<div align="center">**SECTION 770 – TRAFFIC SIGNAL MATERIALS**</div>

Make the following amendments to said Section:

(I)   Amend **Subsection 770.02(A) Standard Traffic Signal Heads** from line 211 to 289 to read:

> **(b)**   To ensure quality and performance, LED head shall have prior history of testing and use by CALTRANS and shall exceed ITE standards. Failure on one LED shall not affect other LED's. LED head shall have fully-encapsulated electronic circuitry and configuration for 12-inch ball."
>
> **(2)   Housing.** Signal head housing or case shall consist of an assembly of separate interchangeable sections. Interchangeable sections shall be expandable type for vertical mounting without tie rods, and shall be secured together in watertight manner to form unit. Individual optical units shall be housed in each section. The side of housing or door containing lens shall be square.   Housing shall be of polycarbonate resin only. Aluminum housing is not acceptable for use on this project.
>
> Polycarbonate housing shall be ultra-violet-stabilized virgin polycarbonate resin of dark green color, injection molded, complete with integral top, bottom, and sides; and shall have minimum thickness of 0.09 inch.
>
> Each section shall be furnished complete with one-piece hinged door mounting for lens and other parts of optical system, watertight gaskets, and simple door-locking device. Optical system shall be mounted to allow for swinging various parts open for ready access or removal. Sections shall be interchangeable and designed to permit removing or adding of sections. Round opening shall be provided in top and bottom of each section face to receive 1-1/2 inch supporting pipe frame. All bolts, screws, hinge pins, and door-locking devices shall be made of stainless steel. Interior screws and fittings shall be made of stainless steel.
>
> Gaskets, including door, lens and reflector gaskets, shall be of neoprene. Lampholder gaskets shall be heat-resistant.
>
> Lampholders shall be wired to provide for connection of white wire to shell of lampholder and black or colored wire to bottom or end terminal of lampholder. These wires shall connect to terminal block mounted inside at back of housing. Each terminal block shall be furnished with sufficient screw-type terminals spaced to terminate all field conductors and lamp conductors independently. Terminals to which field conductors

47 are attached shall be permanently identified or conductors shall be color-
48 coded to aid field wiring.
49
50   Each lens shall be furnished with removable tunnel-type hood
51 made of 0.030-inch-thick sheet aluminum or of polycarbonate with
52 minimum thickness of 0.060 inch. Hoods shall be 11 inches minimum in
53 length.
54
55   **(3)   Back Plates.** Louvered back plates shall be furnished and installed
56 on mast arm mounted signal heads. Back plates shall be constructed of
57 aluminum alloy 3003-H14 sheet having minimum thickness of 0.058 inch
58 and minimum dimensions equal to signal head size plus five-inch border,
59 with a one-inch retro-reflective border around the outside edge of the front
60 surface. Back plates shall be dull black in color."
61
62 **(II)**   Amend **Subsection 770.02(C) Programmed Visibility Traffic Signal**
63 **Heads** by replacing lines 333 through 427 to read as follows:
64
65 "Programmed visibility traffic signal heads are not acceptable for use on this
66 project."
67
68 **(III)**   Amend **Subsection 770.04 – Pedestrian Signal** by replacing lines 590
69 through 599 to read as follows:
70
71   **"(J)   Pedestrian Signal Push Button With Integral Sign.**   The
72 pedestrian push button unit shall consist of an assembly that can be
73 secured to traffic poles with standard screws, be tamper proof,
74 weatherproof, and constructed so that electrical shocks are impossible to
75 receive.
76
77   **(1)   Materials.**
78
79   **(a)**   The housing for the push button assembly shall be of
80   cast and/or machined aluminum. The push button
81   assembly shall be weatherproof with a water diverting
82   groove set in the outside diameter of the actuator
83   button receptor. The housing shall be designed to
84   reduce vandalism and shall mount on the side or top
85   of a pole with a minimum 2-inch diameter button. The
86   push button housing shall be capable of mounting in
87   an 'up button' or 'down button' configuration. All wire
88   connections shall be accessible from the back of the
89   assembly.
90
91   **(b)**   An ADA acceptable raised directional sign shall be
92   installed with stainless steel fasteners to the housing.

93		The sign shall consist of a raised walking person and
94		a raised arrow indication. Paint the unit black and
95		paint the raised walking person and arrow white. The
96		sign shall be capable of mounting in an 'up button' or
97		'down button' configuration. The raised walking
98		person and arrows shall be directional and match the
99		indication as shown in the plans.
100		
101	**(c)**	The pushbutton shall extend from the sign faceplate
102		approximately three inches. The pushbutton actuator
103		shall be convex in design having a flat area on the
104		face for uses of a stylus, ADA acceptable, two inches
105		in diameter, and have a tension of less than five
106		pounds when pressed. The button shall be
107		manufactured in a way that it cannot be stuck in a
108		closed (constant call) position.
109		
110	**(d)**	The pedestrian push button shall be a piezo electric
111		type and be UL listed. The button shall have a
112		stainless steel actuator and shall be mounted within
113		the housing with stainless steel, non-corrosive,
114		tamper proof fasteners. The unit shall operate
115		between 12-24V DC or AC, 3 inch round mounts with
116		4 mounting bolts. The pedestrian button shall give an
117		audio and visual signal each time the pedestrian
118		button is activated."

119

120 **(IV)** Amend **Subsection 770.05(A) - Controller Assembly,** from line 603 to
121 643 to read:

122

123 **"(A)   Controller Assembly.** Controller assembly shall include an ATC
124 Compliant Traffic Controller.   Assembly shall also include cabinet and
125 auxiliary equipment.

126

127 Each controller assembly listed in Table 770.05-1 – Controller Assembly
128 Requirements contains sufficient equipment for a minimum full 8-vehicle,
129 4-pedestrian, and 4-preemption phase intersection, even though the
130 contract documents may not require it.

131

TABLE 770.05-1 – CONTROLLER ASSEMBLY REQUIREMENTS	
Item	Quantity
ATC Traffic Controller	1
332A Aluminum Cabinet	1
Model 200 Load Switches	12
Model 204 Flasher	All

Model 242 Isolators	2
Model FS/ST Isolator	All
Flash Transfer Relay	All
Model 262C Detector Amplifiers (Rotary Sw Type)	8
Model 2010 ECL Conflict Monitor	1
Uninterruptible Power Supply (UPS) System	1
Model M762 Preempt. Card with M768 Auxiliary Input Panel	2
Cellular Router	1

132

133   **(B)   ATC Traffic Controller.** Controller shall be an ATC Traffic
134   Controller that matches with the existing KDOT traffic signal system."

135

136 **(V)**   Amend **Subsection 770.05(C)(5)** from line 660 to 665 to read:

137

138   "**(5)**   Not Used."

139

140 **(VI)**   Amend **Subsection 770.05(D) - Auxiliary Equipment** from line 697 to
141 741 to read:

142

143   "**(1)   Model 2010 ECL Conflict Monitor.** An Eberle Design Inc. (EDI)
144   model 2010ECL Signal Monitor, or approved equal. Conflict monitor shall
145   meets all requirements of the CalTrans "TSCE Specifications 1/89".

146

147   **(2)   Model M762 Optical Preemption Module with M768 Auxiliary**
148   **Input Panel.** M762 shall be card-type and shall interface with Model 170
149   cabinet preemption slots of input file. Each M762 Module shall have two
150   channels of preemption. M762 shall include firmware to discriminate
151   between two valid priority signals, to prioritize valid same priority signals
152   on a first come, first served basis, and to override low priority signal if high
153   priority is received. M762 Module shall receive input signals (9.639 and
154   14.035 Hz) to permit priority preemption operation within 170 local
155   intersection program. M762 shall optically isolate output signals and shall
156   trigger active low signal to controller for high priority and pulsed active low
157   signal for low priority.   M768 Auxiliary Input Panel shall be used to
158   interconnect M762 with the terminals inside the traffic cabinet. The State's
159   preemption systems employ the 3M/Global Traffic Technologies Opticom
160   System.   New preemption equipment shall be 3M/Global Traffic
161   Technologies Opticom or accepted equal that is fully compatible with
162   3M/Global Traffic Technologies Opticom.

163

164   **(3)   Security Tumbler for Signal Cabinet.** The signal control cabinet
165   door locks (2 locks for each cabinet) are keyed to take Best Lock Series
166   tumblers. The contractor shall furnish and install 2 lock cylinders that will
167   fit in the current locks on the signal cabinet. The lock cylinders keys shall

168	be one of a kind, licensed to HDOT, and each cylinder shall have 1 set of
169	keys with "do not duplicate" stamped on each key.
170	
171	**(4) Uninterruptible Power Supply (UPS) System.** See Subsection
172	770.13 - Uninterruptible Power Supply (UPS) System.
173	
174	**(5) Cellular Access Point.** Cellular Router shall;
175	
176	**(a)** Include all hardware, antennae, and other components
177	necessary to ensure communication between the controller
178	and KDOT Traffic Management Center (TMC).
179	
180	**(b)** Include service to a cellular provider until the end of the
181	warranty period.
182	
183	**(VII)** Add **Subsection 770.12 – Video Detection System** to read:
184	
185	This specification sets forth the minimum requirements for a video detection
186	system that detects vehicles, bicycles, and motorcycles on a roadway by
187	processing video images and that provides vehicle presence, traffic flow data,
188	event alarms, and full-motion video for real-time traffic control and management
189	systems.
190	
191	**(A) System Hardware**
192	
193	The video detection system shall be comprised of two major hardware
194	components: a video sensor and a communications interface panel. An
195	optional wired input/output card shall be available for certain cabinet
196	types.
197	
198	**(1) Video Sensor**
199	
200	The video detection system shall include a video sensor that
201	integrates a high-definition (HD) camera with an embedded
202	processor for analyzing the video and performing detection.
203	
204	**(a) Camera and Processor**
205	
206	**1.** The camera shall be a color CMOS imaging
207	array.
208	
209	**2.** The camera shall have HD resolution of at
210	least 720p (1280x720 pixels).
211	
212	**3.** The camera shall include a minimum 10X
213	optical zoom.

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4. It shall be possible to zoom the lens as required to satisfy across-the-intersection detection objectives, including stop line and advance detection.

5. It shall be possible to zoom the lens remotely from the TMC for temporary traffic surveillance operations or to inspect the cleanliness of the faceplate.

6. The camera shall have direct, real-time iris and shutter speed control by the integrated processor.

7. The processor shall support H.264 video compression for streaming output.

(b) **Video Sensor Enclosure Assembly**

1. The camera and processor shall be housed in a sealed IP-67 enclosure.

2. The faceplate of the enclosure shall be glass and shall have hydrophilic coating on the exterior surface to reduce debris accumulation and maintenance.

3. The faceplate shall have a thermostatically-controlled indium tin oxide (ITO) heater applied directly on the interior surface to keep the faceplate clear of condensation.

4. An adjustable aluminum visor shall shield the faceplate from the sun and extraneous light sources.

5. An integral aiming sight shall assist in aiming the camera for the detection objectives.

6. A removable rear cap and cable strain relief shall seal the power connection.

7. The rear cap shall be tethered to the enclosure to avoid dropping the cap during installation.

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8. The rear cap shall be fastened to the body of the video sensor with a single, captive bolt.

9. The rear cap and enclosure shall include Gore breathers to equalize internal and external pressure.

10. The sensor shall be self-supporting on manufacturer's mounting brackets for easier fastening during installation.

11. It shall be possible to rotate the field-of-view 360° without changing the angle of the visor.

(c) **Power and Communications**

1. Power and communications for the video sensor shall be carried over a single three-conductor cable.

2. Termination of the three-conductor cable shall be inside the rear cap of the enclosure on a three-position, removable Phoenix terminal block. Each conductor shall be attached to the Phoenix plug via a screw connection.

3. The video sensor shall operate normally over an input voltage range of 89 to 265 VAC at 50 or 60 Hz.

4. Power consumption shall be no more than 16 watts typical.

5. No supplemental surge suppression shall be required outside the cabinet.

6. All communications to the video sensor shall be broadband-over-power via the same three-conductor cable that powers the unit. Coaxial cable shall not be required.

(2) **Communications Interface Panel**

The video detection system shall include an interface panel in the traffic cabinet that manages communications between the video sensors, the traffic management center (TMC), a maintenance

306   technician, and the traffic cabinet itself.

(a)   Video Sensor Connection

1.   The communications interface panel shall provide connection points for four video sensors.

     i.   Each sensor connection shall be a 3-pole terminal block, which supplies power and broadband-over-power communications to the sensor.

     ii.   The broadband-over-power communications shall provide a throughput of 70 to 90 Mbps.

     iii.   The broadband-over-power connection shall support at least 1,000 feet of cabling to the video sensor.

     iv.   Each video sensor connection shall include a power switch.

     v.   There shall be an LED for each video sensor to indicate the state of the power to the sensor and an LED for each video sensor to indicate the status of communications.

     vi.   Each video sensor connection shall contain a resettable fuse.

     vii.   Each video sensor connection shall provide high-energy transient protection.

(b)   Traffic Management Center (TMC) Communications

1.   An Ethernet port shall be provided to connect to a remote Traffic Management Center (TMC).

     i.   The TMC connection shall support 10/100/1000 Mbps Ethernet communication.

| 352 | | | **ii.** | A security protocol shall be set up to restrict communication to the main TMC and all components in the event of an unauthorized access. |

ii. A security protocol shall be set up to restrict communication to the main TMC and all components in the event of an unauthorized access.

iii. The communications interface panel shall proxy all network requests that arrive on the TMC connection to avoid unwanted network traffic from reaching the broadband-over-power network between the communications interface panel and the video sensors.

iv. All communications to the video detection system through the TMC connection shall be to a single IP address.

(c) **Local User Communications**

1. A wired Ethernet port shall be provided to connect the technician at the cabinet to the video detection system for setup and maintenance purposes.

i. The maintenance port shall support 10/100/1000 Mbps Ethernet communication.

ii. All communications to the video detection system through the maintenance port shall be to a single IP address.

iii. The maintenance port shall support DHCP to automatically assign an IP address to the user's computer, if desired.

2. An 802.11g Wi-Fi access point shall allow wireless connection to the video detection system at the cabinet for setup and maintenance purposes.

i. All communications to the video detection system through the Wi-Fi

398			access point shall be to a single IP Address.
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400			
401		**ii.**	The Wi-Fi access point shall support DHCP to automatically assign an IP Address to the user's computer.
402			
403			
404			
405		**iii.**	The Wi-Fi access point shall include a dipole, omnidirectional antenna.
406			
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408		**iv.**	A momentary pushbutton shall allow the user to turn the Wi-Fi access point on or off.
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412		**v.**	The Wi-Fi access point shall turn itself off automatically after a period of inactivity from connected devices.
413			
414			
415			
416		**vi.**	An LED shall indicate when the Wi-Fi access point is enabled.
417			
418			
419		**vii.**	The Wi-Fi access point shall operate simultaneously with the wired maintenance port and with the TMC connection.
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(d) Traffic Controller Connection

The communications interface panel shall provide one connection to communicate to the traffic controller through the cabinet.

1.		The traffic controller connection shall support a TS2 Type 1 compatible SDLC interface.
	i.	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.
	ii.	The traffic controller connection shall support a protocol interface to SDLC-capable traffic controllers (NEMA or TEES).

444			**iii.**	The traffic controller connection shall
445				support the NEMA TS2 SDLC protocol
446				to include up to 64 detector outputs and
447				32 inputs.
448				

iii. The traffic controller connection shall support the NEMA TS2 SDLC protocol to include up to 64 detector outputs and 32 inputs.

2. The traffic controller connection shall be able to connect to a wired input/output card, which supports wired I/O in cabinets without a SDLC-capable controller.

   i. The wired I/O data communications link shall support at least 24 outputs and 16 inputs.

   ii. It shall be possible to connect and use both SDLC communications and communication to the wired input/output card simultaneously.

(e) USB Ports

1. The communications interface panel shall include two USB 2.0 ports.

   i. If a communications interface panel fails to start and run due to a software or operating system failure, it shall be possible to reinstall all system and application software from a USB memory stick without necessitating removal of the communications interface panel from the cabinet.

(f) Power

1. The communications interface panel shall accept input voltage in the range of 89-265 VAC, 50/60 Hz power from the transient-protected side of the cabinet.

2. The communications interface panel shall be protected by two slow blow fuses. Spares shall be attached to the panel.

(3) Wired Input/Output Card

490			The video detection system shall support an optional wired
491			input/output card that communicates with the communications
492			interface panel for real-time detection states and other I/O to the
493			traffic controller. The card may reside in a standard detector rack
494			or shelf-mount enclosure with power module.

490   The video detection system shall support an optional wired input/output card that communicates with the communications interface panel for real-time detection states and other I/O to the traffic controller. The card may reside in a standard detector rack or shelf-mount enclosure with power module.

(a)   The optional 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 or Caltrans TEES Input File.

     1.   The card shall occupy two slots of the detector rack.

     2.   The card shall provide four detector outputs on its rear-edge connector.

     3.   A front connector shall provide communication to the communications interface panel.

     4.   A front connector shall allow 16 inputs and 24 contact-closure detector outputs for wiring into the cabinet.

         i.   A front panel LED for each of the 16 inputs and 24 outputs shall indicate the state of the input or output.

     5.   The wired input/output card shall support optional expansion cards in other slots. Each expansion card shall support 4 outputs to the back edge of the card.

     6.   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.

(B)   **System Software**

The video detection system shall include management software for configuration, monitoring and data collection purposes.

     (1)   Management Software

         (a)   Management software shall be a Windows-based

application.

1.   The software shall be compatible with Windows 7 and Windows 10 operating systems.

2.   The software shall communicate with the video detection system via Ethernet.

(b)   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.

(c)   The management software shall provide the user a means to name individual video sensors and communications interface panels.

(d)   The management software shall provide a means for the user to zoom the camera optics while viewing a live video stream.

(e)   The management software shall provide a means for the user to calibrate distances in the field of view.

(f)   The management software shall provide the user a means to create 4-sided detection zones in the field of view using either a still snapshot or live video.

1.   The management software will overlay an outline of each detection zone over the background image.

2.   It shall be possible for the user to place detection zones anywhere in the field of view for stop line detection and/or advance detection.

3.   It shall be possible for the user to set the desired color of both the on and off states of the detection zone overlay.

4.   It shall be possible for the user to alter the size and shape of any previously created zone.

5.   It shall be possible for the user to overlap zones, either partially or fully.

582

583 **6.** It shall be possible for the user to name each
584 zone uniquely.

585

586 **7.** It shall be possible for the user to assign each
587 zone to detect vehicles, to detect bicycles, or to
588 detect both, and to specify different outputs for
589 each type.

590

591 **8.** It shall be possible for the user to assign the
592 same output to multiple zones such that the
593 output will be on if any of the zones are
594 detecting a vehicle or bicycle.

595

596 **9.** It shall be possible for the user to assign a
597 single zone to more than one output such that
598 if a vehicle or bicycle is detected, all the
599 assigned outputs shall be turned on.

600

601 **10.** The management software shall be capable of
602 creating at least 99 detection zones per video
603 sensor.

604

605 **(g)** It shall be possible for the management software to
606 retrieve all configuration parameters from video
607 sensors or communications interface panels.

608

609 **1.** It shall be possible for the user to save all the
610 settings for a video sensor or a
611 communications interface panel to a laptop file.

612

613 **2.** The management software shall provide a
614 means to read or import all the settings from a
615 previously saved configuration file for a video
616 sensor or a communications interface panel.

617

618 **(h)** The management software shall be able to download
619 a new version of the application software into a
620 communications interface panel and its attached
621 video sensors.

622

623 **(i)** The management software shall provide a screen to
624 monitor operation of a video sensor.

625

626 **1.** The monitoring screen shall include a live video
627 stream from the video sensor with at least HD

628			1280x720 pixel resolution.
629			
630		**2.**	The monitoring screen shall show indications of detection in real time by changing the color of the detection zone.
631			
632			
633			
634		**3.**	It shall be possible for the user to configure different indications for vehicle detections vs. bicycle detections when both are configured for the same zone.

<table>
<tr><td>628</td><td></td><td></td><td>1280x720 pixel resolution.</td></tr>
</table>

628   1280x720 pixel resolution.

629

630   **2.**   The monitoring screen shall show indications of
631   detection in real time by changing the color of
632   the detection zone.

633

634   **3.**   It shall be possible for the user to configure
635   different indications for vehicle detections vs.
636   bicycle detections when both are configured for
637   the same zone.

638

639   **4.**   The monitoring screen shall include the
640   following optional, configurable objects. It shall
641   be possible for the user to size and position
642   them anywhere on the screen and to change
643   the color and size of text.

644

645   **i.**   An indication of when an output is on or
646   off, along with a user-configurable name
647   for that indicator.

648

649   **ii.**   The current time in the video sensor.

650

651   **iii.**   A user-configurable title or name.

652

653   **iv.**   The version number of the video sensor
654   software.

655

656   **5.**   It shall be possible for the user to turn the
657   overlay graphics on or off with a single setting.

658

659   **(j)**   The management software shall provide a screen to
660   monitor operation of the intersection with a quad-view
661   video stream from the communications interface
662   panel.

663

664   **1.**   The quad-view video stream shall have a
665   resolution of at least HD 1280x720 pixels,
666   where each of the sensor videos comprising
667   the quad-view shall be at least 640x360 pixels.

668

669   **2.**   It shall be possible for the user to configure the
670   order that the sensor videos appear in the
671   quad-view.

672

673   **3.**   The real-time quad-view video stream shall be

674		capable of displaying the overlay graphics for
675		all four sensors simultaneously.
676		
677	**(k)**	While monitoring the video of a single video sensor or
678		of the quad-view, it shall be possible for the user to
679		request a "snapshot" or single-frame image to save to
680		a named file on a laptop.
681		
682	**(l)**	While monitoring the video of a single video sensor or
683		of the quad-view, it shall be possible for the user to
684		record a period of the video to save to a named file on
685		a laptop.

(C) System Functionality

The video detection system shall provide the following features and functionality.

(1) Detection Performance

(a) The video detection system shall detect the presence of vehicles in defined zones and turn on the assigned output when the vehicle is present in the zone.

1. Stop Line Detection

i. For detection zones placed at the stop line, the probability of not detecting the presence of a vehicle shall be 1% or less under all operating conditions when the video sensor is installed and configured properly.

ii. For detection zones placed at the stop line, the probability of falsely detecting a vehicle that is not present shall be 3% or less under all operating conditions when the video sensor is installed and configured properly.

2. Advance Detection

iii. It shall be possible to place advance detector zones such that the farthest point of the zone is up to 600 feet from the video sensor. Advance detector

720		zone placement shall include 2-3 car
721		lengths of field-of-view beyond the
722		farthest point of the zone.
723		
724	**(b)**	To ensure statistical significance for the above
725		detection performance specifications, the data shall
726		be collected over 24-hour time intervals (so as to
727		avoid a single lighting condition) and will contain a
728		minimum of one hundred (100) vehicles per lane.
729		The calculations of detection performance will not
730		include turning movements where vehicles do not
731		pass through the detectors, vehicle lane-change
732		anomalies, or where they stop short or stop beyond
733		the combined detection zones.

734
735 **(2)** **Failsafe Mode**

736
737 **(a)** The video detection system shall provide a failsafe
738 mode for each video sensor. If the failsafe mode is
739 enabled, all programmed presence detection outputs
740 for the video sensor shall be turned on, thus placing
741 constant calls to the controller. When failsafe mode is
742 disabled, all outputs revert to normal on/off
743 operations.

744
745 **(b)** The video sensor shall continuously monitor the
746 overall contrast in the video. If the overall contrast
747 falls below a preset level (such as caused by dirty
748 faceplate, severe glare, or extreme fog on the
749 faceplate), the sensor shall enable the failsafe mode.
750 When sufficient contrast is restored in the video, the
751 sensor will disable the failsafe mode.

752
753 **(c)** The communications interface panel shall
754 continuously monitor the connectivity status of the
755 attached video sensors. If any video sensor goes
756 offline due to either electrical failure or internal
757 software failure, the communications interface panel
758 shall enable the failsafe mode for that video sensor. If
759 the video sensor comes back online, failsafe mode
760 shall be disabled.

761
762 **(3)** **Data Collection**

763
764 **(a)** The video detection system shall automatically collect
765 and store traffic flow data in non-volatile memory for

766 later retrieval and analysis. No additional hardware or
767 software shall be necessary. The data shall include:
768
769 **1.** Vehicle counts per phase.
770
771 **2.** Vehicle average speeds.
772
773 **(b)** All data shall be stored in a cloud-based storage
774 indefinitely.
775
776 **(c)** The management software shall be able to retrieve
777 collected data for a specified period of time or for all
778 currently stored data and save into a standard CSV
779 file.
780
781 **(4)** **Operations Log**
782
783 **(a)** The communications interface panel and each video
784 sensor shall maintain a time-stamped operations log
785 of routine and special events in non-volatile memory
786 for later retrieval and analysis.
787
788 **(5)** **Time Synchronization**
789
790 **(a)** The video detection system and management
791 software shall provide three methods to synchronize
792 the time of day clocks in the communication interface
793 panel and the video sensors, as follows:
794
795 **1.** Manual time synchronization operation by the
796 user, which sets the time to the current time on
797 the laptop where the management software is
798 running.
799
800 **2.** A configuration setting to allow the
801 communications interface panel to
802 automatically obtain time from the NEMA TS2
803 protocol on the SDLC channel and broadcast it
804 to the video sensors.
805
806 **3.** A configuration setting to allow the
807 communications interface panel to
808 automatically obtain time from up to five
809 Network Time Protocol (NTP) sources and
810 broadcast it to the video sensors.
811

(6)   Video Streaming

      a.   In addition to the ability to view video streams in the management software, it shall be possible to view video from individual sensors or to view the quad-view from the communications interface panel using a third-party video player application on a tablet, smartphone or laptop computer.

(D)   Installation and Setup

The video detection system hardware shall be designed for flexible, fast and easy installation and setup.

    (1)   It shall be possible to mount the video sensor on an intersection pole, mast arm, or luminaire arm.

    (2)   No special tools or extra equipment, other than a laptop for configuration, will be required.

    (3)   Once all hardware is installed, connected and functional, it shall be possible to configure the video detection system for a typical 4-approach, 8-phase intersection in 15 minutes or less.

(E)   Warranty, Service and Support

The video detection system shall be provided with the following warranty, service and support options.

    (1)   Warranty

      (a)   In addition to the requirements of Subsection 108.17 Guarantee of Work, the manufacturer shall warrant the video detection system for a minimum of three (3) years. An option for up to six (6) years of warranty shall be available.

    (2)   Service

      (a)   Ongoing software support by the manufacturer will include software updates of the video sensor, communications interface panel, and management software. These updates will be provided free of charge during the warranty period. The manufacturer will maintain a program for technical support and

858			software updates following expiration of the warranty
859			period. This program will be available to the
860			contracting agency in the form of a separate
861			agreement for continuing support.

862

863   **(3)**   **Support**

864

865   **(a)**   A quick-start guide, installation guide, application
866   notes, and other materials shall be available from the
867   manufacturer to assist in product installation and
868   setup for various applications. In addition, training
869   online or in person shall be available.

870

871   **(b)**   Training shall be available to personnel of the
872   contracting agency in application design, operation,
873   setup, and maintenance of the video detection
874   system.

875

876   **(c)**   Manufacturer shall provide a tech support website
877   and an 800 number for technical support."

878

879 **(VIII)** Add **Subsection 770.13 – Uninterruptible Power Supply (UPS) System**
880 to read:

881

882 **"770.13 Uninterruptible Power Supply (UPS) System**

883

884   **(A) Definitions**

885

886   **(1)**   UPS – Uninterruptible Power Supply

887

888   **(2)**   GUI – Graphical User Interface

889

890   **(3)**   NiZn - Nickel-Zinc

891

892   **(4)**   SNMP - Simple Network Management Protocol

893

894   **(5)**   SMTP - Simple Mail Transfer Protocol

895

896   **(6)**   TCP/IP - Transmission Control Protocol/Internet Protocol

897

898

899   **(B) UPS System Requirements:**

900

901   **(1)**   **Compatibility**

902

903   The UPS shall be compatible with the Agency's current traffic
904   controller cabinet, controller and cabinet components, including the

905 safety monitor, for full time operation. The UPS shall include all
906 necessary cables to connect the UPS and batteries.
907
908 **(2)   Run-time**
909
910 The UPS shall provide a 2-amp cabinet load a minimum run-time of
911 four (4) hours of full color operation at ambient temperature of 25°C.
912
913 **(3)   Output Capacity**
914
915 UPS must provide a minimum of 1000W continuous active output
916 capacity, with a 90% typical inverter efficiency while running in battery
917 backup mode. The UPS must have surge output capability of 2000W.
918
919 **(4)   Output Voltage**
920
921 When under battery power, the UPS output voltage shall be 120 VAC,
922 ±3%, pure sine wave output, with <2% total harmonic distortion (THD),
923 and frequency of 60 Hz ±0.5%.
924
925 **(5)   Transfer Time**
926
927 The maximum transfer time allowed, from disruption of utility line
928 voltage to stabilized inverter line voltage from batteries   shall be thirty-
929 three (33) milliseconds max. The maximum transfer time when
930 switching from inverter line voltage to utility line voltage after the line-
931 qualifying period shall be thirty-three (33) milliseconds max. The UPS
932 shall be capable of allowing the user to program the line qualifying
933 period as three (3), ten (10) or thirty (30) seconds.
934
935 **(6)   Operating Environment**
936
937 Operating temperature for the UPS and Power Interface Module (PIM)
938 shall be -35°F to +165°F (-37° to +74°C).
939
940 **(7)   Certifications**
941
942 The UPS battery cells shall be recognized UL-2054, CSA 22.2 No.
943 60950-1
944
945 **(8)   Power & Control Connections**
946
947 **(a)   Power Interface Module (PIM)**
948 The UPS shall utilize a Power Interface Module (PIM) to
949 connect utility AC input to the UPS and batteries as well
950 as routing UPS output power to the cabinet load.
951
952 **(b)   AC Connection**

953		The AC input and output shall be separate panel
954		mounted plug/receptacles that allow no possibility of
955		accidental exposure to dangerous voltages.
956		
957	**(c)**	**Battery Connections**
958		

959   **1.**   The batteries shall have digital battery bus
960   connections to the UPS with locking connectors
961   with provision for six battery ports. There shall be
962   AC power connections from the Power Interface
963   Module to the batteries that are separate from
964   the digital battery bus connections.
965

966   **2.**   The UPS must offer six (6) battery ports that can
967   accommodate a mix of any form-factor NiZn
968   batteries compatible with the UPS system.
969

970   **3.**   The UPS must be capable of accepting batteries
971   of different capacities at once, giving the user the
972   ability to utilize different battery sizes to achieve
973   required run-times.
974

975   **4.**   The UPS must allow the user to 'Hot Swap' any
976   of the battery form-factors while on utility power
977   and/or battery backup power.
978

979   **(9)**   **Battery**
980

981   **(a)**   The standard and XRT UPS batteries must utilize a
982   Sealed Nickel-Zinc (NiZn) battery technology. Lead-Acid
983   or Lithium battery technologies will not be accepted.
984

985   **(b)**   The standard run-time battery panel(s) must incorporate
986   a bendable design, which allows the battery panel(s) to
987   flex or bend for installation between the 19" EIA rack and
988   the sidewall of the 33X cabinet.
989

990   **(c)**   The standard run-time module(s) must have the
991   capability of being installed on/under a shelf or be rack
992   mountable within the 19" EIA rack.
993

994   **(d)**   XRT battery solutions shall come with an intelligent
995   management system that consolidates all battery
996   connections to the UPS and manages the battery string.
997

998   **(e)**   The charging/battery monitoring circuitry shall be
999   incorporated within the panel, module or extended run
1000   time battery solutions.

(10)   Charge

The UPS must be able to recharge panel and module batteries from 0% to 100% state of charge (full capacity) within four and one half (4.5) hours of complete discharge at 25°C when AC utility line voltage is available. Extended run time batteries shall be able to recharge batteries from 0% to 100% state of charge (full capacity)   within ten (10) hours of complete discharge at 25°C when AC utility line voltage is available. The number of batteries connected to the UPS shall have NO effect on the recharge time. The batteries must be able to charge at up to 50°C ambient temperature. The UPS must not require trickle/float charging.

Wall Charging - The UPS panel, module and extended run time batteries shall be able to be charged using a 120VAC,15A wall outlet (20A for extended run time) without need of a UPS inverter/controller, battery charger or battery tender.

(11)   Unit failure

The UPS must have a fail-safe utility tie feature (bypass mode) with a visual indicator that automatically cuts back to the utility line in the event of a UPS or battery failure, or complete battery discharge.

(12)   Operating Modes

The UPS shall have intelligent two-stage operation defined as:

(a)   Stage One: Line Attenuator, Waveform Monitoring and Switchover to Battery Backup

(b)   Stage Two: Waveform Monitoring, Return to AC Power.

(13)   Oscilloscope Function

The UPS shall have an oscilloscope function continuously monitoring the incoming utility AC waveform. The oscilloscope function shall continuously evaluate three (3) measures of the incoming utility AC waveform:

(a)   Voltage: A continuous RMS measurement with user programmable AC voltage thresholds.

1047		**(b)**	Waveform Anomalies: Oscilloscope enhanced
1048			sensitivity mode compares incoming utility waveform to
1049			a mathematically pure sine wave reference waveform.
1050			
1051		**(c)**	Frequency: Continuously measured with frequency
1052			deviation detected as quickly as 1 cycle and a default
1053			threshold of 60Hz $\pm$6Hz.

1054

(C)   **Functionality and Operational Requirements**

1056

    (1)   **LCD Display**

1058

         The UPS shall have a 64 x 128 Pixels LCD display with white LED backlight. From the main screen, the LCD display shall provide the following information;

1062

        (a)   Utility line voltage

1064

        (b)   UPS status

1066

        (c)   Cabinet consumption in watts

1068

        (d)   Most recent AC power outage duration
        (e)   Battery capacity State of Charge percentage

1071

    (2)   **LCD Display Menu**

1073

         The LCD Display Menu shall provide the user the ability to program and monitor all UPS parameters;

1076

    (3)   **Local User Interface**

1078

         The UPS shall include a navigational dial to allow users the ability to navigate the menu to setup the UPS.

1081

    (4)   **Voltage Thresholds**

1083

        (a)   The UPS shall allow the user to set high and low AC line voltage thresholds to determine parameters to transfer from utility line power to battery backup power.

1087

        (b)   The UPS shall bypass utility line power if the utility line voltage is outside of the set high and low voltage parameters.

1091

        (c)   The UPS shall have a programmable utility AC qualification time after restoration of utility AC power to

| 1094 | | | within specified voltage thresholds with choices of 3, 10 |
| 1095 | | | or 30 seconds. |

1096

1097   **(5)**   **Notifications**

1098

1099   All alarm functions shall be available on SNMP, SMTP and
1100   Programmable Relay.

1101

1102   **(6)**   **Programmable Relays**

1103

1104   The UPS Inverter/Controller shall include eight (8) Class 2
1105   programmable relays, which can be triggered by power line
1106   conditions, and user selected settings of the UPS. Each relay
1107   shall have the ability to trigger by multiple conditions
1108   simultaneously. The programming options are as follows;

1109

1110   **(a)**   Power Fail without delay / Power fail with delay

1111

1112   **(b)**   Time of Day

1113

1114   **(c)**   Battery Capacity

1115

1116   **(d)**   System Fault

1117

1118   **(7)**   **Event Log**

1119

1120   The UPS shall provide an event log with a 1000 event capacity,
1121   which will allow the user to view the event type, date, time and
1122   duration of a given event. UPS configuration changes shall also
1123   be defined as an event and captured in the event log. The data
1124   shall be recorded in a FIFO format, so the oldest event is
1125   purged as the newest is entered.

1126

1127   **(8)**   **Automatic Bypass Switch**

1128

1129   The UPS shall have an automatic bypass function with a visual
1130   indicator to bypass the UPS and allow the utility line voltage
1131   through to the cabinet.

1132

1133   **(9)**   **Circuit Breakers**

1134

1135   The UPS system shall include a Power Interface Module (PIM)
1136   equipped with a 20A circuit breaker and automatic bypass
1137   capability.

1138

1139   **(10)**   **Cold Start**

1140

1141   The UPS shall be equipped with "Cold Start" capabilities, which
1142   provides the user the ability to turn the UPS on and supply
1143   battery backup power when no utility line voltage is available.
1144   This allows the user the ability to install a UPS and provide
1145   backup AC power at an intersection that has no   utility line
1146   voltage available.

1147

(11) Audible Indicators

The UPS shall have audible indicators for the following parameters:

(a)   System Startup

(b)   Cold Start

(c)   Inverter On/Off

(d)   Inverter Output Over Current

(e)   AC Mis-wire

(f)   Rotating Navigation Dial with Press to Select and Back Button use

(g)   UPS Fault

(12) Maintenance

There shall be no battery maintenance requirements for the life of the batteries including no battery rotation, maintenance discharge or cell balancing.

(13) Visual Indicators

The UPS shall have visual indicators on its front panel for the following:

(a)   Red indicator - UPS Fault

(b)   Solid Green indicator - Backup Mode On

(c)   Flashing Green indicator - Batteries are below 10% capacity

(d)   Yellow - Relay Triggered

1188			The batteries shall have the following visual indicators
1189			through a multi-color LED providing battery status and
1190			alarms

1191 • Green = Backup Mode
1192 • Blue = Charging Mode
1193 • Red = Battery Fault
1194 • White Blinking = Charged, battery at rest

1195

(D)   Communication

1197

(1)   The UPS must have the capability to provide Ethernet and IP addressing communications with the capability for remote monitoring and programming as well as remote firmware updating capability. This capability must be provided through embedded webserver software within the UPS.

1203

(2)   The UPS shall be equipped with an Ethernet port. The Ethernet port shall be an RJ45, EIA 568B pin out type connector. The Ethernet port shall be 10/100Mbps, TCP/IP capable.

1207

(E)   Graphical User Interface

1209

(1)   The embedded webserver will provide a Graphical User Interface (GUI) that shall be password protected and require a user ID, password and the UPS IP address to access.

1213

(2)   The GUI shall have a status area that details the UPS status, location, available AC line voltage status and real-time cabinet power consumption. When in backup mode, the GUI shall display the most recent power failure duration. The status area must be displayed on every page.

1219

(3)   The GUI shall have a Home screen with clickable icons and tabs, which will allow the user to navigate the GUI with ease. The home screen shall allow the user to view real-time graphical charts of the cabinet power consumption and AC line voltage status. The home screen must allow the user the ability to view a live waveform from the AC utility line in the cabinet.

1226

(4)   The GUI shall have an Event Log page to allow the user to view the event type, date, time and duration of a given event. The GUI must provide the user the capability of viewing the waveform of the given event.

1231

(5)   The GUI shall have a relay Configuration page to allow the user to program the relay contacts.

1234

1235   **(6)**   The GUI shall have a System Configuration page that allows
1236   the user to configure all the setup parameters of the UPS.
1237
1238   **(7)**   The GUI shall communicate notification and alerts through
1239   SNMP and SMTP protocols.
1240

1241 **(F)**   **Warranty**

1242

1243 The UPS, as a complete system including batteries, must be warranted to be
1244 free from defects in material and workmanship for a minimum of 5 years for
1245 the battery cells and 2 years for the electronics from the date of shipment."

1246

1247 **END OF SECTION 770**

1248