a visual appearance similar to that of an incandescent lamp (i.e., smooth and non-pixilated).

Maximum permissible luminance: When operated within the temperature range, the actual luminance for a module shall not exceed three times the required peak value of the minimum maintained luminance. Luminance uniformity: The uniformity of the signal output across the emitting section of the module lens (i.e., the hand, person, or countdown icon) shall not exceed a ratio of 5 to 1 between the maximum and minimum luminance values (cd/m^2).

The standard colors for the LED Pedestrian Signal Module shall be White for the walking person and Portland Orange for the hand icon and the countdown digits.

(E) Electrical Requirements. All wiring and terminal blocks shall meet the requirements of Section 13.02 of the VTCSH Standard. Maximum of three secured, color coded, 1 meter (39 in) long 600 V, 16 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +105°C, are to be provided for electrical connection. The conductors shall be color coded

with orange for the hand, blue for the walking person and white as the common lead.

LED modules shall operate from a 60 ± 3 Hertz ac line power over a voltage range from 80 to 135 VAC RMS. Nominal operating voltage for all measurements shall be 120 ± 3 VAC RMS. Fluctuations in line voltage over the range of 80 to 135 VAC RMS shall not affect luminous intensity by more than ± 10 %. To prevent the appearance of flicker, the module circuitry shall drive the LEDs at frequencies greater than 100 Hz when modulated, or at DC, over the voltage range specified.

Low Voltage Turn Off: There should be no illumination of the module when the applied voltage is less than 35 VAC RMS. To test for this condition, each icon must first be fully illuminated at the nominal operating voltage. The applied voltage shall then be reduced to the point where there is no illumination. This point must be greater than 35 VAC RMS.

Turn-ON and Turn-OFF Time: A module shall reach 90% of full illumination (turn-ON) within 75 msec of the application of the nominal operating voltage. The signal shall cease emitting visible illumination (turn-OFF) within 75 msec of the removal of the nominal operating voltage.

Default Condition: For abnormal conditions when nominal voltage is applied to the unit across the two-phase wires (rather than being applied to the phase wire and the neutral wire) the pedestrian signal unit shall default to the hand symbol. The on-board circuitry of a module shall include voltage surge protection:

- To withstand high-repetition noise transients and low repetition high-energy transients as specified in NEMA Standard TS-2 2003; Section 2.1.8
- Section 8.2 IEC 1000-4-5 & Section 6.1.2 ANSI/IEEE C62.41.2-2002, 3kV, 2 ohm
- Section 8.0 IEC 1000-4-12 & Section 6.1.1 ANSI/IEEE C62.41.2-2002, 6kV, 30 ohm

The LED signal and associated on-board circuitry shall meet the requirements of the Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices. The modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 25°C (77°F). Total harmonic distortion induced into an AC power line by the module, operated at nominal operating voltage, and at 25°C (77°F) shall not exceed 20%.

The current draw shall be sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units. Off State Voltage Decay: When the module is switched from the

On state to the Off state the terminal voltage shall decay to a value less than 10 VAC RMS in less than100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

(F) Module Functions. The module shall operate in one mode: Clearance Cycle Countdown Mode Only. The module shall start counting when the flashing don't walk turns on and will countdown to "0" and turn off when the steady "Don't Walk" signal turns on. The module shall not have user accessible switches or controls for the purpose of modifying the cycle, icons or digits. At power on, the module enters a single automatic learning cycle. During the automatic learning cycle, the countdown display shall remain dark. The unit shall re-program itself if it detects any increase or decrease of Pedestrian Timing. The digits shall go blank once a change is detected and then take one complete pedestrian cycle (with no counter during this cycle) to adjust its buffer timer.

The module shall allow for consecutive cycles without displaying the steady Hand icon ("Don't Walk"). The module shall recognize preemption events and temporarily modify the crossing cycle accordingly. If the controller preempts during the walking man, the countdown shall follow the controller's directions and shall adjust from walking man to flashing hand. It shall start to count down during the flashing hand. If the controller preempts during the flashing hand, the countdown shall continue to count down without interruption. The next cycle, following the preemption event, shall use the correct, initially programmed values. This specification is worded such that the flashing don't walk time is not modified.

If the controller output displays Don't Walk steady condition or if both the hand/person go dark and the unit has not arrived to zero, the unit suspends any timing and the digits shall go dark.

(G) Warranty. In addition to the requirements in Subsection 108.17 Guarantee of Work, manufacturers will provide the following warranty provisions. Replacement or repair of an LED signal module that fails to function as intended due to workmanship or material defects within the first 5 years (60 months) from the date of final acceptance.

(H) Case. Case shall be one-piece, corrosion-resistant, die-cast aluminum alloy that is complete with integrally cast top, bottom, sides, and back. Four integrally cast hinge lug pairs shall facilitate operation of swing open door.

Case for pedestrian signals shall be dust-proof, weatherproof, and corrosion-resistant. Case shall provide for easy access and replacement of components.

Case shall be suitable for post-top or bracket mounting.

Top and bottom of case shall have opening to adjust standard 1-1/2 inch pipe brackets. Bottom opening of signal case shall be furnished with "Shurlock" boss integrally cast into the case. Dimensions of "Shurlock" boss shall be as follows: outside diameter – 2-5/8 inches, inside diameter – 1-31/32 inches, number of teeth – 72, angle of teeth – 90 degrees, depth of teeth – 5/64 inch. Teeth shall be clean, sharp, and provide full engagement. Radial angular grooves of "Shurlock" boss, when used with "Shurlock" fittings, shall provide positive positioning of entire signal to eliminate rotation or misalignment of signal.

(I) Door Frame. One-piece corrosion-resistant, aluminum alloy casting doorframe shall be furnished complete with two hinge lugs and two latch slots for each door. Door shall be attached to case by two Type 304 stainless steel spring pins. Two stainless steel hinged bolts with captive stainless steel wing nuts and washer shall be attached to case with use of stainless steel spring pins. Latching or unlatching of door shall require no special tools.

(J) Z-Crate Visor. Each signal shall be furnished with Z-crate type visor designed to eliminate sun phantom. Z-crate type sunshield shall be installed parallel to face of "HAND" and "WALKING PERSON" messages. Z-crate visor assembly shall be held in place by stainless steel screws. Z-crate assembly shall be furnished with minimum of 20 straight horizontal louvers and 21 horizontal louvers, each one formed in zigzag pattern.

Every other formed louver shall be reserved to form cells 1-inch square but rotated 45 degrees from horizontal to provide diamond-shaped cells when assembled. Each diamond shall be bisected by insertion of straight louver interspersed between each pair of formed zigzag louvers. If each apex of each formed louver comes in contact with interspersed straight louver, entire length of joint shall be chemically welded. Basic material used in construction of Z-crate visor shall be nominally 0.030 inch thick and 100 percent impregnated black polycarbonate plastic processed with flat finish on both sides.

Assembly shall be enclosed in mounting frame constructed of minimum 0.040-inch-thick aluminum. Frame shall be 1-1/2 inches deep and contain mounting holes for direct insertion in pedestrian signal doorframe

(K) Transformers. Two transformers shall be furnished with recessed secondary contacts and integral Pyrex glass electrode housing. Transformers shall be mechanically locked together, requiring four mounting bolts for mounting entire transformer assembly. Both transformers shall be furnished with 4000-volt, 30-milliampere secondary.

Each transformer shall be furnished with 120-volt (nominal) primary windings and power factor of 90 percent, minimum. Transformers shall nominally require only 39 watts each at 115VAC.

(L) Fused Switch. Fused switch shall be furnished inside case on terminal blocks for de-energizing transformer primary circuit. Fused switch shall include two cartridge fuses and lever for disconnecting fuses.

(M) Painting. Before final assembly, case, doorframe, and Z-crate visor (aluminum portion only) shall be cleaned and a chromate conversion coating applied inside and out, in accordance with Military Specification MIL-C-5541E. Synthetic enamel, alkyd, semi-gloss, low VOC content, conforming to Master Painters Institute (MPI) Standard No. 94, shall be applied electrostatically. Color shall be same as standard traffic signal head. Finish shall be oven-cleaned for minimum of 20 minutes at 350 degrees F."

(III) Amend **Subsection 770.05 – Controller Equipment** from line 603 to line 643 to read as follows:

"(A) Controller Assembly. Controller assembly shall include ATC controller, cabinet, and auxiliary equipment.

Testing and quality control requirements shall be as specified in Subsection 623.03(G)(2)(a).

Each controller assembly shall contain sufficient equipment for full 8-vehicle, 4-pedestrian, and 4-preemption phase intersection, even though the contract documents may not require it.

(B) ATC Controller. ATC Controller shall be compliant with ATC 5201 Standard v06, and shall have a touch-screen graphical user interface."

(IV) Amend **Subsections 770.05 (D) – Auxiliary Equipment** from line 694 to line 720 to read as follows:

"(D) Auxiliary Equipment. Controller unit shall be delivered supplied with the following auxiliary equipment:

(1) Model M752 Optical Preemption Module. M752 shall be card-type and shall interface with the preemption slots of the installed controller. Each M752 Module shall have two channels of preemption. M752 shall include firmware to discriminate between two valid priority signals, to prioritize valid same priority signals on a first come, first served basis, and to override low priority signal if high priority is received. M762 Module shall receive input signals (9.639 and 14.035 Hz) to permit priority preemption operation within the local intersection program. M762 shall optically isolate output signals and shall trigger active low signal to controller for high priority and pulsed active low signal for low priority. The State's preemption systems employ the 3M Opticom System. New preemption equipment shall be 3M Opticom or accepted equal that is fully compatible with 3M Opticom.

(2) Universal Time Standard (UTS) Module. UTS Module shall be a stand-alone precision clock, located in controller cabinet. UTS Module shall be used to update internal clock of the installed controller by decoding five broadcast frequencies (2.5, 5, 10, 15, 20 MHz) transmitted by WWVH (radio station) of the U.S. National Institute of Standards and Technology. Hardware and software of UTS equipment shall be compatible without modification to the installed controller's hardware or software. UTS Module shall meet the following specifications:"

(V) Amend **Subsections 770.05 (D)(2) – Universal Time Standard (UTS) Module** line 734 to read as follows:

"**(i)** DB25 to controller cable and connectors."

(VI) Amend **Section 770** by adding the following after line 1029:

"770.12 Video Detectors.

(A) Description. This specification sets forth the minimum requirements for a real-time, wide area video vehicle detection system that monitors vehicles on a roadway by processing video images and that provides detector outputs to a traffic controller or similar device. This system shall be easily configurable and expandable to meet traffic management applications such as intersection control, traffic monitoring or surveillance, traffic safety applications, and traffic control during road or intersection construction. For example, it shall be possible to maintain semi- or fully-actuated detection at the stop line by lane or by phase, in the dilemma zone, or advanced extension detection while construction is underway.

(1) System Hardware. The machine vision system hardware shall consist of three components: 1) a color or monochrome video detection camera, 2) a modular, two video channel MVP unit for cabinet interface, and 3) a power and video interface panel. Additionally, an optional personal computer (PC) shall host the server and client applications to program and monitor the system components. The real-time performance shall be observed by viewing the video output from the sensor with overlaid flashing detectors to indicate the current detection state (on/off).

The MVP shall communicate detection events or alarms in the cabinet to the traffic controller or other device. Up to four (4) contact closure inputs and eight (8) contact closure outputs shall be provided to a traffic signal controller and comply with the National Electrical Manufacturers Association (NEMA) type C or D detector rack or Caltrans TEES Input File standards. When connected to a

Detector Port Master (DPM), the MVP may also receive DPM inputs and provide additional outputs to the traffic controller via the DPM contact-closure or SDLC outputs.

The interface panel shall provide video coax connections and termination points for three-wire power cables and optional two-wire zoom control that may be mounted on a pole or mast arm. It also provides for mechanical strain relief of these incoming cables to the cabinet. A junction box or splice point between the camera and the interface panel is permissible depending on local installation standards. The interface panel shall provide high-energy transient protection to protect other cabinet equipment from outside electrical surges.

The hardware shall consist of the following items to be provided by the system supplier:

- Three white machine vision processor units with approved image sensor cameras
- One communications manager to support WiFi communication and streaming video, mounted on aluminum flat panel
- Three camera mounting brackets with 74" tube and 62" cable
- All cable required for installation and operation of the above hardware

Items to be provided by others:

- Installation
- Interconnection branch cabling

(2) System Software. A laptop or netbook or tablet (with software sypplied as needed) may use the USB interface for setup, maintenance, monitoring, and other tasks including traffic data collection and the backup of the configuration in an operations log archive supply software.

The MVP's embedded software shall incorporate multiple applications that perform a variety of diagnostic, installation, fault tolerant operations, and vehicle detection processing. The detection shall be reliable, consistent, and perform under all weather, lighting, and traffic congestion levels.

There shall be a suite of client applications that reside on the host client-server PC. The applications shall execute under Microsoft Windows 10. Available client applications shall include:

- Master network browser: Learn a network of connected modular MVP units, display basic information, and launch other client applications to perform various operations.
- Configuration setup: Create and modify detector configurations to execute on the MVP.
- Operation log: Retrieve, display, and save field hardware run-time operation logs and special events that have occurred. This is also an archived backup of the entire configuration.
- Data Collection: Setup and retrieve traffic data from the MVP.
- Software install: Reconfigure one or more MVP units with a newer release of embedded system software.

(3) MVP Hardware. The MVP shall be shelf or rack mountable. Nominal outside dimensions excluding connectors shall not exceed 4.5 in. (H) x 2.3 in. (W) x 7 in. (D) plus its handle. The MVP shall be capable of mounting in a standard detector card rack, or in an optional shelf-mounted enclosure. The MVP weight shall not exceed 0.5 lb.

(B) Functional Capabilities.

(1) Functional Capabilities. The real-time, detection performance of the MVP shall be optimized to meet the detection objective of the traffic application. The detection objective determines the camera mounting location, the number of traffic lanes to monitor, sizing, placement, and orientation of vehicle detectors, whether traffic is approaching or receding from the camera's field of view, and how to minimize the effects of lane-changing maneuvers.

(2) Real-Time Detectors. The MVP shall be capable of simultaneously processing information from two (2) CCTV video cameras. The video will be digitized and analyzed at a rate of up to 30 frames per second. Video input to the MVP shall be uncompressed, full motion analog video at 25 or 30 frames per second.

Different detector types shall be selectable via software. All of the following Detector Types shall be supported for each camera input. Detector types shall include the following: Stop Line, Count, Presence, Speed, Detector Function, Station, and Label. The Stop Line detector can provide a large detection area during red for safety with various driver behaviors and then a small snappy

detection output to the controller for efficiency of intersection control during green.

Multiple detector outputs can be combined together via OR, AND, NAND, NOR, and M of N logical functions. In addition, the MVP can condition the detector outputs based on the state of the associated traffic signals. All of the following detector output types shall be available: Type 0, Type 1, Type 2, Type 3, Type 4, Type 5, Type 6, Type 7, and Type 9 (Moving Vehicle).

Detectors shall accurately detect approaching, receding, or stopped vehicles in multiple traffic lanes, and make the detections available to a variety of outputs that reflect the current real-time detector state.

The MVP will detect the absence of a valid video signal on each image sensor input and place all detector outputs associated with the failed image sensor input on maximum recall.

The MVP will also detect when the quality of the video input from the image sensor is not sufficient for robust vehicle detection (e.g., when environmental conditions obscure the sensor view). Actions for this video contrast loss capability shall be selectable by the user, including placing the detector outputs associated with the failed sensor on minimum recall, maximum recall, or fixed time recall.

A supervisor computer is not required for detector configuration or operation. When a computer is used for setup, monitoring, or troubleshooting, it shall be possible to disconnect the supervisor computer and the MVP shall perform vehicle detection as a standalone unit.

(3) External Interface. It shall be possible for the MVP to output the detection signal directly to NEMA TS1, TS2, Type 170, Type 179, 2070, SCATS, and SCOOT controllers. It shall be possible to selectively disable and re-enable any or all of the detection outputs. The MVP shall provide eight (8) open collector outputs on the front connector and four (4) jumper selectable outputs on the rear edge connector. The MVP shall provide four (4) open collector inputs on the front connector. When connected to a DPM, the MVP may also receive DPM inputs and provide additional outputs to the traffic controller via the DPM contact-closure or SDLC outputs.

A USB connection shall allow configuration and monitoring for each camera. The MVP's embedded software may be changed

using a simple USB memory stick or with a laptop or netbook or tablet.

(4) Detection Zone Placement. The video detection system shall provide flexible detection zone placement at any orientation within the field of view of the camera to serve the detection objective. Traffic can flow through the scene vertically, horizontally, diagonally, or around a curve. The system shall be capable of detecting both approaching and receding vehicles, with similar accuracies.

Detection zones may overlap for optimal road coverage to serve the detection objective. In addition, selective groups of detectors may be combined logically into a single output and further modified with optional delay and extension timing and signal state inputs if available. The configuration shall support outputs by lane, by phase, and for advanced extension timings.

Optimal detection shall be achieved when the camera placement provides an unobstructed view of each traffic lane where vehicle detection is required. Obstruction of the view includes when vehicles from a lane closest to the camera obscures the view of the roadway of a lane further away from the camera. An application design guide and training shall be available to the engineer and technician.

(5) Detection Zone Programming. Placement of detection zones shall be by means of a mouse and video monitor or with an optional personal computer with the Windows 10 operating system and updated software. A mouse draws detection zones on the monitor. Using the mouse or optional PC keyboard, it shall be possible to place, size, and orient detection zones for optimal road coverage for vehicle detection. It shall be possible to edit previously defined detector configurations to permit adjustment of the detection zone size and placement, to add detectors for additional traffic applications, or to reprogram the MVP for different traffic applications or changes in installation site geometry or traffic rerouting.

The optional PC shall allow backup of the entire configuration and archived operations log for each camera. It shall be possible to download detector configurations from the PC to the MVP, to retrieve the detector configuration that is currently running in the MVP sensor, and to back up detector configurations by saving them to the PC fixed disk or other removable storage media.

(6) Detection Zone Operation Verification. Real-time detection operation shall be verifiable by viewing the video output of the MVP, with overlaid detection zones on any standard analog video display device (monitor) or on the optional supervisor computer. Front panel LED lights will show assigned contact-closure pin outs from the unit. An LED shall be ON when its assigned detector output is ON. An LED shall be OFF when its assigned detector is OFF. The MVP shall display eight (8) local outputs.

(7) Providing Optimal Detection. The video detection system shall provide optimal detection of vehicle passage and presence when the camera is adjacent to the desired coverage area and mounted 30 ft or higher above the roadway detection area. When in line with the left-turn thru-lane lane mark, the camera may be mounted on the signal mast arm. The farthest detection zone location shall not be greater than 10 times the mounting height of the camera above the zone. The recommended deployment geometry for optimal detection is an unobstructed view of each traveled lane where detection is required. The camera shall be provided by the same manufacturer as the MVP to maximize performance. The camera shall view either approaching or receding traffic. The preferred orientation for optimal detection shall be to view approaching traffic, since there are more high-contrast features on vehicles that are viewed from the front rather than the rear. The camera, when placed at a mounting height that minimizes vehicle image occlusion and the zoom lens aimed to match the detection area, shall be able to monitor a maximum of 6 to 8 traffic lanes simultaneously depending on the field of view.

(8) Demand Presence Detection Performance. Using an installed camera that meets the optimal viewing specifications described above for intersection traffic control applications, the system shall be able to provide accurate demand presence detection. The demand presence accuracy shall be based on the ability to enable a protected turning movement on an intersection stop line, when a demand exists. The probability of not detecting a vehicle for demand presence shall be less than 1% error under all operating conditions. In the presence of artifact conditions, the MVP shall minimize extraneous (false) protected movement calls to less than 7%.

To ensure statistical significance, the demand presence accuracy and error shall be calculated over time intervals that contain a minimum of one hundred vehicles in each lane. The calculation of the demand presence error shall not include turning movements where vehicles do not pass through the detectors, or

where they stop short or stop beyond the combined detection zones. Vehicle lane change anomalies will be excluded from the calculations.

(9) Video Processing. The analog video output shall provide a graphics overlay that indicates the current real-time detector state. The MVP shall process a maximum of ninety-nine (99) virtual objects or detection zones placed anywhere in the field of view of each camera. The user may hide some objects from the output view and display hidden objects while watching the output video. While not strictly a detector, an operator-defined label, visible in the video overlay, shall identify the camera field of view, various operational system parameters such as time of day, date, processing load index, the state of any detector output, the traffic signal state, and the state of any detector interface card (detector port master if used).

Similarly, the video output may be viewed on a computer as streaming snapshots with flashing detectors.

Snapshot images shall be transferred using one of the following options: an uncompressed black and white bitmap, JPEG black and white image, uncompressed color bitmap, or JPEG color bitmap. The quality of snapshot images transferred shall be user selectable.

(10) MVP Environmental. The MVP shall operate reliably in the adverse environment found in the typical roadside traffic cabinet. It shall meet the environmental requirements set forth by NEMA TS1 and TS2 standards and Caltrans TEES. Operating temperature shall be from -34 C to +74 degrees C (-29 F to +165 F) at 0% to 95% relative humidity, non- condensing.

(11) Electrical. The MVP shall be powered by 12 or 24 volts at 11 watts maximum. The MVP shall include transient protection sufficient to meet the requirements set forth in the NEMA TS1 and TS2 standards. Power to the MVP shall be from the transient-protected side of cabinet power.

Communications shall be via a USB connector for each camera on the front of the unit for USB mouse, memory stick, or PC.

The MVP shall be equipped with two (2) composite video inputs (color or monochrome), so that a signal from two (2) image sensors can be processed in real-time. The MVP shall be equipped with two (2) composite video outputs with BNC connectors on the

front of the MVP. The use of miniature video connectors shall not be acceptable. The MVP shall output standard NTSC or PAL video format at 1 Vpp.

The MVP software shall be stored in flash memory within the MVP. This software shall be capable of updates without the removal of modules or memory devices. The MVP software and/or the supervisor applications shall include diagnostic software to allow testing of the MVP 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.

(12) MVP Operations Log. The MVP shall maintain a non-volatile operations log to archive significant operational events and provide a complete backup of the configuration, which can be restored into a replacement unit in case of disaster. It minimally contains: revision numbers for the current MVP hardware and software components, title and comments for the detector configuration; date and time of the last detector configuration downloaded to the MVP, date and time of video connection or loss, date and time that the operations log was last cleared, date and time communications were opened or closed with the MVP; date and time of last power-up; and time-stamped, self-diagnosed, hardware and software errors that shall aid in system maintenance and troubleshooting. Optionally, the user may route other time-stamped events to the log. The MVP processor will reboot itself automatically when software or hardware functions are not operating properly and log these events.

(13) Traffic Data Collection. The MVP will be capable of traffic data collection in real-time for immediate access or storage in non-volatile flash memory within the MVP for later retrieval. No additional hardware or software will be necessary. The manufacturer will provide a method of estimating storage limits depending on the data types and time intervals selected before the oldest data is overwritten.

Traffic statistics shall include volume, occupancy, vehicle classification, flow rate, headway, speed, level of service, space occupancy, and density measures. The video system shall record traffic data and alarms by event or by multiple time intervals from 1 to 3600 seconds (1 hour) or for intersection monitoring by intersection cycle split for display, retrieval, and analysis. It will be possible to record the passage of individual actuations and signal changes for troubleshooting and maintenance.

(C) Installation and Training. The supplier of the video detection system shall provide support during the installation and testing of the video detection system and computer equipment as required by the contracting agency.

Training is available to personnel of the contracting agency in the operation, set up, and maintenance of the video detection system. The MVP and its support hardware/software are a sophisticated leading-edge traffic technology system. Proper instruction from certified instructors is recommended to ensure that the end user has complete competency in system operation. The User's Guide and Installation Manual are not adequate substitutes for practical classroom training and formal certification by an approved agency.

(D) Warranty, Maintenance, and Support. In addition to the requirements of subsection 108.17 Guarantee of Work for a minimum of three (3) years, the supplier shall warrant the video detection system. An option for additional year(s) warranty for up to six (6) years shall be available.

The manufacturer of the MVP shall have a Quality System that is ISO 9001 registered. Written confirmation of the ISO 9001 registration shall be available from the manufacturer prior to bid acceptance if requested.

The video vehicle detection system shall not require any special maintenance tasks beyond the usual preventive maintenance inspections typical for a traffic cabinet and intersection.

Ongoing software support by the supplier shall include software updates of the MVP and supervisor computer applications. These updates shall be provided free of charge during the warranty period. The supplier shall maintain a program for technical support and software updates following expiration of the warranty period. This program shall be available to the contracting agency in the form of a separate agreement for continuing support.

770.13 Pedestrian Signal Push Button with Integral Sign.

(A) Description. The pedestrian push button unit shall consist of an assembly that can be secured to traffic poles with standard screws, be tamper-proof, weatherproof, and constructed so that electrical shocks are impossible to receive.

(B) Materials.

(1) The housing for the push button assembly shall be of cast and/or machined aluminum. The push button assembly shall be weatherproof with a water diverting groove set in the outside diameter of the actuator button receptor. The housing shall be designed to reduce vandalism and shall mount on the side or top of a pole with a minimum 2-inch diameter button. The force required to activate push buttons shall be no greater than 3.5 pounds. Push buttons shall be operable with a closed fist. There shall be a locator tone complying with X02.5.1.5. Push buttons shall have a visual contrast with the body background of at least 70 percent. There shall be a visible and audible indicator that the button press has occurred. See https//www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/background/access-advisory-committee-final-report/x02-5-pedestrian-street-crossings for additional ADA features. The push button housing shall be capable of mounting in an 'up button' or 'down button' configuration. All wire connections shall be accessible from the back of the assembly.

(2) An ADA-acceptable raised directional sign shall be installed with stainless steel fasteners to the housing. The sign shall consist of a raised walking person and a raised arrow indication. Paint the unit black and paint the raised walking person and arrow white. The sign shall be capable of mounting in an 'up button' or 'down button' configuration. The raised walking person and arrows shall be directional and match the indication as shown in the plans.

(3) The pushbutton shall extend from the sign faceplate approximately three inches. The button shall be manufactured in a way that it cannot be stuck in a closed (constant call) position. The pushbutton actuator shall be convex in design having a flat area on the face for uses of a stylus, two inches in diameter, and meet ADA requirements including the following:

- The force required to activate push buttons shall be no greater than 3.5 pounds.
- Push buttons shall be operable with a closed fist.
- There shall be a locator tone complying with X02.5.1.5.
- Push buttons shall have a visual contrast with the body background of at least 70 percent.
- There shall be a visible and audible indicator that the button press has occurred.
- See https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/background/access-advisory-committee-final-report/x02-5-pedestrian-street-crossings for additional ADA features.

(4) The pedestrian push button shall be a piezo electric type and be UL listed. The button shall have a stainless steel actuator and shall be mounted within the housing with stainless steel, noncorrosive, tamper-proof fasteners. The unit shall operate between 12-24V DC or AC, 3-inch round mounts with four mounting bolts."

END OF SECTION 770