

# CITY OF ONTARIO MASTER PROVISIONS

## SPECIAL PROVISIONS FOR TRAFFIC SIGNAL CONSTRUCTION PROJECTS

**ITEM: TRAFFIC SIGNAL SYSTEM (LUMP SUM)**

### **SP-1.0 DESCRIPTION OF WORK**

The Contractor shall furnish, install and/or modify a complete traffic signal system, including all traffic signal equipment, safety lighting and electrical systems in conformance with the approved plans and with these Special Provisions at the location(s) identified herein.

#### **SP-1.1 Location of Work**

The Contractor shall complete the work at the following location(see cover sheet).

**A cover sheet shall be included with:**

- 1. The intersection name.**
- 2. The design engineering firm name, address and phone number.**
- 3. The design engineer's name and registration number.**
- 4. Reference these Special Provisions as "City of Ontario, Special provisions for traffic signal construction projects dated July 2014, Pages SP-1 thru SP-40.**
- 5. Add reference to design engineer's section SP 3.0 with the number of pages.**

### **SP-2.0 SPECIFICATIONS**

The Specifications for this project are the provisions in Section 86, "Electrical Systems," of the Caltrans Standard Specifications and Standard Plans, 2010 editions, (also referred to collectively as "Standard Specifications," "Specifications," or "Special Provisions") as amended herewith where applicable, and as per the Contract documents.

#### **86 ELECTRICAL SYSTEMS 86-1 GENERAL**

Add to Section 86-1 "General" of the Standard Specifications the following:

##### **86-1.01A Brand Name Equal**

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On the Plans or in the Specifications, certain articles or materials to be incorporated in the Project may be designated under a brand name/manufacturer or the equal thereof. Such designations are intended to be descriptive, but not restrictive, and are to indicate the quality and characteristics of articles and materials that shall be satisfactory. The use of alternative articles or materials which are of equal quality and of the required characteristics for the purposes intended will be permitted, subject to the requirements listed below.

Unless the Contractor clearly indicates in the submitted bid that it is proposing to use an "equal" product, the bid shall be considered as offering a product referred to by brand name in these Specifications. The brand name, if any, of the proposed substitute product shall be listed on an attachment to the bid and shall indicate the product referred to by brand name in these Specifications that it is proposed to be substituting.

The awarding of a contract to a Contractor who has indicated in the bid that it is proposing to use an "equal" product shall not constitute an admission by the City of the equality of said product. The Contractor understands and agrees that in so awarding a contract, the City reserves the right to reject any such proposed substituted product. The Contractor further understands and agrees that in the event the City rejects a proposed "equal" product, the Contractor shall then supply either a product designated by brand name in the Specifications or a substitute which meets with the approval of the City.

With respect to all proposed substitutions of "equal" products, the Contractor shall submit all pertinent and appropriate data substantiating the request for said substitutions within thirty (30) days after the award of a Contract. In this regard, the Contractor shall note that the City is not responsible for locating or securing any information which is not included in said substantiating data. The burden of proof as to the equality or suitability of the proposed alternative products is borne entirely by the Contractor.

The Engineer shall be the sole judge as to the equality and/or suitability of proposed alternative articles or materials, and the decision of the Engineer shall be final and conclusive. Unless extended by mutual agreement of the parties, the Engineer shall notify the Contractor of the decision concerning the proposed substitution of "equal" items within thirty (30) days after submission of the substantiating data. All such decisions by the Engineer shall be in writing, and no proposed alternative product shall be deemed approved unless the Engineer has so indicated in writing.

### **86-1.04 EQUIPMENT LIST AND DRAWINGS**

Section 86-1.04, "Equipment List and Drawings," of the Standard Specifications, is hereby amended to read:

The Contractor shall submit for review and approval a list of the equipment and materials intended to be installed on the project, along with any corresponding drawings. The list must include:

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- Name of equipment manufacturer
- Dimensions
- Item identification number(s) and Serial Number(s)
- List of components
- Expected date of delivery of all equipment and materials
- Maintenance manuals and operation manuals for all new controller units, master control units, malfunction management units, optical preemption units, and any other peripheral or auxiliary units installed in the controller assembly, one set per each signal installation. The maintenance manual and operation manual may be combined into one manual. The manuals shall include, but not be limited to the following items:
  - Specifications
  - Design characteristics
  - General operation theory
  - Function of all controls
  - Trouble-shooting procedure (diagnostic routine)
  - Block circuit diagram
  - Geographical layout of components
  - Schematic diagrams
  - List of replaceable component parts with stock numbers
  - Complete instructions for implementation of all operator programmable functions
- Three (3) sets of controller cabinet schematic wiring diagrams, or cabinet prints; white background process using iron-sensitized paper; the offset lithograph process; the electrostatic process, or another process approved by the Engineer. One set on 24" x 36" size plan and two sets on 11" x 17" paper. The diagrams shall also be provided to the Engineer on a USB flash drive using the Autodesk "AutoCAD" drawing program (.dwg file extension) and PDF format with .pdf file extension.

The diagrams shall illustrate the relative placement of shelves, terminal blocks, interface panels, wiring, and all other equipment within the cabinet including emergency vehicle pre-emptors, and fiber splice boxes

- Each cabinet print sheet shall include a legend of the nomenclature used on that sheet, and shall contain the following specific information:
  - Sheet 1 shall illustrate the components and wiring on the left side of the cabinet, and intersection drawing. The intersection drawing shall be oriented so that north is to the top of the print, and shall indicate the general areas of detection with the controller input number of the area. The signal phasing and direction of the phase shall be shown in the center of the diagram. Signal poles and pedestrian movements need not be shown.
  - Sheet 2 shall illustrate the main panel, including where cables are attached and what component the cable is attached to.
  - Sheet 3 shall illustrate the right side of the cabinet, the police and auxiliary panels on the cabinet door, and the general cabinet layout.

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- The cabinet layout shall illustrate where each component is located within the cabinet.
- The controller cabinet schematic wiring diagrams shall be placed in a heavy duty plastic envelope, and attached to the inside of the door of each controller cabinet.

### 86-1.05 CERTIFICATE OF COMPLIANCE

Section 86-1.05, "Certificate of compliance", of the Standard Specifications is hereby amended with the addition of the following after the last paragraph:

#### Warranties, Guarantees and Instruction Sheets

Manufacturer's warranties and guarantees for materials used in the work shall be for a minimum of one year from the date of the acceptance of the project. The warranties and guarantees and instruction sheets and parts lists supplied with materials shall be delivered to the Engineer prior to acceptance of the project.

### 86-1.06 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

Section 86-1.06A, "General", of the Standard Specifications, the first paragraph is hereby amended to read:

Existing electrical systems (traffic signal, ramp metering, highway and street lighting, flashing beacon, traffic monitoring, sign illumination and other facilities), or approved temporary replacements thereof, shall be kept in effective operation for the benefit of the traveling public during the progress of the work, except when shutdown is permitted, to allow for alterations or final removal of the systems.

The traffic signal shutdowns shall be limited to periods on Monday, Tuesday, Wednesday, or Thursday, between the hours of 9:00 a.m. and 3:30 p.m.

Forty-eight hour prior notification to the Traffic Engineering Section is required, prior to performing any work on existing systems.

Contacts:     Don Burden           (909) 295-2154  
                  Johnson Hua       (909) 295-2131

Section 86-1.06A, "General", of the Standard Specifications, the fourth paragraph is hereby amended to read:

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Where an existing system or temporary system is being modified, the work necessary to keep all or any part of the system in effective operation required shall be considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

Section 86-1.06A, "General", of the Standard Specifications, the fifth thru the eighth paragraphs is hereby amended to read:

The local agency reserves the right to:

- Continue the operation and maintenance of existing electrical facilities.
- Continue to provide electrical energy to operate existing electrical facilities
- Repair or replace existing facilities damaged by traffic
- Pay for electrical energy to operate existing or new facilities undergoing the functional tests specified in section 86-2.14C.

The Contractor shall:

Verify the location and depth of existing detectors, conduits, pull boxes, and other electrical facilities before using tools or equipment that may damage those facilities or interfere with an electrical system.

Notify the Engineer immediately if existing facilities are damaged by the Contractor's activities, and repair or replace damaged facilities promptly. Damaged detectors are to be replaced within 24 hours. If the Contractor fails to complete the repair or replacement promptly, the City reserves the right to repair or replace said facilities and deduct the costs from the Contractor's compensation.

### **86-1.07 SCHEDULING OF WORK**

Section 86-1.07, "Scheduling of Work", of the Standard Specifications, is hereby amended with the addition of the following between the third and fourth paragraphs:

Traffic signals shall not be placed in operation until the Contractor has completed all work, including any corrections, to the satisfaction of the Engineer.

Section 86-1.07, "Scheduling of Work", of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

The Engineer shall be contacted for approval at least 3 working days in advance of the intended turn-on of a new traffic signal system.

Representatives authorized by the respective equipment manufacturers to work on the various traffic signal system components shall be present to set up prior to the intended

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turn-on, during the turn-on, and for a reasonable period of time thereafter, as determined by the Engineer.

The Contractor is responsible to schedule the authorized representatives and all costs associated with said support are considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

### 86-2 MATERIALS AND INSTALLATION

#### 86-2.03 FOUNDATIONS

Section 86-2.03A, "Foundations", of the Standard Specifications, the third from the last paragraph is hereby amended to read:

All foundations shown to be abandoned shall be completely removed. Foundations may be abandoned in place only upon a determination by the Engineer that it would benefit the project to abandon said foundation in place. If so authorized the top of the foundation and anchor bolts shall be removed, and conduits cut down to a minimum depth of not less than 1-foot below the sidewalk surface or original ground. The resulting hole shall be backfilled with material equivalent to the surrounding material.

#### 86-2.04 STANDARDS, STEEL PEDESTALS AND POSTS

Section 86-2.04B(3), "Standards, and Poles", of the Standard Specifications, the seventeenth subparagraph of the first paragraph is hereby amended to read:

17. All standards shall be round, regardless of the outside diameter.

#### 86-2.05 CONDUIT

Section 86-2.05, "Conduit," of the Standard Specifications, the second paragraph is hereby amended to read:

Interconnect conduit shall be a minimum 3 inch diameter. Sweeps in the interconnect conduit shall not exceed 45 degrees. All other conduits shall be of the sizes shown on the plans, as specified in this Section 86-2.05, or in the special provisions. In addition, the Contractor may, at his option and expense, use conduit of a larger size than that shown or specified provided the larger size is used for the entire length of the run from outlet to outlet. Reducing couplings shall not be permitted.

Section 86-2.05A, "Material", of the Standard Specifications, type numbers four and five are hereby deleted.

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Section 86-2.05B, "Use", of the Standard Specifications, Minimum trade size of conduit must be are hereby amended to read.

Minimum trade size of conduit must be:

1. 1-1/2 inches from electrolier to adjacent pull box.
2. 1-1/2 inch from pedestrian push button post to adjacent pull box.
3. 3 inches from signal standard with mastarm to adjacent pull box, 2 inches all others.
4. 3 - 4 inches from controller cabinet to adjacent pull boxes (two #6 pull boxes required each with two 3 inches conduits, unless otherwise shown on plan).
5. 2 inches from overhead sign to adjacent pull box.
6. 3 inches from service equipment enclosure to adjacent pull box.
7. 3 inches from controller cabinet to adjacent communications pull box.
8. 2 inches from service equipment enclosure to adjacent controller cabinet.
9. 1-1/2 inches if unspecified.

### 86-2.06 PULL BOXES

Section 86-2.06A, "Materials" of the Standard Specifications, the following paragraphs are hereby added after the first paragraph with the following:

Pull boxes, covers and extensions for installation in the ground or in sidewalk areas shall be of the sizes and details shown on the plans and shall be precast of reinforced concrete (PCC). The pull boxes shall be as manufactured by Christy Products of Cypress, California or an approved equal. The top of the pull boxes shall have a protective plastic coating as a part of the pull box. The plastic coating shall be formed around the top edges of the pull box so as to reduce chipping the concrete of the pull box rim and cover.

Pull box lids shall be fiberglass, and shall be easily removable.

Pull boxed installed in interconnect runs shall be #6 with an extension. Pull boxes installed adjacent to mast arm poles, or in which four or more conduits terminate will be #6, all others shall be #5.

All Pull boxes shall have a minimum of 1-foot of minor concrete around all outside edges. Pull boxes placed within existing sidewalk shall have the entire affected sidewalk panel or panels replaced from construction joint to construction joint, with neat perpendicular saw cuts along the construction joint. Pull boxes with less than five feet of distance between sides to side shall have concrete uniformly place between pull boxes the entire distance.

Pull boxes installed in unimproved areas shall be traffic rated and a pull box marker shall be installed adjacent to the pull box, and comply as defined below.



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Section 86-2.06B, "Cover Markings" of the Standard Specifications, is hereby added to with the following:

Pull box lid cover markings shall be:

- TRAFFIC SIGNAL COMMUNICATIONS – for any pull boxes that contain only fiber optic cables or traffic signal interconnect cables.
- TRAFFIC SIGNAL - for any pull boxes that contain traffic signal field wiring that includes DLCs, signal preemption, video detection, communications cables, etc.
- STREET LIGHTING – for any pull boxes that contain only street light wiring or cabling.

The lids shall be protected during the course of construction. Any damage to the pull boxes or lid at the time the project is accepted shall be rejected and a new pull box or lid installed in its place.

### 86-2.08 CONDUCTORS

Section 86-2.08E, "Signal Interconnect Cable", of the Standard Specifications, is hereby deleted and replaced with the following:

The City standard for signal communications is Fiber Optic Cable.

Fiber Optic Cable shall consist of 6-strand single mode fibers that shall be designated and terminated in the controller cabinet assembly. A splice box for all 6 strands of fiber shall be used for each fiber interconnect cable entering the controller cabinet assembly and shall be attached to a fiber modem by means of an **Singlemode PC Duplex SC-SC Patch Cable** of sufficient length to reach equipment. There shall be a minimum of 6 feet of slack at each controller cabinet assembly and pull box.

Splices in signal interconnect fiber are only permitted at the splice panels to be located within the controller cabinet assembly or fiber system splicing handhole.

Where copper cable is needed to maintain communications with a legacy system, such as Aries, the Signal Interconnect Cable shall be REA PE 22 cable that consists of twelve pair of No. 19 AWG copper conductors. Conductors shall be twisted in pairs, designated and connected in the controller assembly, and color coding shall distinguish each pair as follows:

- Red/Blue Pair - LOCAL RECEIVE
- Green/White Pair - LOCAL TRANSMIT
- Orange/White Pair- TELEPHONE

### 86-2.09 WIRING



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Section 86-2.09B, "Installation", of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

A white nylon marker tie with a label area of 1 inch x ½ inch, shall be placed near the end of all detector loop cables. The marker tie shall indicate the detector input number to the controller in black indelible ink. Near the end of all interconnect cables a white nylon marker tie with a label area of 1 inch x ½ inch shall be placed indicating the intersection where the cable is from (Master side) or where the cable is to (further from Master).

Section 86-2.09C, "Connectors and Terminals", of the Standard Specifications, the second paragraph is hereby amended to read:

Except detector loop lead-in cable, all stranded conductors smaller than No. 14 shall be terminated in crimp style terminal lugs. Conductors in detector loop lead-in cable shall be terminated in crimp style spade connector.

Section 86-2.09D, "Splicing", of the Standard Specifications, item numbers four, five and six of the first paragraph are hereby deleted.

Section 86-2.09E, "Splice Insulation", of the Standard Specifications, the following paragraph is hereby added after the last paragraph:

Insulate splices using "Epoxy splice kit" meeting all requirements of the 3M, Scotchcast resin splice kit line.

### **86-2.10 BONDING AND GROUNDING**

Section 86-2.10, "Bonding and Grounding", of the Standard Specifications, the following paragraph is hereby added after the last paragraph:

At each multiple service point and controller cabinet location, a ground electrode shall be furnished and installed. Ground electrodes shall be a one-piece length of copper clad steel rod not less than 5/8-inch in diameter not less than 10 feet in length. Ground electrodes in the foundations shall be enclosed in a 1-inch diameter PVC Schedule 40 conduit, shall be angled to exit the foundation approximately 1 foot below grade and shall be installed in accordance with the provisions of the Code. The service equipment or controller cabinet shall be bonded to the ground electrode by use of a ground clamp and a No. 6 or larger copper wire, forming a continuous ground system.

### **86-2.14 TESTING**

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Section 86-2.14A, "Materials Testing", of the Standard Specifications, is hereby deleted and replaced with the following:

It shall be the Contractor's responsibility to arrange to have any and all traffic signal controller assemblies, complete with optical preemption components, wiring diagrams and manuals, delivered for testing to a testing facility approved by the City.

The current approved testing facility is:

Computer Service Company  
12907 East Garvey Avenue  
Baldwin Park, CA 91706.

Telephone: (951) 738-1444.

Traffic signal controller assemblies, including controller units, fully wired cabinets, and auxiliary equipment, shall meet the operational and functional requirements of the plans and specifications when tested in accordance with California Tests 658 and 659, and shall be unaffected by transient voltages when tested in accordance with California Test 667.

As part of the testing requirements, the Contractor shall ascertain that the traffic controller manufacturer has a current quality control procedure that includes the following:

- Acceptance testing of all supplied components
- Physical and functional testing of all modules
- A minimum 100-hour burn-in of all modules
- Physical and functional testing of all controller units and all auxiliary equipment
- A minimum 24-hour burn-in of all controller units and all auxiliary equipment
- A minimum of 24 hours operation of every complete controller assembly
- Physical and functional testing of the complete controller assembly
- A Certificate of Compliance with the approved procedure and a test report signed by a responsible managing employee shall accompany each controller assembly submitted to the testing facility.
- Each new controller unit and auxiliary equipment and any new modification shall be environmentally tested and operated for 24 hours at -18°C. and at 71°C. A report of the test results shall be prepared which shall indicate all problems and corrective actions taken. The test report shall be submitted to the City for approval before the unit is supplied to the Contractor for installation.

Testing and quality control procedures must comply with NEMA TS Standards for Traffic Control Systems. The Contractor shall not place any equipment into service until all required testing is satisfactorily complete and certification is provided to that effect. All costs associated with testing, and any required re-testing resulting from initial failed testing, shall be considered as part of the lump sum bid price and no additional compensation will be allowed therefore.

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## 86-3 CONTROLLER ASSEMBLIES

### 86-3.01 CONTROLLER ASSEMBLIES

Section 86-3.01, "Controller Assemblies", of the Standard Specifications, is hereby deleted in its entirety and shall read:

#### 86-3.01A Controller Assembly General

A controller assembly shall be provided and shall consist of a complete mechanism for controlling the operation of traffic control signals, including the controller unit and all necessary auxiliary equipment, mounted in a fully wired cabinet, and all equipment required to provide the operation shown on the plans and these special provisions.

Details of operation for the controller assembly shall be in include twelve phases operations with 4 overlaps available with 64 channels of detection and 4 evp channels for preemption. The controller assembly shall be programmed in the field in accordance with the traffic phases, preferential phase sequence and concurrence, signal indications, signal indication sequence, detection requirements and other details shown on the plans or as specified in the special provisions.

Each controller unit, with auxiliary equipment, shall operate various traffic signal devices, as shown on the plans, to provide right of way, change, clearance and other indications, with duration and sequence as determined by traffic demand or preset programming.

#### 86-3.01B Interval Sequence

The color sequence of vehicle signal indications shall be green-yellow-red, except that in response to a preemption actuation it may be green-yellow-green. During any interval, there shall be no visual flicker of vehicle or pedestrian signal indications.

#### 86-3.01C Flashing Operations

All controller assemblies shall be equipped for flashing operation of signal lights. Flashing operation, when required by railroad pre-emption, flashing control, or other causes, shall be set for flashing red on all approaches unless otherwise specified. Pedestrian signals shall be extinguishable during flashing operations.

The flash transfer relay may be used to energize the flasher and shall transfer signal light circuits from the controller unit to the flasher and shall cause the flashing indications specified above.

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When the controller, remote flash command or other automatic command is used to make changes from flashing to stop-and-go operation, the change shall be made at the beginning of the major street green interval. Automatic changes from stop-and-go operation to flashing operation, except due to monitoring device or pre-emption operation, shall be made at the end of the major street red interval.

Flashing mechanism shall be independent of the controller unit and shall remain in operation upon shutdown of the controller unit or removal of the controller unit from the cabinet.

### **86-3.01D Pre-emption**

A pre-emptor shall pre-empt normal controller unit operation when activated by the pre-emption circuit or by a test switch. The pre-emptor shall cause the signals to display the sequence of indications shown on the plans. Once the pre-emption sequence is begun, it shall continue to the end regardless of the condition of the pre-emption circuit or test switch. If a railroad pre-emptor is actuated at the time power is restored, after a supply voltage interruption, which would have caused the controller assembly to stop cyclic operation, the controller assembly shall cause no-signal indications to be displayed until the end of pre-emptor actuation.

The controller unit shall resume normal operation when the pre-emptor actuation ceases, and shall operate normally when the pre-emptor is removed. When the pre-emption circuit or test switch is returned to its normal condition, the controller unit shall go through the phase sequence shown on the plans as if calls had been received and remembered on all phases. Pedestrian "WALK" or WALKING PERSON indications shall appear with the first corresponding green indication.

### **86-3.01E Controller Assembly Testing**

See Section 86-2.14 "Testing" in these Special Provisions for testing requirements.

### **86-3.01F Type 90 Controller Assembly**

Each Type 90 controller assembly shall contain a traffic signal controller unit equivalent to an Econolite Kobalt controller and shall conform to the requirements in NEMA Standards for Traffic Control Systems, as described in Publication No. TS2-92 and shall comply with TS2 Types 1 and 2, and these Special Provisions.

The controller shall be fully compliant with the NTCIP communications protocol and include the necessary telemetry interface modules to be integrated into the City's

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CENTRACS Advance Transportation Management System (ATMS) and/or the City's legacy ARIES system.

The controller unit shall be modular in design and shall be keyboard, touch screen and tablet programmable to provide a minimum of twelve phases and four overlaps with full density functions on all phases.

The controller unit display shall be a high contrast touch screen color display. The display shall provide simultaneous indications for Ring 1 and Ring 2, showing which phase is timing and count down the timing of each interval.

The default status display shall differentiate between vehicle calls originating in the field and calls created internally by the controller. The detector status display shall show unprocessed detector calls and differentiate between delays, extensions, and disconnected calls. When operating as a TS2 Type 1 controller, detectors not assigned to call a phase will not, as a default, display constant calls.

All controller unit circuits and all logic or timing circuits external to the controller unit shall consist entirely of solid-state electronic circuitry.

The controller unit shall be capable of non-interconnected coordination. The coordination function shall be internal to the controller unit and shall provide the following functions as a minimum:

- 120 coordination event plans, each with its own cycle, offsets, split timing, coordinated phases, vehicle and pedestrian recall and phase omits.
- Offset and split entries displayed in percent or seconds.
- Automatic permissive periods.
- Fixed or floating force-off.
- Crossing arterial coordination
- Quick-sync feature.
- Separate control for non-interconnected coordination and time of day functions.
- 200 schedule programs, configurable for any combination of months, days of the week, and days of the month.
- Fixed or floating exception day programs that override the day plan event on a specific day.
- 50 day plan events that can use any of the 100 action plans.
- 100 action plans that can be used by any of the 50 day plans.
- 16 phases, 8 configurable concurrent groups in 4 timing rings.
- 16 vehicle overlaps that can be configured as normal, green/yellow, PPLT/FYA or Econolite.
- Dynamic max operation.
- Extendable walk and pedestrian clearance.
- Advanced Walk.
- Bike input and green timing.

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- Adaptive red clearance.
- Ten preemption sequences. Each may be configured as priority, first-come-first-serve, or bus preemption operation.
- ECPI interlock to provide added monitoring.
- Railroad gate-down input and timing.
- Conditional delay when entering preemption.
- Multiple exit preemption options, Exit to selected exit phase, Exit to coordination (no transition), Exit to interrupted pedestrian phase.
- Designate any two non-conflicting phases as hold phases during emergency vehicle preemption.

Additional Cabinet accessories.

In all cabinets

- Two fiber optic patch panels located under the top shelf of the type P cabinet using rack mounting style mounts for 2- six count SC patch connections or Four fiber optic patch panels located under the top shelf of the type R cabinet using rack mounting style mounts for 4- six count SC patch connections.
- Two **Ruggedcom model RS900L-H1-P-C2-C2-V1-XX** dual fiber modems using SC connectors to the patch panel for the 6 strand, single-mode fiber optic cable and connecting to one SIC copper cable, compatible with the City's CENTRACS Advanced Transportation Management System.
- Any and all equipment and work necessary to connect and integrate this location with the City's CENTRACS traffic control system through fiber cable.
- When fiber interconnection is not available, in addition to the above equipment the contractor shall install a ENCOM wireless radio model number COMMPAK BB58 INT at the intersection to the satisfaction of the engineer, providing these features. Operating at the 5.8 GHz frequency, with up to 54 Mbps (802.11 a/g). Each radio can perform as master, remote • or repeater. Operational in point-to-point, point-to-multipoint and multipoint-to-multipoint configurations. 600 milliwatt transmitter allows for range of up to 60 miles. Delivers consistent low latency communications with power over Ethernet. STRATOS configuration, diagnostic and management utility application shall be provide. With a 3 year warranty.
- An additional ENCOM wireless radio model number COMMPAK BB58 INT at an intersection determined by the engineer and to the satisfaction of the engineer, providing the same features as above, to complete the interconnection for this intersection.

At locations that require attaching to Aries Legacy system this is in addition to the above fiber requirements.

- If necessary to interface with an Aries Legacy system, the Contractor shall also furnish two **Ruggedcom model RS900L-H1-P-TX-TX-V1-XX** dual copper modem's for communications through SIC copper cable.
- Any and all equipment and work necessary to connect and integrate this location with the City's ARIES traffic control system through 12pr. twisted cable.

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- Other auxiliary equipment as required, as specified in the special provisions or as shown on the plans.

### **86-3.02 BATTERY BACKUP SYSTEMS**

Section 86-3.02, "Battery Backup System", of the Standard Specifications, is hereby deleted in its entirety and shall read:

#### **86-3.02A(1) Summary**

The contractor shall furnish and install a battery backup system at each signal location. The system shall include a battery backup unit, separate cabinet, bypass switch, cable assemblies, battery disconnect unit, and wire from service to BBS to cabinet. The battery backup unit shall be Model 24M11-WBE as manufactured by Dimensions Unlimited, Inc. The bypass switch with 30A relay shall be Dimensions Part Number 511020-1. The cable assembly shall be Part Number 611524, 24-Volt for a four-battery installation and a cable length of nine feet.

The Contractor shall install a surge arrestor in the service pedestal meeting the requirements in the Special Provisions or Standard Specifications. The batteries, shall provide 2 continuous hours of operation through four 12 Volt, 105 Amp-Hour each installed in PVC protective battery cases and shall be housed in the separate BBS cabinet mounted on the left side of the signal cabinet. The battery disconnect unit shall be 24-Volt equivalent to the Universal Battery Disconnect Model UBD101 and shall have no current draw once the batteries are at 21 volts, unit to prevent the batteries from discharging completely.

#### **86-3.02A(2) Submittals**

See Section 86-1.04 "Equipment List and Drawings" in these Special Provisions for submittal instructions.

#### **86-3.02A(3) Quality Control and Assurance**

The City may request testing of the external BBS cabinet assembly prior to installation. After complete installation, the Contractor is to perform functional testing for 30 minutes of continuous, satisfactory operation with utility power turned off in the presence of the Engineer. The installed batteries must be warranted by the manufacturer for 2 years to operate within a temperature range of -13F to +140F.

#### **86-3.02B Materials**



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Batteries shall:

- Be deep cycle, sealed, prismatic, lead-calcium based, absorbed glass mat, valve-regulated lead-acid type
- Be group size 24
- Be commercially available and stocked locally
- Be marked with a date code, maximum recharge data, and recharge cycles
- Be new and fully charged when furnished
- Be free from damage or deformities
- Have a 12-Volt voltage rating
- Have a carrying handle
- Have 2 top-mounted threaded-stud posts that include all washers and nuts required for attaching the corresponding BBS battery harness
- Include rubber insulating protective covers for protecting the lugs, posts, and wiring: red for positive terminal and black for negative terminal

### 86-3.02C Construction

The external cabinet shall be mounted to the left side of the controller cabinet and constructed as shown on City of Ontario Standard Drawing 5202. The typical side-mounting location of the external cabinet is flush with the bottom of the controller cabinet and approximately equidistant from the front and rear door edges.

The external cabinet must be ventilated by using louvered vents, a filter, and a thermostatically controlled fan. The fan must operate on standard 120-Volt AC from the same line output as the controller cabinet. A 2-position terminal block must be provided on the fan panel along with 10 feet of connected hookup wire.

The external cabinet surface must be anodized aluminum. Do not use anti-graffiti paint.

The external cabinet must include all bolts, washers, nuts, and cabinet-to-cabinet coupler fittings necessary for mounting it to the controller cabinet assembly.

Fasteners for the external cabinet must include:

- Six 18-8 stainless steel hex head, fully-threaded, 3/8-inch – 16 x 1-inch cabinet mounting bolts
- 2 washers per bolt designed for 18-8 stainless steel, 1-inch OD round, 3/8-inch flat-type bolt
- K-lock nut per bolt consisting of 18-8 stainless steel K-lock washer and a hex-nut
- 2 – 2-inch x 30-inch aluminum strap 1/8 inch thick w/3 holes each for mounting

External cabinet to controller cabinet couplings must include a conduit for power connections between the 2 cabinets. Couplings must include:

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- 2-inch nylon-insulated steel chase nipple, T & B 1947 or equivalent
- 2-inch sealing, steel locknut, T & B 146SL or equivalent
- 2-inch nylon-insulated steel bushing, T & B 1227 or equivalent

The cabinet wiring shall be No 10 AWG, 600-Volt, with the following coloring scheme. A black wire from the breaker in the service cabinet to a surge arrestor as per Section 86-3.04D(3) "Surge Arrestor" to the bypass switch in the BBS cabinet. A red wire shall run from the bypass switch to the controller cabinet. A white wire shall run from the neutral bar in the service cabinet to the neutral bar the controller cabinet. A white wire shall run from the neutral bar in the controller cabinet to the bypass switch in the BBS cabinet. A green wire shall run from the ground buss in the service cabinet to the ground buss at the controller cabinet. A green wire shall run from the grounding bus in the controller cabinet to the bypass switch in the BBS cabinet. The cabinet manufacture shall install a landing bar to which the BBS wires shall be landed.

### 86-3.04 CONTROLLER CABINETS

Section 86-3.04A "Cabinet Construction" of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

The cabinet and doors shall be fabricated of 0.125-inch minimum thickness aluminum with continuously welded exterior seams only; the stainless or cold rolled steel options are not acceptable.

The exterior of each aluminum cabinet shall have a clear anti-stick graffiti proofer coating (GPA-200) as manufactured by SEI Chemical of Northridge, California. The interior surfaces of each aluminum cabinet shall retain their unfinished natural appearance, and be smooth and free of any burrs or other rough edges. All coatings shall be commercially smooth, substantially free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance.

The cabinet door lock shall be operable by a Corbin #2 key. The door shall have a switch which will activate intersection alarm 1 when the door is open. Unless specifically shown on the plans differently, when facing the cabinet door, the cabinet door hinges shall be on the right. When the door is closed and latched, the door shall be locked. The handle shall swing toward the hinge side of the door when opening, and shall have a provision for padlocking in the closed position. The handle shall have a minimum length of 7 inches and shall be provided with a 5/8 inch, minimum, steel shank. The handle shall be fabricated of cast aluminum or of zinc-plated or cadmium-plated steel.

A minimum of two aluminum shelves shall be provided to support the controller unit and auxiliary equipment in the type P cabinet and a minimum of three aluminum shelves

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shall be provided to support the controller unit and auxiliary equipment in the type R cabinet. The shelves shall extend across the entire width of the cabinet and shall not affect the lowering of the main panel.

Section 86-3.04B "Cabinet Ventilation", of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

Each controller cabinet shall be provided with louvered vents in the cabinet door. Filters shall be placed over the louvers and over the cabinet fan intake inside the cabinet to prevent any unfiltered air from entering the cabinet. Filters shall be self sealing, they shall be constructed of 100% polyester media, and shall have three distinct stages of filtration with graduated density. A non-migrating tackifier shall be sandwiched between the second and third layers. The main cabinet filter shall have a wire frame. The cabinet shall be completely sealed to assure that all air passing in or out of the cabinet must pass through a filter.

Section 86-3.04C, "Cabinet Wiring", of the Standard Specifications is amended to stipulate the following limitations or additional requirements:

Field terminals for signal feeds shall be screw type with barrier block.

All logic ground I/Os available in the controller shall be brought out to terminal boards to facilitate utilizing all functions, including interconnection operation, in the future.

Any connections or wire terminations which are not readily accessible without the removal or displacement of the equipment upon which they are mounted, shall be soldered, or held in place with self-locking nuts.

It shall be possible to lower the main panel and access the back of the panel without removal or disturbing the shelves, the equipment upon the shelves, or the equipment cables.

All equipment cables shall be routed around the interior wall of the controller cabinet, and either brought around the front of the shelf or brought under the shelf where the appropriate equipment is sitting. Cables shall be brought out from behind the main panel on the side closest to the equipment they will be connecting to. Slack shall be provided in the cables to allow adjustment of the equipment's position upon the shelf. Cables shall not be routed to a piece of equipment from more than one direction. The SDLC cables shall be used for the controller, MMU, and detector racks. Any excess cable length between the detector interface panels and the detector racks shall be stored under the detector racks and secured with cable ties as appropriate. Equipment cables will not be allowed to hang freely across the interior of the controller cabinet, obstruct the view of the intersection controller or master controller displays, or interfere with the removal of the equipment from their shelves or lowering of the main panel.

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All NEMA defined I/Os shall be terminated on the main panel. The manufacturer defined "D" connector I/Os shall be brought out to terminal interface panels to facilitate utilizing the additional system functions.

Detectors shall be assigned as follows.

Detection Area	Label on Plan	Input Channel	Input Phase	Detector Model With Bike Lane	Detector Model without Bike Lane
Southbound No. 1 L/T Bike/Veh	1B-N-Ø1	1	Ø1	C-1201-B	C-1201-B
Northbound No. 1 Thru Bike/Veh // Northbound Striped Bike Lane	1B-S-Ø2 / BL-S-Ø2	2	Ø2		
Westbound No. 1 L/T Bike/Veh	1B-E-Ø3	3	Ø3	C-1201-B	C-1201-B
Eastbound No. 1 Thru Bike/Veh // Eastbound Striped Bike Lane	1B-W-Ø4 / BL-W-Ø4	4	Ø4		
Northbound No. 1 L/T Bike/Veh	1B-S-Ø5	5	Ø5	C-1201-B	C-1201-B
Southbound No. 1 Thru Bike/Veh // Southbound Striped Bike Lane	1B-N-Ø6 / BL-N-Ø6	6	Ø6		
Eastbound No. 1 L/T Bike/Veh	1B-W-Ø7	7	Ø7	C-1201-B	C-1201-B
Westbound No. 1 Thru Bike/Veh // Westbound Striped Bike Lane	1B-E-Ø8 / BL-E-Ø8	8	Ø8		
Southbound No. 1 & 2 L/T Presence	1P-N-Ø1	9	Ø1	C-1200-SS	C-1200-SS
Northbound No. 1 & 2 Thru Bike/Veh	1P-S-Ø2	10	Ø2		
Westbound No. 1 & 2 L/T Bike/Veh	1P-E-Ø3	11	Ø3	C-1200-SS	C-1200-SS
Eastbound No. 1 & 2 Thru Bike/Veh	1P-W-Ø4	12	Ø4		
Northbound No. 1 & 2 L/T Bike/Veh	1P-S-Ø5	13	Ø5	C-1200-SS	C-1200-SS
Southbound No. 1 & 2 Thru Bike/Veh	1P-N-Ø6	14	Ø6		
Eastbound No. 1 & 2 L/T Bike/Veh	1P-W-Ø7	15	Ø7	C-1200-SS	C-1200-SS
Westbound No. 1 & 2 Thru Bike/Veh	1P-E-Ø8	16	Ø8		
Southbound No. 1 L/T Advance	1A-N-Ø1	17	Ø1	C-1201-SS	C-1201-SS
Northbound No. 1 Thru Advance	1A-S-Ø2	18	Ø2		
Westbound No. 1 L/T Advance	1A-E-Ø3	19	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 1 Thru Advance	1A-W-Ø4	20	Ø4		
Northbound No. 1 L/T Advance	1A-S-Ø5	21	Ø5	C-1201-SS	C-1201-SS
Southbound No. 1 Thru Advance	1A-N-Ø6	22	Ø6		
Eastbound No. 1 L/T Advance	1A-W-Ø7	23	Ø7	C-1201-SS	C-1201-SS
Westbound No. 1 Thru Advance	1A-E-Ø8	24	Ø8		
Reserved	Reserved	25	Ø1	C-1200-SS	C-1200-SS
Northbound Thru No. 3 & 4 Presence	2P-S-Ø2	26	Ø2		
Reserved	Reserved	27	Ø3	C-1200-SS	C-1200-SS
Eastbound Thru No. 3 & 4 Presence	2P-W-Ø4	28	Ø4		
Reserved	Reserved	29	Ø5	C-1200-SS	C-1200-SS
Southbound Thru No. 3 & 4 Presence	2P-N-Ø6	30	Ø6		
Reserved	Reserved	31	Ø7	C-1200-SS	C-1200-SS

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Detection Area	Label on Plan	Input Channel	Input Phase	Detector Model With Bike Lane	Detector Model without Bike Lane
Westbound Thru No. 3 & 4 Presence	2P -E-Ø8	32	Ø8		
Southbound No. 2 L/T Bike/Veh	2B-N-Ø1	33	Ø1	C-1201-B	C-1201-B
Northbound No. 2 Thru Bike/Veh	4B-S-Ø2	34	Ø2		
Westbound No. 2 L/T Bike/Veh	2B-E-Ø3	35	Ø3	C-1201-B	C-1201-B
Eastbound No. 2 Thru Bike/Veh	4B-W-Ø4	36	Ø4		
Northbound No. 2 L/T Bike/Veh	2B-S-Ø5	37	Ø5	C-1201-B	C-1201-B
Southbound No. 2 Thru Bike/Veh	4B-N-Ø6	38	Ø6		
Eastbound No. 2 L/T Bike/Veh	2B-W-Ø7	39	Ø7	C-1201-B	C-1201-B
Westbound No. 2 Thru Bike/Veh	4B-E-Ø8	40	Ø8		
Northbound No. 4 Thru Bike/Veh	3B-S-Ø2	41	Ø1	C-1200-B	C-1201-B
Northbound No. 3 Thru Bike/Veh	2B-S-Ø2	42	Ø2		
Eastbound No. 4 Thru Bike/Veh	3B-W-Ø4	43	Ø3	C-1200-B	C-1201-B
Eastbound No.3 Thru Bike/Veh	2B-W-Ø4	44	Ø4		
Southbound No. 4 Thru Bike/Veh	3B-N-Ø6	45	Ø5	C-1200-B	C-1201-B
Southbound No. 3 Thru Bike/Veh	2B-N-Ø6	46	Ø6		
Westbound No. 4 Thru Bike/Veh	3B-E-Ø8	47	Ø7	C-1200-B	C-1201-B
Westbound No. 3 Thru Bike/Veh	2B-E-Ø8	48	Ø8		
Southbound No. 2 L/T Advance	2A-N-Ø1	49	Ø1	C-1201-SS	C-1201-SS
Northbound No. 2 Thru Advance	2A-S-Ø2	50	Ø2		
Westbound No. 2 L/T Advance	2A-E-Ø3	51	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 2 Thru Advance	2A-W-Ø4	52	Ø4		
Northbound No. 2 L/T Advance	2A-S-Ø5	53	Ø5	C-1201-SS	C-1201-SS
Southbound No. 2 Thru Advance	2A-N-Ø6	54	Ø6		
Eastbound No. 2 L/T Advance	2A-W-Ø7	55	Ø7	C-1201-SS	C-1201-SS
Westbound No. 2 Thru Advance	2A-E-Ø8	56	Ø8		
Northbound No. 4 Thru Advance	4A-S-Ø2	57	Ø1	C-1201-SS	C-1201-SS
Northbound No. 3 Thru Advance	3A-S-Ø2	58	Ø2		
Eastbound No. 4 Thru Advance	4A-W-Ø4	59	Ø3	C-1201-SS	C-1201-SS
Eastbound No. 3 Thru Advance	3A-W-Ø4	60	Ø4		
Southbound No. 4 Thru Advance	4A-N-Ø6	61	Ø5	C-1201-SS	C-1201-SS
Southbound No. 3 Thru Advance	3A-N-Ø6	62	Ø6		
Westbound No. 4 Thru Advance	4A-E-Ø8	63	Ø7	C-1201-SS	C-1201-SS
Westbound No. 3 Thru Advance	3A-E-Ø8	64	Ø8		

Section 86-3.04D(2), "Convenience Receptacle," of the Standard Specifications, is hereby amended with the addition of the following after the last paragraph:

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A minimum of two filtered convenience receptacles shall be mounted in a readily accessible location in the controller cabinet on the left and right upper walls.

### **86-3.04D(5) Control Panel Assembly**

A control panel assembly shall be provided inside the cabinet door. It shall be readily accessible when the door is open. The control panel assembly shall consist of:

- A switch which shall be wired to energize the controller unit timing circuits while the signal lights are off or are being operated by flasher. The switch shall be labeled and rated for load current.
- A "Signal-Flash" switch which, when placed in the "Flash" position, shall provide flashing operation as specified in Section 86-3.03, "Flashing Operations." When said switch is placed in the "Signal" position, the controller unit shall resume control.
- The "Stop Time" switch shall be a three position toggle switch. When placed in the "OFF" position the controller unit shall not stop time. When placed in the "ON" position the controller unit shall stop time. When placed in the "Auto Stop Time" position, will cause the controller unit to stop time when the "Flash-Automatic" switch in the police panel is placed in the "Flash" position.
- The vehicle and pedestrian test switches shall be single pole, double throw, on/off/momentary on, toggle switches. The "ON" position shall be normal operation, the "OFF" position shall not allow any calls from the field to enter the controller, the "MOMENTARY ON" shall place a momentary call into the controller. The toggle switches shall be as specified in Section 86-3.04E(1), "Toggle Switches." The switches shall be installed so that pushing down on the toggle to the bottom position shall be the momentary on position. The test switches shall have a label indicating the operation of the three switch positions. There shall also be the following label above the test switches "For normal operation place switch in UP position."

### **86-3.04D(6) Police Panel Assembly**

A police panel assembly, located behind the auxiliary door, shall be provided. The key hole for the police panel shall be provided with a cover to prevent foreign materials from entering the police panel. The police panel assembly shall consist of:

- A "Flash-Automatic" switch which, when placed in the "Flash" position, shall cause the controller assembly to go into the flashing mode and remove power from the signal bus. When placed in the "Automatic" position, it shall cause the controller assembly to resume operation.
- A "Lights-Off" switch which, when placed in the "OFF" position shall extinguish the signal indications.
- A "Manual Control" switch, which when placed in the "ON" position with the police panel door open, activates the "Manual Control Enable" input to the controller unit, and allows "Interval Advance" inputs to the controller from a manual pushbutton



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connected to a 6 foot cord retractable this cord. The cord shall have a plug that will not allow the door to close until the cord is unplugged and stored inside the police panel. The manual control switch shall be protected by door-actuated switch interlock on the police panel door which will disconnect the manual control enable when the police panel door closes regardless of the manual control switch position. The "Manual Control" switch shall also activate controller alarm 3.

- A door-actuated switch which activates intersection alarm 2 when the police panel door is open.

A removable, rigid metal cover shall be provided on the back of the police panel to cover the switch terminals.

### **86-3.04E Components**

Section 86-3.04E(3), "Circuit Breakers", of the Standard Specifications is hereby amended with the addition of the following:

The main cabinet breaker shall be rated at 30 amps and shall protect all circuits within the cabinet except the cabinet fan, the lighting fixture and the GFCI. Those items not protected by the main cabinet breaker shall be protected by a 15 amp breaker. A second 15-amp breaker for additional protection of the peripheral control equipment shall be placed between the cabinet filtering and the peripheral control equipment.

### **86-3.04E(5) Monitoring Device**

A monitoring device shall consist of an Eberle Design Inc. Model MMU-16LEip solid-state malfunction management unit installed external to, and electrically independent of, the solid state controller unit. The malfunction management unit shall meet the requirements of NEMA Standards Publication TS2-2003 and be downward compatible with existing NEMA TS1-1989 controller assemblies. The unit shall be keyboard programmable. The unit shall log high and low voltage conditions in addition to faults. A backlit LCD screen shall be provided for viewing of event logs. In the event of conflicting green, yellow or walk signals on the AC field terminations, simultaneous indications of active green, yellow, walk, or red field signal outputs on the same channel, the absence of voltage on all four of the field signal outputs of a channel, or the absence of a minimum 2.8 second period of an active yellow field signal output, the monitoring device shall cause the signal system to go into flashing operation. The flashing operation shall lock-in and shall release only upon operation of a reset switch. Operation of the monitor shall energize the stop timing circuit of the controller unit. The monitor shall communicate to the controller through the SDLC interface on the controller. The incoming AC line voltage shall be monitored and the occurrence and duration of voltage dips, surges, and long term over-voltage conditions shall be logged. The monitor shall also have a signal sequence history log and shall be capable of displaying up to 30 seconds of signal status prior to the fault trigger event.



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Conflicting green is defined as occurring when 25 Volts rms, or more, at 60 Hz appears for 500 milliseconds, or more, on any green circuit that is in conflict with the green circuit called for by a normally functioning controller unit. Conflicting greens lasting less than 200 milliseconds, or a conflicting voltage of less than 10 Volts rms shall not cause the device to place the signal in flashing operation.

All power supplies that provide voltage to logic circuits, except detector logic circuits, shall be monitored. If any voltage drops to a level where equipment does not work properly, the signal shall go into flashing operation.

Operation of a signal monitoring device shall disable all functions of the "Flash Automatic" switch in the police panel. When the controller assembly is equipped with railroad preemption equipment, the signal shall be wired to provide a flashing red on all phases upon operation of the monitoring device, and power shall be removed from the railroad preemption equipment.

The cabinet shall be wired so that it is possible to remove the monitoring device without causing the intersection to go into flashing operation so long as the cabinet door remains open, and such that the intersection will go into flashing operation with the monitoring device removed and the door closed.

### **86-3.04E(6) Solid-State Switching Devices**

Solid-state switching devices shall be provided with LEDs to monitor each lamp circuit input from the controller and output to the field conductors. The LEDs shall be visible when viewing the installed switching device and during a flash condition the output LEDs shall latch showing the last outputs.

### **86-3.04E(7) Solid-State Logic**

Solid-state logic or timing circuits, external to a controller unit, shall be built on edge connected plug-in, printed circuit boards. Logic circuits shall be built-up by plugging logic circuit boards into wired connectors. When logic circuit boards are used, they shall be installed in a chassis. Each chassis shall be covered, shall be provided with a MS type connector and shall be shelf-mounted.

### **86-3.04E(8) Special Timing**

Each special timer shall have a range from 0 to 30 seconds or the range shown on the plans. Timing of the interval shall be adjustable in one second maximum increments. Calibration accuracy shall be to the smallest selectable setting if the line voltage is at any value from 105 to 130 Volts while the ambient temperature is between 0 degrees F and 160

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degrees F. Each special timer shall be a plug-connected solid-state digital device with an indicator light to show when the timer is operating.

### **86-3.04E(9) Time Switch**

Time switches to control specified functions shall be solid-state. The time switch shall provide a minimum of 3 circuits with digital LED or LCD readout to indicate time of day and day of week settings. The time switch shall provide a minimum of 28 ON/OFF set points, in one minute maximum increments, at any time during the 7-day week, and with 5-minute minimum ON/OFF capability. The ON feature shall be a minimum of one minute to a maximum of 6 days, 23 hours and 59 minutes. The time switch shall be rated at 120 Volts, 60 Hz and 5 amperes per circuit. Operating instructions for the time switch shall be provided and affixed to the inside of the enclosure door.

### **86-3.04E(10) Flasher**

The flasher shall be a solid-state device with no contact points or moving parts. The flasher shall provide 2 output circuits each equipped with LEDs to monitor the circuit. The circuits shall permit alternate flashing of signal faces and shall be capable of carrying a minimum of 15 amperes per circuit at 120 Volts. The LEDs shall be visible when viewing the installed flasher.

The coil of the flash transfer relay shall be energized only when the signals are in flashing operation.

### **86-3.04E(11) Heavy Duty Relays**

Heavy duty relays shall be designed for continuous duty. Relays shall operate during ambient temperatures from 64 degrees F to 160 degrees F. Each relay shall operate in the 8-pin Jones-type socket shown on the plans.

Relays shall be provided with double-pole, double-throw contacts. Contact points shall be of fine silver, silver-alloy, or superior alternative material. Contact points and contact arms shall be capable of operation for 250,000 cycles with 20 amperes of tungsten load per contact at 120 volts, 60 Hz AC.

Coils shall have a power consumption of 10 volt-amperes or less and shall be designed for continuous duty on 120 Volts, AC.

Heavy duty relays shall be enclosed with a removable, clear plastic cover.

### **86-3.04E(12) Light Duty Relays**

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Light duty relays shall be enclosed with a removable, clear plastic cover and shall be permanently marked with the coil voltage.

Relays with coils rated at 120 Volts, or more, shall be the 3-pole, double-throw type, with a contact rating of 2 amperes at 120 Volts AC. Relays shall be provided with a plug for mounting in a standard 11-pin socket.

Relays with coils rated at 24 Volts, or less, shall be the 2-pole, double-throw type, with a contact rating of 2 amperes at 120 Volts AC. Relays shall be provided with a plug for mounting in a standard 8-pin socket.

Relays used to switch logic voltages shall have contacts designed for the voltage and current to be switched, except that the minimum contact rating shall be one ampere at 120 Volts AC.

### **86-3.04E(13) Toggle Switches**

Toggle switches shall have poles as required and shall be rated at 200 percent of circuit current for circuits of 10 amperes or less and 125 percent of circuit current for circuits over 10 amperes.

Circuit breakers used as toggle switches shall be UL or ETL listed for switching operation.

### **86-3.04E(14) Telemetry Interface Unit**

A telemetry interface panel, equipped with a surge arrester to reduce the effects of voltage transients in the interconnect cable, shall be furnished and installed in an easily accessible location. The panel shall be provided with two jumpers to allow connection of a 620 ohm resistor across the command and read-back lines. A telemetry interface cable shall be included with each interface unit. Each interface unit shall provide terminal blocks as necessary to allow system command and local read-back. Shall be installed when the cabinet is to be used with the city's Legacy Aries system.

### **86-3.04E(15) Lighting Fixture**

Each traffic actuated cabinet shall be provided with LED lighting fixture(s) mounted on the inside top of the cabinet near the front edge. Fixture shall be provided ample light to see each piece of equipment that is install within the cabinet. The LED shall operate from a normal power factor UL or ETL listed ballast/driver.

The "ON-OFF" switch for the lighting fixture shall be a door-actuated switch that turns the light on when the door is open, and off when the door is closed.

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### **86-3.04E(16) Card Guides**

Card guides shall be designed to provide support and guidance for printed circuit cards. The guides shall provide continuous support and guidance for a minimum of 90 percent of the length of the card to be inserted. Support shall be provided on 2 sides of the card. The guides shall not allow the card to be inserted into the edge connector at more than one degree off normal.

### **86-3.04E(17) Radio Interference Suppressors**

Radio interference suppressors shall provide a minimum attenuation of 50 decibels over a frequency range of 200 kilohertz to 75 megahertz when used in connection with normal installations. The interference suppressor shall be hermetically sealed in a substantial metal case filled with a suitable insulating compound. Terminals shall be nickel-plated, 10-24 brass studs of sufficient external length to provide space for connecting 2 No.8 conductors, and shall be so mounted that the terminals cannot be turned in the case. Ungrounded terminals shall be properly insulated from each other and shall maintain a surface leakage distance of not less than 1/4 inch between any exposed current conductor and any other metallic part, with an insulation factor of 100-200 mega-ohms dependent on external circuit conditions. Suppressors shall be designed for 125 percent of the total connected load and in no event less than 25 amperes on 120 Volts, 60 Hz single-wire circuits, and shall meet standards of the UL or ETL, and the EIA.

### **86-3.04E(18) Printed Circuit Boards**

Printed circuit boards shall be designed to facilitate identification of components. Identification shall be made either by part identification markings or by providing a pictorial diagram in the maintenance manual for the unit showing physical location and identification of each component. Printed circuit boards shall be NEMA FR-4 glass cloth base epoxy resin board, 1/16-inch minimum thickness. with organic solder masking and gold plated contacts. Intercomponent wiring shall be copper track, with a minimum weight of 2 ounces per square foot, and with adequate cross section for the current to be carried. Printed circuit design shall be such that components may be removed and replaced without permanent damage to board or tracks.

## **86-3.05 ADDITIONAL REQUIREMENTS FOR CONTROLLER ASSEMBLIES**

The following requirements shall apply to all controller assemblies:

### **86-3.05A Control Priorities**

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The devices, controls and equipment shall have the following priorities over the others. Each device, control or item of equipment shall override the operation of those items listed below it and shall yield its operation to those items listed above it.

- Power failure
- Power restart
- Flashing
- Railroad pre-emptor
- Emergency vehicle pre-emptor
- Phase selector
- Interconnect
- Time switch
- Normal controller unit operation

### **86-3.05A Operating Voltage**

All controller units shall operate over the range of voltages from 100 Volts to 135 Volts at 60 Hz. The voltage for pedestrian push buttons shall not exceed 25 Volts.

### **86-3.06 ADDITIONAL REQUIREMENTS FOR CONTROLLER ASSEMBLIES WITH CLOSED-CIRCUIT TELEVISION (CCTV) INSTALLED IN CONTROLLER CABINET.**

The following requirements shall apply to all controller assemblies with **Closed-circuit television (CCTV)** installed in controller cabinets:

#### **86-3.06A Closed-circuit television (CCTV)**

Closed-circuit television (CCTV), shall be model SW720P-H.264-HD30-ENG as manufactured by Wireless Technology, Inc., 2064 Eastman Avenue Suite 113, Ventura, CA 93003-7787, Phone: (805) 339-9696, Fax: (805) 339-0932, Web: [www.gotowti.com](http://www.gotowti.com)

#### **86-3.06B Quality and manufacturing**

The manufacturer providing the specified product shall be certified to comply with the requirements of ISO 9001-2008. Equipment shall be current standard production units and shall have been in production for a minimum of six months.

#### **86-3.06C System description**

A fully assembled, factory tested and certified unit with the following features:

- A 1080P high definition day/night, color/monochrome CCD camera with a x30 optical zoom lens and support for multiple video streaming formats.

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- A low maintenance, hydrophilic coated, energy saving, directly heated, non-fogging camera faceplate window.
- A high accuracy, wide dynamic range, variable speed pan and tilt mechanism with continuous 360 degree rotation in both axes and automatic image flip.
- An environmentally rugged housing suitable for harsh environments, that is compatible with the temperature, power, vibration and shock requirements of NEMA TS-2, as well as the environmental dust and water resistance requirements of IEC 60529 IP66 and IP67 ratings.
- Ethernet streaming video and control, as well as support for RS-485 serial data control and analog NTSC compatible video output to support legacy systems.

### 86-3.06D Product Specifications

The camera system shall meet or exceed the following design and performance specifications.

#### 86-3.06D(1) Image Sensor and Lens

##### Image Sensor and Lens

- Image Sensor Type: EXMOR CMOS Image Sensor
- Image Sensor Size: 1/2.8"
- Image Sensor Pixel Resolution: 2096 horizontal x 1561 vertical
- Effective Pixels: 1920 Horizontal x 1080 vertical
- Analog Video Output Format: NTSC, 1Vpp at 75 Ohms, unbalanced
- Maximum Lens Aperture: F1.6 at full wide angle – F4.7 at full telephoto
- Optical Zoom Range and Focal Length: x1 to x30 (4.3mm ~ 129mm)
- Digital Zoom Range: x1 to x12 with smooth transition from optical to digital
- Extended Digital Zoom and Focal Length: 94mm ~ 1128mm
- Optical Zoom Speed: 1.6s with focus tracking off - 4.6s in 30P/60P mode
- Horizontal Angle of View: 63.7 degrees (wide angle) to 2.3 degrees (tele)
- Minimum Focus Distance: 10mm (wide angle) to 1200mm (tele)
- Auto Focus: Selectable between Auto/Manual
- Manual Focus Speed: approximately 3.2 seconds – near to far
- Shutter Speed: Adjustable from 1 second to 1/10,000 second. Settings below 1/60 second increase integration time to improve low light sensitivity with video frame store to provide continuous video output.
- Auto Iris: Electronically controlled from F1.6 to F14 and Closed, to provide optimum sensor illumination for constant video output.
- Gain Range: 28 steps
- Gamma: 0.45 or Straight
- Color Balance: Auto White Balance with adjustable red and blue levels.
- Signal to Noise Ratio: >50dB
- Synchronization: Crystal

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### 86-3.06D(2) H.264/MJPEG ENCODING ENGINE

The camera system shall integrate the H.264/MPEG-4/MJPEG encoding with functions as specified below;

- Video Encoding: H.264 (Baseline/Main/High Profile, up to Level 4.1), MPEG-4 (Simple Profile) and MJPEG standards
- Video Streams: Two independently configurable streams; (2) H.264 streams, (1) H.264 and (1) MJPEG or (1) MPEG-4 and (1) MJPEG.
- Video Stream Configuration Properties;
- Codec
- Video Stream 1: H.264, MJPEG or MPEG-4
- Video Stream 2: H.264, MJPEG or MPEG-4
- Image Resolution: 1080p, 720p, D1, 2-CIF, VGA, CIF
- Streaming Mode: CBR or VBR
- Image Settings: (GOP (M, N)), Quality Value
- Frame Rate: 30, 15, 7, 4, 2, 1
- Data Rate: Adjustable from 64k to 12Mbps in VBR mode and 64k to 16Mbps in CBR mode.
- Connection Types: Uni-cast, multi-unicast or multi-cast
- Video Latency: <250ms
- Network Protocol Layers: RTP, RTSP, UDP, TCP, IP, HTTP, IGMPv2, ICMP, ARP as a minimum

### 86-3.06D(3) Camera Housing Module

The Camera Housing Module shall integrate a housing as specified below;

- Outside surface of camera housing window provided with high temperature vacuum deposited hydrophilic coating to reduce window cleaning maintenance.
- Inside surface of camera housing window provided with electrically conductive coating to allow energy saving direct heating of window glass to prevent fogging.
- Proportionally controlled closed loop window heater drive circuit with outside temperature sensor unit to provide fog free window operation under all environmental conditions.
- Temperature sensor and microprocessor controlled image sensor heater to provide reliable operation of zoom lens down to -34 degrees Celsius.

### 86-3.06D(4) Pan and Tilt Drive Assemblies (both axes)

The Pan and Tilt Drive Assemblies (both axes) shall be integrated as specified below;

- Drive Range: 360 degrees continuous rotation (both axes)
- Drive Speed: Variable from 0.0003 Degrees/Second to 100 Degrees/Second



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- Drive Resolution: 0.005625 Degrees
- Drive Repeatability: 0.05 Degrees typical
- Preset to Preset Time: Selectable between 2 seconds and 5 seconds for 180 degree motion in both axes
- Operator Motion Speed: Pan and Tilt speeds are proportional to both operator speed commands and camera zoom setting.
- Brakes: Electrically operated pan and tilt motor brakes with a minimum holding torque of 300 oz./in shall be provided to maintain the camera position when power is removed from the camera.

### **86-3.06D(5) Operational Features**

The Operational Features shall be integrated as specified below;

- Presets: Minimum of 64 presets, each preset to store variable data for pan position, tilt position, zoom setting, focus setting and 24 characters of titling text to be displayed when the preset is recalled. Preset titling to remain on screen until subsequent preset or camera control commands are received.
- Tours: Eight tours of up to 32 presets each shall be supported. Presets may be assigned to the tours in any order and may be used multiple times within one tour.
- Panning Tours: Any or all of the eight tours may be used as “panning” tours by selecting exactly two presets for the tour. The first preset selected for the tour shall set the counter-clockwise panning limit and the tilt angle for the tour, and the second preset selected shall set the clockwise panning limit for the tour. The positioning system shall pan smoothly from one preset to the other and back again until a subsequent camera command is received.
- Sector Zones: Up to 16 sector zones with user settable right and left pan limits may be programmed with one line of up to 20 characters of ID titling per zone.
- Privacy Zones: Any Sector Zone may be utilized as a privacy zone by setting the video mode to “OFF” within that zone.
- Low Pressure Warning Indicator: Provide low pressure warning indicator on video display for cameras supplied with pressurized camera housing option.
- Internal Temperature Warning Indicator: Provide an internal temperature warning indication on the video display.
- Program Memory: Unit must be field upgradable using FLASH or other type of non-volatile memory to store programming.

### **86-3.06D(6) Camera Power and Signal Interface**

The Camera Power and Signal Interface shall be integrated as specified below;

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- Video output shall be configured as 75 Ohm, 1Vpp, unbalanced signal labeled as “video” and “video shield” in documentation.
- Two levels of transient protection shall be included using a gas discharge tube followed by 40A 2kW transient voltage suppressor.

Control Data signals shall be provided for bidirectional differential data conforming to EIA RS-485 signal levels and drive capabilities.

- The camera shall also be compatible with EIA RS-422 drivers and receivers (Note that EIA RS-232 support is provided by LCU).
- The camera shall support up to 32 cameras on one control data bus.
- “+TX”, “-TX” shall designate the control data lines connected to the RS-485 output drivers within the camera.
- “+RX”, “-RX” shall designate the control data lines connected to the RS-485 receiver inputs within the camera.
- “Data Shield” shall designate the data reference signal.
- Two levels of transient protection shall be included using gas discharge tubes followed by 40A 300W transient voltage suppressors.

Control Data protocol support include Cohu, Pelco D and NTCIP codes without the use of additional protocol convertor hardware.

- Power input and operational performance shall be in conformance with the following specifications and shall be documented by an outside independent laboratory.
- Power input shall be less than 100 Watts with all options installed and operating.
- AC Mains operating voltage and frequency shall be 85VAC to 265VAC and 60Hz +/- 3Hz.
- Power interruption immunity shall be per NEMA TS-2 paragraph 2.1.4.
- Power transient immunity shall be per NEMA TS-2 paragraph 2.1.6.

Mechanical:

- Interface connector shall be weatherproof and corrosion resistant MS style 18 Pin type with gold plated contacts or AMP style 16 pin type with gold plated contacts.
- Camera weight shall be 20 pounds or less.
- Nominal camera dimensions shall be 14”H x 13”W x 9.5”D or less.
- Camera housing shall be constructed of rugged, corrosion resistant materials such as powder coated aluminum, stainless steel and UV resistant, shock resistant polymer materials suitable for use in all outdoor environments and under all shock and vibration conditions.

Environmental

- The camera shall undergo independent laboratory testing to certify conformance with the following environmental and mechanical specifications:
- Operational temperature range shall be from -34 degrees Celsius to +74 degrees Celsius and shall be tested with high line and low line operating voltages per NEMA TS-2 paragraphs 2.1.2, 2.1.3 and 2.1.5.

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- Immunity to vibration shall be tested according to NEMA TS-2 paragraphs 2.1.9 and 2.2.3 using a 0.5g amplitude signal from 5Hz to 30Hz applied in each of 3 mutually perpendicular axes for 30 minutes.
- Immunity to shock shall be tested according to NEMA TS-2 paragraphs 2.1.10 and 2.2.4 using a 10g amplitude, 10ms duration shock pulse in each of three mutually perpendicular axes.
- Immunity to water spray (IPx6 rating) shall be tested according to IEC 60529 section 14.2.6 using a 25 gallon per minute water stream through a 12.5mm nozzle at nine feet for three minutes.
- Immunity to water immersion (IPx7) shall be tested according to IEC 60529 section 14.2.7 using an immersion depth of 1 meter measured at the bottom of the camera and a duration of 30 minutes.
- Immunity to external icing shall be tested according the NEMA 250-2003 section 5.6.
- Immunity to corrosion shall be tested according to NEMA 250-2003 section 5.10 and the procedure specified in ASTM-B117 Marine.
- Electromagnetic radiation shall be within the limits set by FCC Regulations 47 CFR Part 15 for Class A devices.
- Pressurization
- The camera housing tube shall be supplied pressurized to 5psi or greater using dry nitrogen.
- A 15psi pressure relief safety valve shall be installed in the camera tube housing to prevent the camera tube housing from being over-pressurized.
- The camera tube housing shall be provided with pressure and temperature sensors to allow remote monitoring of these parameters.
- An under pressure warning shall be displayed on the video image when the camera housing tube pressure drops below a preset limit.
- An altitude adjustment parameter shall be supported to allow compensation for local elevation during installation.

### 86-3.06D(7) ENG Brakes

The ENG Brakes shall be integrated as specified below;

- An ENG brake shall be included such that for electronically controlled pan and tilt brakes which prevent the camera from moving in the pan or tilt axis when it is powered off or when the unit is not being directed to change its pan or tilt position (SW720-H.264-HD30-ENG Model)

## 86-4 TRAFFIC SIGNAL FACES AND FITTINGS

### 86-4.01 VEHICLE SIGNAL FACES

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Section 86-4.01, "Vehicle Signal Faces" of the Standard Specifications, is hereby amended with the addition of item 7:

The City does not use 8-inch indications, all signal indications (circular and arrows) shall be provided with 12-inch sections.

### **86-4.01E Backplates**

Section 86-4.03, "Backplates", of the Standard Specifications, the first paragraph is replaced with:

Where shown on the plans, backplates shall be furnished and installed on signal faces. All backplates used on metal signal heads shall be louvered. Dimensions, materials and installation details shall be as shown on the plans. Background light must not be visible between the backplate and the signal face or between sections.

### **86-4.03 PEDESTRIAN SIGNAL FACES**

Section 86-4.03, "Vehicle Signal Faces" of the Standard Specifications, is hereby amended with the addition of the following:

Pedestrian signals shall be of the Gelcore Light Emitting Diode (LED) Countdown type, Part No. PS7-CFF1-01A-18 or approved equal.

### **86-4.04 SIGNAL MOUNTING ASSEMBLIES**

Section 86-4.06, "Signal Mounting Assemblies", of the Standard Specifications, replace the paragraph that begins with, "For Type SV-1-T mountings..." with the following:

Vehicle signal faces with 5 or more sections shall be provided with an additional terminal compartment at the top of the assembly, and shall be bolted to the standard in the same manner as the lower terminal compartment for side mounted head assemblies may require an extension 1½" pipe to clear mastarm on pole, for 1-A pole installations of vehicle signal faces with 5 or more sections shall be provided with a 15 foot 1-A pole and mounting shall be done using a top mounting per Caltrans signal slip fitter detail for top mounting on Caltrans standard plan ES-4D, and the lower terminal compartment bolted to the lower section of the pole.

## **86-5 DETECTORS**

### **86-5.01A(2) Sensor Unit Construction**

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Replace Reserved with the following:

Each controller assembly shall be equipped with four detector racks, with , 24-2 channel sensor units for detection, 6-2 channel sensor units with additional count outputs, and 2-2 channel emergency vehicle preemption discriminators. Count detectors shall have the word "Count" on the face plate to differentiate them from the detectors with only the standard outputs. Detector racks shall be protected on the top from water intrusion.

The detector 1-8, 26, 28 30, 32, and 33-48 shall be able to receive the green output read back to the detector card for the bike extension timing function of the card.

Type and quantity of Reno detector cards shall be provided shall be as follows unless stated otherwise in the engineers equipment need for project statement.

When Bike preformed Loops are used all lanes

8 - Model C-1200-SS Standard Detector cards

12 - Model C-1201-SS Count Detector cards

12 - Model C-1201-B-SS Bike Detector cards for preformed loops

When Type D Loops and Bike preformed Loops are used for left turn and thru bike lanes

8 - Model C-1200-SS Standard Detector cards

12 - Model C-1201-SS Count Detector cards

8 - Model C-1201-B-SS Bike Detector cards for preformed loops

4 - Model C-1200-B-SS Bike Detector cards for Type D loops

Each output circuit of the unit shall be provided with a high intensity red LED to indicate a call output, delay timing, extension timing, pending state or failed loop.

The vehicle detector shall continuously check the integrity of the loop. The detector shall be able to detect shorted or open circuit loops, or sudden changes in inductance exceeding 25% of the nominal inductance. If a fault is detected, the LED shall emit a particular repeating sequence of flashes followed by a pause to identify each type of fault.

Sensor units shall conform to the requirements in Section 6 of the NEMA Standards Publication No. TS2-1992. The units shall be NEMA Type-C, 2-channel, rack mount type detectors. Sensors shall be Model C-1200-SS, Model C-1201-SS, Model C-1200-B-SS (Bike Detection), and Model C-1201-B-SS (Bike Detection) as manufactured by Reno A&E of Reno, Nevada.

## **Section 86-5.01A(4) Installation Details**

Section 86-5.01A(4), "Installation Details", of the Standard Specifications, is hereby amended with the addition of the following:

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Loop conductors shall be twisted six turns per foot from the point that the conductors enter together the saw cut leading to the pull box, until spliced to the detector lead-in cable. The contractor may at his option install 6-foot diameter round loops in-lieu of 6-foot x 6-foot square loops, where shown on the plans. So that optimum sensitivity is obtained at the sensor unit, the loops shall be joined in the pull box in series, and physically adjacent loops shall be wound with opposite rotation. Rotation reversal may be accomplished at the pull box by reversing the leads. The sealant for filling slots shall conform to hot-melt rubberized asphalt sealant:

## **Section 86-5.01A(5) Preformed Inductive Loops**

Section 86-5.01A(5), "Preformed Inductive Loops", of the Standard Specifications, is hereby amended with the addition of the following:

Presence detection shall include lane-by-lane detection capable of discriminating between vehicles and bicycles; shall provide extension/hold for detected bicycles; shall contain a preformed parallelogram loop wired continuously from the loop to the cabinet; shall be installed across the entire width of each travel lane plus 12 inches of overhang; and shall be installed at a 45 degree angle to approaching traffic.

## **Section 86-5.01A(6) Type D Inductive Loops**

Section 86-5.01A(6), "Type D Inductive Loops", of the Standard Specifications, is hereby amended with the addition of the following:

Presence detection shall include lane-by-lane detection capable of discriminating between vehicles and bicycles; shall provide extension/hold for detected bicycles; shall contain a Type D loop wired continuously from the loop to the first pullbox; shall be installed 1 foot from the crosswalk and centered in the width of each travel lane; and shall be installed per Type D loop detector configuration on Caltrans standard plan ES-5B. The Type D loop shall be installed with 5 turns and the loop conductors shall be twisted six turns per foot from the point that the conductors enter together the saw cut leading to the pull box, until spliced to the detector lead-in cable.

## **86-5.01D Emergency Vehicle Detector System**

### **86-5.01D(1) General**

The term "modulated light signal detector" applies to a complete installation consisting of one optical detector, and connecting cable for each approach and the discriminator modules necessary to provide the proper preemption inputs to the controller.

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### 86-5.01D(2) Optical Detector

Each optical detector shall be a weatherproof unit capable of receiving optical energy from two separately aimable directions and providing a separate output for each. The horizontal angle between the two directions shall be variable from 180 degrees to 5 degrees. Each such detector, when used with standard emitters, shall have a range of at least 1800 feet for Class II signals.

The reception angle for each photocell assembly shall be a maximum of 8 degrees in all directions about the aiming axis of the assembly.

All internal circuitry shall be solid state, and electrical power shall be provided by the associated discriminator module.

Each optical detector shall be contained in a housing, which shall include two rotatable photocell assemblies, an electronic assembly, and a base. The base shall have an opening to permit its mounting on a mast arm or a vertical pipe nipple. The mounting opening shall have female threads for 3/4 inch conduit. A cable entrance shall be provided which shall have male threads and gasket to permit a waterproof cable connection. Each detector shall weigh not more than 2 1/2 pounds and shall present a maximum wind load area of 36 square inches. The housing shall be provided with weep holes to permit drainage of condensed moisture.

### 86-5.01D(3) Cable

Optical detector cable shall meet the requirements of IPCEA-S-61-402/NEMA WC 5, Section 7.4, 600-Volt control cable, 167 degrees F., Type B, and the following:

- The cable shall contain 3 conductors, each of which shall be No. 20 (7X28) stranded, tinned copper with low-density polyethylene insulation. Minimum average insulation thickness shall be 25 mils. Insulation of individual conductor shall be color coded: 1-yellow, 1-blue, 1-orange.
- The shield shall be either tinned copper braid or aluminized polyester film with a nominal 20 percent overlap. Where the film is used, a No. 20 (7X28) stranded, tinned, bare drain wire shall be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
- The jacket shall be black polyvinyl chloride with minimum ratings of 600 Volts and 176 degrees F and a minimum average thickness of 45 mils: The jacket shall be marked as required by IPCEA/NEMA.
- The finished outside diameter of the cable shall not exceed 0.35 inch.



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- The capacitance, as measured between any conductor and the other conductors and the shield, shall not exceed 48 pico-farads per foot at 1000 Hz.
- The cable run between each detector and the controller cabinet shall be continuous without splices.

### 86-5.01D(4) Discriminator Module

Each discriminator module shall be rack mounted and designed to be compatible and usable within a NEMA TS1 or NEMA TS2 Type 1 controller assembly.

Each discriminator module shall be capable of operating four channels, each of which shall provide an independent output for each separate input and able to operate on IR only operation, GPS only operation, or simultaneous IR and GPS operation

Each discriminator module, when used with its associated detectors, shall be capable of receiving Class II signals, establishing the validity of received signals, and providing a NEMA defined output for each channel to the appropriate input of the controller unit. The discriminator outputs shall provide inputs to the controller unit as follows:

Controller Input	Preempt Direction
EVP-3	Northbound
EVP-4	Southbound
EVP-5	Eastbound
EVP-6	Westbound

### 86-5.01D(5) Auxiliary Interface Panel (AIP)

Auxiliary Interface Panel (AIP) shall be prewired in traffic signal cabinet prior to shipping by cabinet manufacture. With all wiring to operate the discriminator module in IR only operation, GPS only operation, or simultaneous IR and GPS operation. The AIP shall be wired to allow the following features and/or capabilities when needed:

- Green sensing or green light verification
- Auxiliary infrared detector inputs
- Additional preempt outputs
- Turn signal dependent operation (For GPS operation)
- Separate outputs for high and low priority
- Clock sync input (In IR operation)
- Clock sync output (For GPS operation)
- Confirmation light outputs with the phase selectors.

### 86-5.02 PEDESTRIAN PUSH BUTTON ASSEMBLIES

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Section 86-5.02, "Pedestrian Push Button Assemblies", of the Standard Specifications, add the following to the first paragraph:

The assembly shall be equivalent to the Campbell Model MPS-57-Rnd-G, and the housing shall be green powder coated aluminum. The pedestrian push button shall be Polara "Bull Dog" with a nonlatching LED, or an equivalent approved by the City. The pedestrian push button shall also be capable of working with econolite's extended walk function using a push and hold for additional walk time.

Section 86-5.02, "Pedestrian Push Button Assemblies", of the Standard Specifications, the sixth paragraph is hereby amended to read:

Pedestrian push button signs shall be porcelain enameled metal only, structural plastic is not allowed.

### 86-6 LIGHTING

**86-6.02 RESERVED** is replaced with **LED LUMINAIRES**

Intersection safety lights shall be LED type, watt as shown on plan, manufacturer shall be GE Lighting. Contractor shall submit to the city the cut sheets for all LED luminaires to be use on this signal project.

### 86-6.09 INTERNALLY ILLUMINATED STREET NAME SIGNS

Section 86-6.09 "Internally Illuminated Street Name Signs," of the Standard Specifications, the entire section is hereby deleted and amended to read:

**Reflective Street Name Sign as manufactured by Safeway Sign Company Model number SSGT and shall meet the descriptive requirements as stated below, except illumination requirements, as approved by the City.**

The sign panels shall be rigid mounted in a frame, with white diamond grade reflective legend, symbols, arrows, and border on each face, the background shall be green.

The sign and panels shall be designed and constructed to prevent deformation warping, or failure when subjected to 100 mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals", and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of reflective street name signs. The certificate shall state that the reflective street name signs meet the wind load requirements as described above.

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The signs shall be attached to a 10-foot arm mounted 8 feet above the signal mast arm mounting, and extending from the shaft of the pole parallel to the signal mast arm. Each 10-foot arm shall have an end cap, a cable guide, and 3 sign mounting tabs with bronze bushings. The tabs shall be welded to the arm and shall be positioned 2', 6' and 8' from the outside end of the arm. The tabs shall be of such length that the center of the mounting hole in the tab shall be 4" below the center line of the arm. The hanging street name sign lower mounting assembly shall be mounted directly to the tabs with a 1/2-inch stainless steel bolt. The mounting is similar to that shown in Caltrans Standard Plan ES-33, view FF.

At locations with an existing pole, the arm shall be mounted using a clamp on type assembly as manufactured by Valmount Corp. The clamp on assembly shall have a minimum of four bolts, and a set bolt to assure the mast arm will not change position after it is installed and aligned. The mounting clamp assembly and arm shall be designed and constructed to prevent deformation or failure when subjected to 80-mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals," and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of mast arms. The certificate shall state that the arm and mounting assembly are designed to accommodate the internally illuminated street name sign mast arm assembly and meets the requirements as described above.

At locations where a new pole is installed, the arm shall be attached to a mounting plate on the pole using four high strength cap screws. The mounting plate attachment shall be designed and constructed to prevent deformation or failure when subjected to 100-mph wind loads as set forth in the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires, and Traffic Signals," and amendments thereto. A Certificate of Compliance conforming to these Special Provisions shall be submitted by the manufacturer with each lot of mast arms. The certificate shall state that the pole is designed to accommodate the internally illuminated street name sign mast arm assembly and meets the requirements as described above.

Signs shall be Type A.

## **Section 86-6.11B(1) Photoelectric Unit**

Section 86-6.11B(1) Photoelectric Unit, of the Standard Specifications, is hereby amended with the addition of the following before the first paragraph:

Photoelectric control shall be Type V for all new highway safety lighting and, when used, internally illuminated street name signs.

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## **SP 3.0 ADDITIONAL OR SPARE EQUIPMENT, ADDITIONAL WORK TO BE REQUIRED**

*This area shall be added to as additional sheets to be field out by the design engineer with any additional requirements and/or equipment necessary for this project. The design engineer shall use the follow format and list the SP3.0 section's as reference on the cover sheet.*

*The Contractor shall furnish the following additional or spare equipment:*

*Add here any requirements for spare or additional equipment:*

*Use the following format*

*SP 3.1 Traffic Signal Controller*

*SP 3.2 Malfunction Management Unit*

*SP 3.3 Detector Cards, Load Switches, BIUs*

*Etc.*

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## **SP 4.0 PAYMENT**

Payment for completing the Traffic Signal System shall be the lump sum bid per location for the **ITEM "TRAFFIC SIGNAL SYSTEM"** and no additional compensation shall be allowed therefore.