SECTION 770 – TRAFFIC SIGNAL MATERIALS

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 are attached shall be permanently identified or conductors shall be color-coded to aid field wiring.

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

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

117

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

120

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

124

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

129

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

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

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

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

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

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

(2)   Model M762 Optical Preemption Module with M768 Auxiliary Input Panel. M762 shall be card-type and shall interface with Model 170 cabinet preemption slots of input file. Each M762 Module shall have two channels of preemption. M762 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 170 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.   M768 Auxiliary Input Panel shall be used to interconnect M762 with the terminals inside the traffic cabinet. The State's preemption systems employ the 3M/Global Traffic Technologies Opticom System.   New preemption equipment shall be 3M/Global Traffic Technologies Opticom or accepted equal that is fully compatible with 3M/Global Traffic Technologies Opticom.

(3)   Security Tumbler for Signal Cabinet. The signal control cabinet door locks (2 locks for each cabinet) are keyed to take Best Lock Series tumblers. The contractor shall furnish and install 2 lock cylinders that will fit in the current locks on the signal cabinet. The lock cylinders keys shall be one of a kind, licensed to HDOT, and each cylinder shall have 1 set of keys with "do not duplicate" stamped on each key.

169 **(4)** **Uninterruptible Power Supply (UPS) System.** See Subsection
170 770.13 - Uninterruptible Power Supply (UPS) System.
171
172 **(5)** **Cellular Access Point.** Cellular Router shall;
173
174 **(a)** Include all hardware, antennae, and other components
175 necessary to ensure communication between the controller
176 and KDOT Traffic Management Center (TMC).
177
178 **(b)** Be included to the existing KDOT priority network service
179 subscription with a cellular provider. Cellular provider shall
180 manage and service the router for the duration of the
181 subscription 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 types.
196
197 **(1)** **Video Sensor**
198
199 The video detection system shall include a video sensor that
200 integrates a high-definition (HD) camera with an embedded
201 processor for analyzing the video and performing detection.
202
203 **(a)** **Camera and Processor**
204
205 **1.** The camera shall be a color CMOS imaging
206 array.
207
208 **2.** The camera shall have HD resolution of at least
209 720p (1280x720 pixels).
210
211 **3.** The camera shall include a minimum 10X
212 optical zoom.
213
214 **4.** It shall be possible to zoom the lens as required
215 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.

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

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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 technician, and the traffic cabinet itself.

(a) Video Sensor Connection

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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.

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

354   unauthorized access.

355

356   **iii.**   The communications interface panel
357   shall proxy all network requests that
358   arrive on the TMC connection to avoid
359   unwanted network traffic from reaching
360   the broadband-over-power network
361   between the communications interface
362   panel and the video sensors.

363

364   **iv.**   All communications to the video
365   detection system through the TMC
366   connection shall be to a single IP
367   address.

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369 **(c)**   **Local User Communications**

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

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376   **i.**   The maintenance port shall support
377   10/100/1000 Mbps Ethernet
378   communication.

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380   **ii.**   All communications to the video
381   detection system through the
382   maintenance port shall be to a single IP
383   address.

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

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

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395   **i.**   All communications to the video
396   detection system through the Wi-Fi
397   access point shall be to a single IP
398   Address.

399

400	**ii.**	The Wi-Fi access point shall support
401		DHCP to automatically assign an IP
402		Address to the user's computer.
403		
404	**iii.**	The Wi-Fi access point shall include a
405		dipole, omnidirectional antenna.
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407	**iv.**	A momentary pushbutton shall allow the
408		user to turn the Wi-Fi access point on or
409		off.
410		
411	**v.**	The Wi-Fi access point shall turn itself off
412		automatically after a period of inactivity
413		from connected devices.
414		
415	**vi.**	An LED shall indicate when the Wi-Fi
416		access point is enabled.
417		
418	**vii.**	The Wi-Fi access point shall operate
419		simultaneously with the wired
420		maintenance port and with the TMC
421		connection.
422		
423	**(d)**	**Traffic Controller Connection**
424		
425	The communications interface panel shall provide one	
426	connection to communicate to the traffic controller through the	
427	cabinet.	
428		
429	**1.**	The traffic controller connection shall support a
430		TS2 Type 1 compatible SDLC interface.
431		
432	**i.**	The traffic controller connector shall be a
433		15-pin female metal shell D sub-
434		miniature type connector to support a
435		standard NEMA TS2 or TEES SDLC
436		cable.
437		
438	**ii.**	The traffic controller connection shall
439		support a protocol interface to SDLC-
440		capable traffic controllers (NEMA or
441		TEES).
442		
443	**iii.**	The traffic controller connection shall
444		support the NEMA TS2 SDLC protocol to
445		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

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

492	traffic controller. The card may reside in a standard detector rack or
493	shelf-mount enclosure with power module.
494	
495	**(a)** The optional wired input/output card shall comply with
496	the form factor and electrical characteristics to plug
497	directly into a NEMA type C or D detector rack or
498	Caltrans TEES Input File.
499	
500	**1.** The card shall occupy two slots of the detector
501	rack.
502	
503	**2.** The card shall provide four detector outputs on
504	its rear-edge connector.
505	
506	**3.** A front connector shall provide communication
507	to the communications interface panel.
508	
509	**4.** A front connector shall allow 16 inputs and 24
510	contact-closure detector outputs for wiring into
511	the cabinet.
512	
513	**i.** A front panel LED for each of the 16
514	inputs and 24 outputs shall indicate the
515	state of the input or output.
516	
517	**5.** The wired input/output card shall support
518	optional expansion cards in other slots. Each
519	expansion card shall support 4 outputs to the
520	back edge of the card.
521	
522	**6.** The wired input/output card shall support
523	optional harnesses for connection to Input Files
524	or C1, C4, C11, and C12 ports to support Type
525	170 or Type 2070 controllers.
526	
527	**(B) System Software**
528	
529	The video detection system shall include management software for
530	configuration, monitoring and data collection purposes.
531	
532	**(1)** Management Software
533	
534	**(a)** Management software shall be a Windows-based
535	application.
536	
537	**1.** The software shall be compatible with Windows

538   7 and Windows 10 operating systems.
539
540   **2.**   The software shall communicate with the video
541   detection system via Ethernet.
542
543 **(b)** The management software shall automatically
544   determine all video sensors and communications
545   interface panels available on the local network and
546   populate a list of all devices.
547
548 **(c)** The management software shall provide the user a
549   means to name individual video sensors and
550   communications interface panels.
551
552 **(d)** The management software shall provide a means for
553   the user to zoom the camera optics while viewing a live
554   video stream.
555
556 **(e)** The management software shall provide a means for
557   the user to calibrate distances in the field of view.
558
559 **(f)** The management software shall provide the user a
560   means to create 4-sided detection zones in the field of
561   view either a still snapshot or live video.
562
563   **1.**   The management software will overlay an
564   outline of each detection zone over the
565   background image.
566
567   **2.**   It shall be possible for the user to place
568   detection zones anywhere in the field of view for
569   stop line detection and/or advance detection.
570
571   **3.**   It shall be possible for the user to set the desired
572   color of both the on and off states of the
573   detection zone overlay.
574
575   **4.**   It shall be possible for the user to alter the size
576   and shape of any previously created zone.
577
578   **5.**   It shall be possible for the user to overlap zones,
579   either partially or fully.
580
581   **6.**   It shall be possible for the user to name each
582   zone uniquely.
583

584	**7.**	It shall be possible for the user to assign each
585		zone to detect vehicles, to detect bicycles, or to
586		detect both, and to specify different outputs for
587		each type.
588		
589	**8.**	It shall be possible for the user to assign the
590		same output to multiple zones such that the
591		output will be on if any of the zones are detecting
592		a vehicle or bicycle.
593		
594	**9.**	It shall be possible for the user to assign a single
595		zone to more than one output such that if a
596		vehicle or bicycle is detected, all the assigned
597		outputs shall be turned on.
598		
599	**10.**	The management software shall be capable of
600		creating at least 99 detection zones per video
601		sensor.
602		
603	**(g)**	It shall be possible for the management software to
604		retrieve all configuration parameters from video
605		sensors or communications interface panels.
606		
607	**1.**	It shall be possible for the user to save all the
608		settings for a video sensor or a communications
609		interface panel to a laptop file.
610		
611	**2.**	The management software shall provide a
612		means to read or import all the settings from a
613		previously saved configuration file for a video
614		sensor or a communications interface panel.
615		
616	**(h)**	The management software shall be able to download a
617		new version of the application software into a
618		communications interface panel and its attached video
619		sensors.
620		
621	**(i)**	The management software shall provide a screen to
622		monitor operation of a video sensor.
623		
624	**1.**	The monitoring screen shall include a live video
625		stream from the video sensor with at least HD
626		1280x720 pixel resolution.
627		
628	**2.**	The monitoring screen shall show indications of
629		detection in real time by changing the color of

630		the detection zone.
631		
632	**3.**	It shall be possible for the user to configure
633		different indications for vehicle detections vs.
634		bicycle detections when both are configured for
635		the same zone.
636		
637	**4.**	The monitoring screen shall include the
638		following optional, configurable objects. It shall
639		be possible for the user to size and position
640		them anywhere on the screen and to change the
641		color and size of text.
642		
643	**i.**	An indication of when an output is on or
644		off, along with a user-configurable name
645		for that indicator.
646		
647	**ii.**	The current time in the video sensor.
648		
649	**iii.**	A user-configurable title or name.
650		
651	**iv.**	The version number of the video sensor
652		software.
653		
654	**5.**	It shall be possible for the user to turn the
655		overlay graphics on or off with a single setting.
656		
657	**(j)**	The management software shall provide a screen to
658		monitor operation of the intersection with a quad-view
659		video stream from the communications interface panel.
660		
661	**1.**	The quad-view video stream shall have a
662		resolution of at least HD 1280x720 pixels, where
663		each of the sensor videos comprising the quad-
664		view shall be at least 640x360 pixels.
665		
666	**2.**	It shall be possible for the user to configure the
667		order that the sensor videos appear in the quad-
668		view.
669		
670	**3.**	The real-time quad-view video stream shall be
671		capable of displaying the overlay graphics for all
672		four sensors simultaneously.
673		
674	**(k)**	While monitoring the video of a single video sensor or
675		of the quad-view, it shall be possible for the user to

676 request a "snapshot" or single-frame image to save to
677 a named file on a laptop.
678

679 **(l)** While monitoring the video of a single video sensor or
680 of the quad-view, it shall be possible for the user to
681 record a period of the video to save to a named file on
682 a laptop.

684 **(C)** **System Functionality**

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

689 **(1)** **Detection Performance**

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

695 **1.** Stop Line Detection

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

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

711 **2.** Advance Detection

713 **iii.** It shall be possible to place advance
714 detector zones such that the farthest
715 point of the zone is up to 600 feet from
716 the video sensor. Advance detector zone
717 placement shall include 2-3 car lengths of
718 field-of-view beyond the farthest point of
719 the zone.

721 **(b)** To ensure statistical significance for the above

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detection performance specifications, the data shall be collected over 24-hour time intervals (so as to avoid a single lighting condition) and will contain a minimum of one hundred (100) vehicles per lane. The calculations of detection performance will 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.

(2) **Failsafe Mode**

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

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

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

(3) **Data Collection**

(a) The video detection system shall automatically collect and store traffic flow data in non-volatile memory for later retrieval and analysis. No additional hardware or software shall be necessary. The data shall include:

1. Vehicle counts per phase.

2. Vehicle average speeds.

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(b) All data shall be stored in a cloud-based storage indefinitely.

(c) The management software shall be able to retrieve collected data for a specified period of time or for all currently stored data and save into a standard CSV file.

(4) Operations Log

(a) The communications interface panel and each video sensor shall maintain a time-stamped operations log of routine and special events in non-volatile memory for later retrieval and analysis.

(5) Time Synchronization

(a) The video detection system and management software shall provide three methods to synchronize the time of day clocks in the communication interface panel and the video sensors, as follows:

1. Manual time synchronization operation by the user, which sets the time to the current time on the laptop where the management software is running.

2. A configuration setting to allow the communications interface panel to automatically obtain time from the NEMA TS2 protocol on the SDLC channel and broadcast it to the video sensors.

3. A configuration setting to allow the communications interface panel to automatically obtain time from up to five Network Time Protocol (NTP) sources and broadcast it to the video sensors.

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

(3)   Support

(a) A quick-start guide, installation guide, application notes, and other materials shall be available from the

860	manufacturer to assist in product installation and setup
861	for various applications. In addition, training online or
862	in person shall be available.
863	
864	**(b)** Training shall be available to personnel of the
865	contracting agency in application design, operation,
866	setup, and maintenance of the video detection system.
867	
868	**(c)** Manufacturer shall provide a tech support website and
869	an 800 number for technical support."
870	
871	**(VIII)** Add **Subsection 770.13 – Uninterruptible Power Supply (UPS) System**
872	to read:
873	
874	**"770.13 Uninterruptible Power Supply (UPS) System**
875	
876	**(A) Definitions**
877	
878	**(1)** UPS – Uninterruptible Power Supply
879	
880	**(2)** GUI – Graphical User Interface
881	
882	**(3)** NiZn - Nickel-Zinc
883	
884	**(4)** SNMP - Simple Network Management Protocol
885	
886	**(5)** SMTP - Simple Mail Transfer Protocol
887	
888	**(6)** TCP/IP - Transmission Control Protocol/Internet Protocol
889	
890	
891	**(B) UPS System Requirements:**
892	
893	**(1) Compatibility**
894	
895	The UPS shall be compatible with the Agency's current traffic
896	controller cabinet, controller and cabinet components, including the
897	safety monitor, for full time operation. The UPS shall include all
898	necessary cables to connect the UPS and batteries.
899	
900	**(2) Run-time**
901	
902	The UPS shall provide a 2-amp cabinet load a minimum run-time of
903	one (1) hour of full color operation at ambient temperature of 25°C.
904	
905	**(3) Output Capacity**
906	

907 UPS must provide a range of continuous active output capacity from a
908 minimum of 1000W to 1500W, with a 90% typical inverter efficiency
909 while running in battery backup mode. The UPS must have surge
910 output capability of 2000W.
911
912 **(4)   Output Voltage**
913
914 When under battery power, the UPS output voltage shall be 120 VAC,
915 ±3%, pure sine wave output, with <2% total harmonic distortion (THD),
916 and frequency of 60 Hz ±0.5%.
917
918 **(5)   Transfer Time**
919
920 The maximum transfer time allowed, from disruption of utility line
921 voltage to stabilized inverter line voltage from batteries shall be thirty-
922 three (33) milliseconds max. The maximum transfer time when
923 switching from inverter line voltage to utility line voltage after the line-
924 qualifying period shall be thirty-three (33) milliseconds max. The UPS
925 shall be capable of allowing the user to program the line qualifying
926 period as three (3), ten (10) or thirty (30) seconds.
927
928 **(6)   Operating Environment**
929
930 Operating temperature for the UPS and Power Interface Module (PIM)
931 shall be -35°F to +165°F (-37° to +74°C).
932
933 **(7)   Certifications**
934
935 The UPS battery cells shall be recognized UL-2054, CSA 22.2 No.
936 60950-1
937
938 **(8)   Power & Control Connections**
939
940   **(a)   Power Interface Module (PIM)**
941   The UPS shall utilize a Power Interface Module (PIM) to
942   connect utility AC input to the UPS and batteries as well
943   as routing UPS output power to the cabinet load.
944
945   **(b)   AC Connection**
946   The AC input and output shall be separate panel
947   mounted plug/receptacles that allow no possibility of
948   accidental exposure to dangerous voltages.
949
950   **(c)   Battery Connections**
951
952   **1.**   The batteries shall have digital battery bus
953   connections to the UPS with locking connectors
954   with provision for six battery ports. There shall be
955   AC power connections from the Power Interface

956			Module to the batteries that are separate from
957			the digital battery bus connections.
958			
959		**2.**	The UPS must offer six (6) battery ports that can
960			accommodate a mix of any form-factor NiZn
961			batteries compatible with the UPS system.
962			
963		**3.**	The UPS must be capable of accepting batteries
964			of different capacities at once, giving the user the
965			ability to utilize different battery sizes to achieve
966			required run-times.
967			
968		**4.**	The UPS must allow the user to 'Hot Swap' any
969			of the battery form-factors while on utility power
970			and/or battery backup power.
971			
972	**(9)**	**Battery**	
973			
974		**(a)**	The standard and XRT UPS batteries must utilize a
975			Sealed Nickel-Zinc (NiZn) battery technology. Lead-Acid
976			or Lithium battery technologies will not be accepted.
977			
978		**(b)**	The standard run-time battery panel(s) must incorporate
979			a bendable design, which allows the battery panel(s) to
980			flex or bend for installation between the 19" EIA rack and
981			the sidewall of the 33X cabinet.
982			
983		**(c)**	The standard run-time module(s) must have the
984			capability of being installed on/under a shelf or be rack
985			mountable within the 19" EIA rack.
986			
987		**(d)**	XRT battery solutions shall come with an intelligent
988			management system that consolidates all battery
989			connections to the UPS and manages the battery string.
990			
991		**(e)**	The charging/battery monitoring circuitry shall be
992			incorporated within the panel, module or extended run
993			time battery solutions.
994			
995	**(10)**	**Charge**	
996			
997			The UPS must be able to recharge panel and module batteries
998			from 0% to 100% state of charge (full capacity) within four and
999			one half (4.5) hours of complete discharge at 25°C when AC
1000			utility line voltage is available. Extended run time batteries
1001			shall be able to recharge batteries from 0% to 100% state of
1002			charge (full capacity) within ten (10) hours of complete
1003			discharge at 25°C when AC utility line voltage is available. The
1004			number of batteries connected to the UPS shall have NO effect

1005 on the recharge time. The batteries must be able to charge at
1006 up to 50°C ambient temperature. The UPS must not require
1007 trickle/float charging.
1008
1009 Wall Charging - The UPS panel, module and extended run time
1010 batteries shall be able to be charged using a 120VAC,15A wall
1011 outlet (20A for extended run time) without need of a UPS
1012 inverter/controller, battery charger or battery tender.
1013
1014 **(11)   Unit failure**
1015
1016 The UPS must have a fail-safe utility tie feature (bypass mode)
1017 with a visual indicator that automatically cuts back to the utility
1018 line in the event of a UPS or battery failure, or complete battery
1019 discharge.
1020
1021 **(12)   Operating Modes**
1022
1023 The UPS shall have intelligent two-stage operation defined as:
1024
1025 **(a)** Stage One: Line Attenuator, Waveform Monitoring and
1026 Switchover to Battery Backup
1027
1028 **(b)** Stage Two: Waveform Monitoring, Return to AC Power.
1029
1030 **(13)   Oscilloscope Function**
1031
1032 The UPS shall have an oscilloscope function continuously
1033 monitoring the incoming utility AC waveform. The oscilloscope
1034 function shall continuously evaluate three (3) measures of the
1035 incoming utility AC waveform:
1036
1037 **(a)** Voltage: A continuous RMS measurement with user
1038 programmable AC voltage thresholds.
1039
1040 **(b)** Waveform Anomalies: Oscilloscope enhanced sensitivity
1041 mode compares incoming utility waveform to a
1042 mathematically pure sine wave reference waveform.
1043
1044 **(c)** Frequency: Continuously measured with frequency
1045 deviation detected as quickly as 1 cycle and a default
1046 threshold of 60Hz $\pm$6Hz.
1047
1048 **(C)   Functionality and Operational Requirements**
1049
1050 **(1)   LCD Display**
1051

1052		The UPS shall have a 64 x 128 Pixels LCD display with white
1053		LED backlight. From the main screen, the LCD display shall
1054		provide the following information;
1055		
1056		**(a)** Utility line voltage
1057		
1058		**(b)** UPS status
1059		
1060		**(c)** Cabinet consumption in watts
1061		
1062		**(d)** Most recent AC power outage duration
1063		
1064		**(e)** Battery capacity State of Charge percentage

1065
(2)   **LCD Display Menu**

1068   The LCD Display Menu shall provide the user the ability to
1069   program and monitor all UPS parameters;

1071
(3)   **Local User Interface**

1073   The UPS shall include a navigational dial to allow users the
1074   ability to navigate the menu to setup the UPS.

1076
(4)   **Voltage Thresholds**

1078   **(a)** The UPS shall allow the user to set high and low AC line
1079   voltage thresholds to determine parameters to transfer
1080   from utility line power to battery backup power.

1082   **(b)** The UPS shall bypass utility line power if the utility line
1083   voltage is outside of the set high and low voltage
1084   parameters.

1086   **(c)** The UPS shall have a programmable utility AC
1087   qualification time after restoration of utility AC power to
1088   within specified voltage thresholds with choices of 3, 10
1089   or 30 seconds.

1091
(5)   **Notifications**

1093   All alarm functions shall be available on SNMP, SMTP and
1094   Programmable Relay.

1096
(6)   **Programmable Relays**

1098   The UPS Inverter/Controller shall include eight (8) Class 2
1099   programmable relays, which can be triggered by power line
1100   conditions, and user selected settings of the UPS. Each relay

1101		shall have the ability to trigger by multiple conditions
1102		simultaneously. The programming options are as follows;
1103		
1104		**(a)** Power Fail without delay / Power fail with delay
1105		
1106		**(b)** Time of Day
1107		
1108		**(c)** Battery Capacity
1109		
1110		**(d)** System Fault
1111		
1112	**(7)**	**Event Log**
1113		
1114		The UPS shall provide an event log with a 1000 event capacity,
1115		which will allow the user to view the event type, date, time and
1116		duration of a given event. UPS configuration changes shall also
1117		be defined as an event and captured in the event log. The data
1118		shall be recorded in a FIFO format, so the oldest event is
1119		purged as the newest is entered.
1120		
1121	**(8)**	**Automatic Bypass Switch**
1122		
1123		The UPS shall have an automatic bypass function with a visual
1124		indicator to bypass the UPS and allow the utility line voltage
1125		through to the cabinet.
1126		
1127	**(9)**	**Circuit Breakers**
1128		
1129		The UPS system shall include a Power Interface Module (PIM)
1130		equipped with a 20A circuit breaker and automatic bypass
1131		capability.
1132		
1133	**(10)**	**Cold Start**
1134		
1135		The UPS shall be equipped with "Cold Start" capabilities, which
1136		provides the user the ability to turn the UPS on and supply
1137		battery backup power when no utility line voltage is available.
1138		This allows the user the ability to install a UPS and provide
1139		backup AC power at an intersection that has no utility line
1140		voltage available.
1141		
1142	**(11)**	**Audible Indicators**
1143		
1144		The UPS shall have audible indicators for the following
1145		parameters:
1146		
1147		**(a)** System Startup
1148		
1149		**(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

The batteries shall have the following visual indicators through a multi-color LED providing battery status and alarms
- Green = Backup Mode
- Blue = Charging Mode
- Red = Battery Fault
- White Blinking = Charged, battery at rest

(D)   **Communication**

(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.

1198		**(2)**	The UPS shall be equipped with an Ethernet port. The Ethernet
1199			port shall be an RJ45, EIA 568B pin out type connector. The
1200			Ethernet port shall be 10/100Mbps, TCP/IP capable.

(E) **Graphical User Interface**

(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.

(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.

(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.

(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.

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

(6) The GUI shall have a System Configuration page that allows the user to configure all the setup parameters of the UPS.

(7) The GUI shall communicate notification and alerts through SNMP and SMTP protocols.

(F) **Warranty**

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

END OF SECTION 770