

***CITY OF CONCORD***  
***SPECIAL PROVISIONS***

***SIGNALS, LIGHTING & ELECTRICAL SYSTEMS***

*January, 2006*

## **Special Provisions**

### **Signals, Lighting & Electrical Systems**

#### **(86-1.01) Description**

*(Keep at all times for development work or capital improvement projects. **Remove** all notes in red when the final special provision is submitted with plans.)* New development work described in this section shall be done in accordance with Section 86 of the 1992 edition of the California Standard Specifications, the 1992 edition of the California Standard Plans, Construction Plans, and Special Provisions.

Public Works construction project work described in this section shall be done in accordance with Section 86 of the 1992 edition of the State Standard Specifications, the 1992 edition of the State Standard Plans, the City Standard Plans and Specifications, and the Construction Plans.

In case of conflict between any of the contract documents, the document, which takes precedence over and shall be used in lieu of such conflicting portions, shall be as specified in Section 5-1.04 of the State of California Standard Specifications.

#### **(86-1.03) Equipment List and Drawings**

*(Keep at all times when there are materials being provided by contractor.)* All product submittals shall be provided to the City, 7 calendar days prior to equipment and material orders.

The Contractor shall submit to the City, for approval, all applicable submittals including, but not limited to, manufacturer's catalog cut sheets, wiring diagrams, material descriptions, and any other material relevant to the components included in these Special Provisions. These submittals shall be approved by the City, prior to any equipment deliveries to the City. Any equipment that is delivered to the City and rejected by the City shall be removed at the Contractor's expense.

### **86-1.05) Maintaining Existing & Temporary Electric Systems**

*(Keep at all times. This shall apply to all conditions when there is a signal modification or newly installed signal)* Traffic signal system shut downs shall be limited to periods between the hours of 9:00 a.m. and 3:00 p.m. on regular workdays.

No overnight signal system shutdown is permitted, unless prior approval has been obtained in writing from the Engineer. All weekend and holiday work shall also require written approval from the Engineer.

### **(86-1.06) Scheduling of Work**

*(Keep for new signal installations. The bolded new or modified should apply to the appropriate situation)* The initial installation and turn-on of (**new or modified**) equipment shall be made on a Tuesday, Wednesday, or Thursday, if not a holiday. The turn shall be the first order of work for that day and all facets of the traffic signal installation shall be functional. Prior to turning on newly installed traffic signals, Construction Type III Barricades with a minimum 36 inch x 36 inch "Signal Ahead" sign and a portable flashing yellow warning light shall be placed on all approaches to the intersection. These barricades shall remain in place for a minimum of two days following the actual turn-on. In cases where signal sequence has been changed, the contractor shall be responsible for installing "Signal Operation Changed" signs on all approaches designated by the engineer. These signs are to be obtained from City personnel.

*(Keep these paragraphs if new controller assembly is being supplied and installed with the contract)* Present at the time of the turn-on shall be a representative from the Electrical Contractor, Controller Manufacturer (when applicable), Public Works/Engineering Services, and Transportation Division.

*(Keep at all times. This should be included when the possibility arises that work maybe be done by City staff.)* In the event that the Contractor is unable to respond to a problem that develops during the functional test, or for any reason is unable to correct the problem in a timely fashion, as determined by the City, the City may have its own maintenance personnel work on the problem. Any such work performed by the City shall not invalidate the guarantee provided for in these Specifications, and shall be at the Contractor's expense.

### **(86-2.03) Foundations**

*(Keep when any type of foundation or conduit work is being done as a part of the contract. All schedule 40 PVC shall be used so that all materials end up being grounded according to the National Electrical Code)* Schedule 40 PVC with bell bushings shall be used in all cabinet and pole foundations (See Detail Cabinet & Foundation). A 5/8 inch, 10-foot ground rod shall be installed in the foundation.

*(Keep at all times when a controller assembly is either modified with a new base or new installation)* The controller cabinet pad and service enclosure shall have a concrete walk access to it from the existing sidewalk or curb.

### **(86-2.04) Standards, Steel Pedestals and Posts**

*(Keep when new poles are being supplied as a part of the contract. This paragraph should be used in the event that the contractor provides any pole equipment.)* The identification number shall be bead welded or stamped on the

top of the base plate with minimum ½ inch characters in lieu of the riveted stamped identification number, as shown on the State Standard Plan ES-6S. On new poles supplied as part of the contract, the characters described above shall be installed at the factory prior to the galvanizing process.

*(Keep when new poles or modified poles are part of contract work. This was placed here to standardize maintain uniformity if the pole are kept by the City.)* Traffic signal poles shall be set back from face of curb no less than 30 inches to face of standard or pole, and the base plate installed parallel to the stop bar unless otherwise specified by the Engineer. All poles shall be leveled using a plumb bob.

*(Keep the next two paragraphs at all times when the contractor is providing any type of pole standard.)* All holes drilled for wire entry (i.e. junction box, pedestrian push button, and pedestrian clamshell) shall be filed to remove all sharp edges.

Any incorrectly drilled or otherwise damaged poles must be repaired to the manufacture's specifications at the expense of the contractor.

### **(86-2.05) Conduit**

*(Keep the all the following paragraphs in this section at all times when any underground work is being done by the contractor.)* Conduit runs shall have no more than 180° of bends, unless authorized by the Engineer, and shall enter the pull box vertically within +/-30°. When trenching for conduit installation, the top of the installed conduit shall be a minimum of 18 inches below finished grade in the street section. Where the roadway cross section is greater than 18 inches in depth, the finished height of the conduit shall be two inches below the roadway cross section. The trench shall be back filled with two inches of commercial grade sand with the remainder being 2% red oxide concrete.

Conduit installed in non-paved areas shall be covered with conductive plastic underground warning tape six inches above the conduit.

Schedule 40 PVC shall be used throughout the project. All new installed or existing conduits disturbed as a part of a project shall include the supply and installation of Mule Tape ¾" x 2500lb

The ends of conduits in pull boxes shall have Bell Bushings and be a minimum of two inches above the surface of the rock, and between eight and ten inches below the top of the pull box.

Loop stub outs shall be two-inch PVC with bell bushings on each end (See Detail "Type E Modified Loop Details Curb Termination").

### **(86-2.06) Pull Boxes**

#### **(86-2.06A) Materials**

*(Keep 86-2.06A-86-2.06C anytime pull boxes are provided or mentioned in the plans)* All pull boxes shall be of the Quazite "PG" style construction, or its approved equivalent prior to bid, and shall be gray in color. Pull box lids shall have a non-skid surface. The Number 6

(17" x 30") pull boxes shall be used throughout the project unless otherwise noted on the plans. Any primary pull box adjacent to the cabinet shall be 24 inches x 36 inches Quazite "PG" style or equivalent prior to bid. No bolt down lids shall be used.

**(86-2.06B) Cover Markings**

All pull boxes containing street lighting, interconnect, or service exclusively, shall be supplied with pull box lids that accurately reflect their contents. Pull box lids shall have the words "Traffic Signal," "Street Lighting," "Interconnect," or "Service" on the lid, and shall **not** be of the bolt-down type. Lids shall be protected or reversed during the course of construction. All lids damaged or scuffed from construction shall be immediately rejected.

**(86-2.06C) Installation and Use**

Pull boxes in non-paved or asphalt areas shall be constructed with a minimum 3-1/2 inch deep x12 inch wide concrete apron.

On all runs, the spacing of pull boxes shall not exceed 270 feet measured along the conduit. On those runs exclusively for "interconnect," the spacing of pulling points or pull boxes shall not exceed 750 feet, unless otherwise directed by the Engineer. No drain hole or grout shall be placed in the sump area.

A minimum of six inches of 3/4 inch rock shall be placed under each pull box. All pull boxes shall be inspected and approved prior to pulling any conductors.

**(86-2.08) Conductor**

**(86-2.08E) Signal Interconnect Cable**

*(Keep this paragraph anytime SIC is being installed or furnished by the contractor.)* Signal Interconnect Cable (SIC) shall consist of 25 pair #22 AWG solid twisted pairs and comply with Rural Electrification Administration (REA) Specification PE-22 at 5 twists per foot, or as determined by the Engineer. A quality assurance certification shall be provided. If the existing interconnect is to be cut and connected, the contractor shall notify the engineer 24 hours in advance. No more than 48 hours shall pass with the interconnect cable severed.

**(86-2.09) Wiring**

**(86-2.09B) Installation**

Only poly-based lubricants shall be used. Each new conductor shall be installed with six feet of slack in each pull box. Conductors shall not be pulled into conduits until the pull boxes have been set to grade and 3/4 inch rock installed.

Conductors shall not be pulled into conduits unless a traffic signal representative is present to observe the operation. The end of all unused conductors and cables shall be sealed.

**(86-2.09D) Splicing**

*(Keep anytime new or rewiring will be used in the contract)* Conductors shall not be spliced in the pull box nearest the controller, but shall be continued to terminals in the cabinet. All conductors, including neutrals, shall be spliced by methods shown on State Standard Plan ES-13. Splices shall be soldered using 60-40 rosin core solder only. Splices shall be insulated by Method "B" as shown on State Standard Plan ES-13.

**(86-2.10) Bonding or Grounding**

*(Keep at all times when conduit work is being done)* The grounding jumper at each pole shall run continuous to the adjacent pull box attached to the bond wire using Nico Type, or equivalent, compression connector and be soldered with 60-40 rosin core solder. All grounding wire shall be No. 8 solid copper wire.

**(86-2.11) Service**

*(Keep when there is a new or modified service cabinet furnished by contract)* The Contractor shall coordinate with Pacific Gas and Electric Company for any necessary service modification. Any fees and costs required by the utility company shall be borne by the Contractor.

Contact Customer Service:

Pacific Gas and Electric  
1030 Detroit Avenue  
Concord, CA 94519  
(925) 674-6457

The service cabinet(s) shall be Type III-AF *(Determine what type of BBS will be used with service enclosure select either Class 26-000-M-A-UPS or Class 22-46)* Class 26-000-M-A or City approved equal prior to bid (see Detail Service Enclosure). Service shall have a 100-ampere, 2 pole, main circuit breaker with a 50-ampere signal circuit breaker, and a 30-ampere lighting circuit breaker. The service enclosure shall be 12" Wide X 50" High X 7 1/2" Deep.

- Service enclosure shall meet EUSERC requirements.
- Interior of service enclosure shall be fabricated from 14-gauge cold rolled steel and painted white.
- Service enclosure shall be electrostatically painted Bel Tel Green. *(or Todos Santos Blue-contact City for final determination)*
- Service enclosure shall have continuous welded seams.
- Service enclosure shall have full length deadfront with stainless steel hinge.
- Service enclosure shall be fabricated by a manufacturer carrying a UL 508 listing.
- Service enclosure shall have pull section with removable strap.
- Service enclosure shall have fully framed side hinged outer door with swaged close tolerance sides for flush fit with top drip lip & closed cell neoprene flange compressed gaskets.

- Service enclosure shall have hinged deadfront with ¼ turn latch & knurled.
- Deadfront door shall be hinged on the same side as the exterior door & open a minimum of 100°.
- Removable backpan shall be mounted on 4 welded ¼” studs.
- All circuit breakers shall be mounted in a vertical position, handle up for “On” handle down for “Off”.
- Service enclosure shall consist of absolutely prewired in the factory.
- Wiring will be NEMA IIB standards showing external connections & external equipment.
- All bussing shall be UL approved copper THHN cable bussing, fully rated.
- The function of all circuit breakers, switches & other components as required shall be identified by laminated engraved plastic nameplates with minimum ¼” letters fastened with minimum of two #4-40 stainless steel machine screws.
- Wiring schematics include all external equipment & connectors per NEMA IIB.
- As Built factory drawings shall be included and mounted inside the outer door by welded hooks.
- Manufacturer will be required to furnish independent laboratory certification of metal preparation & finish to confirm that the overall product meets these specifications.

Traffic signals and street lighting shall be metered.

Intersection street lighting conductors shall be in a separate conduit from the main traffic signal pull box to the service cabinet.

**(86-2.14) Testing**

*(These next few paragraphs apply when the contractor is supplying the controller assembly)* Prior to field installation, the traffic signal controller(s), wired cabinet(s), and all auxiliary control equipment shall be delivered, by either the Contractor or the Manufacturer, to the City of Concord, Traffic Signal Operations, 1455 Gasoline Alley, Concord, California, where the City will perform the necessary equipment testing.

The City will test the controller equipment for continuous, satisfactory operation (without failure) for 21 consecutive calendar days. Delivery of controller equipment for testing shall occur a minimum of 30 calendar days prior to being picked up by the contractor for installation.

When the controller cabinet has been satisfactorily shop tested, a representative from the traffic signal department will notify the Contractor that the cabinet is available to be picked up. The Contractor shall provide equipment and personnel, as necessary, to safely load the controller cabinet.

**(86-2.14B(3)) Insulation Resistance**

*(Keep this paragraph anytime loop work is in contract)* Insulation resistance of the loops shall be measured prior to sealing. Final resistance to ground shall be greater than 500 Megohms.

**(86-2.16) Painting**

*(Keep the next few paragraphs when contractor furnishes the controller cabinet for the project)* The service cabinet and battery back-up system exteriors shall be powder coated as identified in the sections to follow.

The interior of the controller, service, and battery back-up system cabinet shall be semi-gloss white.

All traffic signal frameworks, and heads, shall be "factory powder coated" in lieu of conventional painting. Signal heads and frame works, as a unit, shall be installed by the contractor at the job site. Extreme care shall be taken by the contractor's workers during the installation of the signals, frame works, and heads. Any scarred marks or cosmetic damage to the equipment caused from tools or installation processes shall be cause for rejection.

The factory powder coat finish shall be applied as described below:

- 1) Pretreatment Process
  - a.) Acid etch degreasing bath
  - b.) Clean water rinse
  - c.) Iron Phosphate adhesion bath
  - d.) Clean water rinse
  - e.) Non-chromate acidulated seal bath
  - f.) Thermal Set Process
  - g.) Convey parts through drying oven for ten minutes at 300 to 400 degrees/F.
  - h.) Apply polyester or epoxy based dry powder coating at 75-90 KV.
  - i.) Convey parts through curing oven for thermal setting for 20 minutes at 400 degrees/F.

Galvanized poles and controller cabinets requiring painting shall follow the procedures shown below:

- a.) The new surface must be solvent-cleaned to remove all oils prior to etching using Dunn Edwards Galva-etch etching liquid GE123 or equivalent prior to bid.
- b.) The surface must then be primed with a primer equivalent prior to bid to the Dunn Edwards Galv-Alum quick dry galvanized/aluminum primer QD 43-7.
- c.) The surface must then be applied with Dunn Edwards SYN-Lustro high performance alkyd gloss enamel 10 series or equivalent to help prevent degradation from adverse environmental conditions.
- d.) The surface shall then be applied with two coats of Todos Santos Blue (Dunn Edwards **Color Number/Name: Deep Blue/10U, Mixing Base:**

**OTHER U/1 Gallon, Formula: 4-1y42,14-7,9-3y36,11-4y21)** or Bel Tel Green (Dunn Edwards **Green/10-M, GALAX Master M/1 Gallon, Formula: 1-2y10,4-2y18,13-44,11-14)** or equivalent prior to bid.

*(Keep this paragraph when cabinet is being re-used in contract)* **(All existing cabinets shall be repainted. The cabinets must first be sanded and then primed. Any corroded spots shall be neutralized with a corrosion inhibitor prior to priming. The cabinet shall be painted with two coats of paint as designated by the City.)**

**(86-3.01 to 86-3.07) Controller Assemblies**

*(Keep when entire controller assembly is supplied or reinstalled by contract)* The Contractor shall install a controller assembly of the following general description, unless otherwise specified:

Type 90 NEMA Controller Assembly, including controller unit, completely wired controller cabinet, inductive loop detector sensor units, conflict monitor, and load switches.

Each controller supplied and/or reinstalled by the contractor, as shown on the plans, shall be compatible with the City's designated controller system.

1. Conductors within cabinets shall be cabled together with self-clinching nylon cable ties. Where appropriate, nylon braided wire loom shall be used throughout the cabinet to maintain a neat and tidy cabinet. Cabinets shall be constructed of aluminum. All connectors for cabinet equipment shall have wires installed on all pins. Spare or unused wires shall be long enough to reach the farthest terminal on the termination panel, with two inches to spare. All unused conductor ends shall be labeled with a wire code marker, insulated, and folded back in a wire bundle.
2. All Type 90 Controller Assemblies supplied and installed by contractor shall conform to the following:
  - a) All "A", "B", "C", and "D" cables shall have a minimum of 2½ feet of slack. All connectors shall be supplied with military specification grade connections.
  - b) They shall be wired for all detectors called for on the Contract Plans or in the Special Provisions, and shall include two spare harnesses wired to the terminal block. Detector cables shall have one foot of slack from edge of shelf to plug strain relief. Wired entries shall be protected with split loom or protective insert to prevent from abrasion or chafing.
  - c) One "D" Connector shall be supplied and wired using Military Specifications MS-3126F24-61S and shall have the pin assignments specified in Table 1.

- d) Terminals, relays and other equipment mounted on the cabinet wall shall be accessible without removal of any equipment housed on the shelves. All terminal block bases for field connections shall be made of bakelite material, general purpose phenolic rated at 150 degrees Celsius.
- e) The convenience receptacle shall have ground-fault circuit interruption as defined by the National Electrical Code. Circuit interruption shall occur on six milliamperes of ground-fault current and shall not occur on less than four milliamperes of ground-fault current. An additional 6-position power strip shall be mounted to the left side wall of the cabinet below the upper detector shelf. The power strip shall be connected to the line side of the GFCI.
- f) The lighting fixture installed in each cabinet shall use the Type B door actuated "On-Off" switch, and shall use a F15T8 CW Lamp. Each cabinet shall include two individually temperature-controlled fans.
- g) The cabinet shall be equipped with Type 66B4-25 Telephone Termination Block (25 pair), and shall be mounted on the front left inside wall 2"-4" from the door of the cabinet mounted vertically alongside the 6-position power strip.
- h) Cabinet shelves shall be arranged to accept and store detectors on the top shelf. There shall be 19 inches between the top shelf and the lower shelf. Below the lower shelf shall contain a slide out document drawer with a riveted hinged upward see through ¼" Plexiglas top. A rack that holds two phase selector cards for emergency vehicle preemption shall be installed approximately 4" from the left cabinet wall of the upper shelf.
- i) When the cabinet auto-flash door switches are in the "Auto" position, the intersection shall go into an all red flash mode when the conflict monitor is disconnected and cabinet door is closed.
- j) Conflict Monitor Unit (CMU) input conductors shall be connected to the field terminals.
- k) Cabinets shall have pre-drilled installation lifting brackets mounted on the cabinet with ¼ inch x 20 (threads per inch) x ¾ inch SS carriage bolts. Lifting brackets shall meet requirements of the Transportation Engineering Electrical Specifications for a 332 cabinet and match the color of the cabinet and be painted separately.
- l) The cabinet shall come with three sets of blue prints identifying the intersection by name, including the intersection layout by phase; and identify all loop detectors and DLC 's with the North arrow pointed to the top of the page. An electronic file shall be included with the cabinet.

- m) The cabinet door filter opening shall be standardized at 12 inches x 16 inches x 1 inch and utilize a spring loaded retaining mechanism that will securely hold a pleated cardboard filter in place without deforming the filter.
- n) The police panel shall include a ¼inch RCA phone plug clearly labeled “Stop Time” and wired to the stop timer for all pre-programmed standard ring structures. The cabinet shall also include a stop timer switch fully insulated ergonomic push button with 6-foot coin extension.
- o) Detector test switches shall be mounted on the cabinet door, 6” or less from the top.
- p) The 14-position load bay shall be mounted in a way that will allow hinging forward. The mechanism shall be firmly mounted with a continuous or welded rod with the hinge point being located on the wall of the cabinet. No bolt down rods will be allowed.
- q) A protective clear plexiglas shall be mounted to protect from inadvertent contact with power distribution assembly.
- r) A 3-position terminal block shall be used for incoming power at the power distribution assembly.
- s) All labels shall be attached with screws or the nut of the appropriate switch.

TABLE 1

CONNECTOR D		
PIN	FUNCTION	I/O
A	Special Function 4	I
B	Preempt 5	I
C	Preempt Interval 1	O
D	Preempt Interval 2	O
E	Preempt Interval 3	O
F	Preempt Interval 4	O
G	Preempt Interval 5	O
H	Preempt Interval 6	O
J	Preempt Interval 7	O
K	Preempt 5	O
L	N/A	-
M!!!	Cabinet Flash In (Warning)	I
N	UCF Soft Flash	O
P	Special Function 2	I
R	Hardwire System	I
S	Special Function 1 Out	O
T	Special Function 2 Out	O
U	Special Function 3 Out	O
V	Special Function 4 Out	O
W	N/A	-
X	N/A	I
Y	Special Function 6 In	I
Z	Special Function 5 In	I
a	Preempt 1	I
b	Preempt 2	I
c	Preempt 3	I
d	Preempt 4	I
e	Free Input	I
f	Split 2	I
g	Split 3	I
h	Coordination Active	O
l	Logic Ground	-
j	Preempt 1 Out	O
k	Preempt 2 Out	O
m	Preempt 3 Out	O
n	Preempt 4 Out	O
p	UCF Flash In	I
q	HW Flash	I
r	Offset 1	I
s	Offset 2	I
t	Offset 3	I
u	Cycle 2	I
v	Cycle 3	I
w	Special Function 1	I
x	Special function 2	I
y	Cabinet Door Open	I
z	N/A	-
AA	System Det 1	I
BB	System Det 2	I
CC	System Det 3	I
DD	System Det 4	I
EE	System Det 5	I
FF	System Det 6	I
GG	System Det 7	I
HH	System Det 8	I
JJ	External Resync In	I
KK	External 24 VDC	O
LL	N/A	-
MM	N/A	-
NN	N/A	-
PP	N/A	-

SPECIAL FUNCTION PANEL			
	A	B	
Detector 9	⊙ 901	⊙	Preempt 1 In
Detector 10	⊙ 902	⊙	Preempt 2 In
Detector 11	⊙ 903	⊙	Preempt 3 In
Detector 12	⊙ 904	⊙	Preempt 4 In
Detector 13	⊙ 905	⊙	Preempt 5 In
Detector 14	⊙ 906	-	
Detector 15	⊙ 907	-	
Detector 16	⊙ 908	-	
	- 910	-	
	- 911	-	
	- 912	-	
Telemetry 2W	⊙ 913	⊙	Chassis Ground
Telemetry 2W	⊙ 914	⊙	
Telemetry 4W	⊙ 915	⊙	
Telemetry 4W	⊙ 916	⊙	2070N DC Ground
Special Function 1 In	⊙ 917	⊙	Special Function 1 Out
Special Function 2 In	⊙ 918	⊙	Special Function 2 Out
Special Function 3 In	⊙ 919	⊙	Special Function 3 Out
Special Function 4 In	⊙ 920	⊙	Special Function 4 Out
Special Function 5 In	⊙ 921	-	
Special Function 6 In	⊙ 922	-	
	- 923	-	
	- 924	-	
	- 925	-	
	- 926	-	
	- 927	-	
	- 928	-	
	- 929	⊙	Door Ajar
	- 930	-	
	- 931	-	
	- 932	-	
	- 933	-	
	- 934	-	
	- 935	⊙	+24 VDC
Flash In (Ground In)	⊙ 936	-	

Unassigned (Capped) = -

**IMPORTANT**

**Note: Install Gas Discharge Tubes A to B for 913 thru 916**

**Note: No Jumper wires A to B = ⊙**

**Note: LL, MM, NN, and PP are to be tied and capped off.**

Output



Input



**(86-3.08B1) Pre-emption Equipment**

*(Keep when the pre-emption equipment is contractor installed or furnished)* The Contractor shall and shall install required optical detectors, card rack, cards, and cables (complete and operable) as shown on the plans and according to the manufacturer's recommendations.

The Engineer will mark the optical detector location for the Contractor. The Contractor shall notify the Engineer at least 24 hours prior to installing the optical detector.

Depending on the line of sight, the Engineer may direct the Contractor to install the optical detector on the signal mast arm by utilizing a 3/4 inch conduit.

Mounting of the optical detector on a 3/4 inch diameter conduit stub shall conform to the following:

Signal Mast Arm - Install by drill and tap method or Pelco Bracket AB-132-29 with 1 1/2 inch to 3/4 inch reducer.

Type 1 Standards - If necessary, retrofit signal framework and hardware.

Optical detectors shall not be mounted on vehicle heads. Optical detectors shall be 3M, Type 721, compatible with the City and Contra Costa County Consolidated Fire Prevention District (CCCCFPD).

Optical cables shall be labeled in the controller cabinet and in the pull boxes adjacent to the signal standards with appropriate phase designations.

Cable shall be 3M, Model #138, or Clifford 3C20 T7OS, or Engineer approved equal, and shall be installed with six feet of slack in controller cabinet and pull boxes. The cable shall not be spliced. The City and/or the CCCCCFPD will test the optical system. Tests will be performed a distance between 300 feet to 1,800 feet between the emitter and the detector being tested.

**(86-08C) Monitoring Device**

The NEMA Conflict Monitor Unit (CMU) shall meet requirements outlined in Section 4 of the NEMA Standard TS 1-1989 Traffic Control Systems and the following requirements:

- a. The green, yellow, red, and Walk indications for each phase shall be brought into the monitor individually and shall be monitored separately with respect to a loss of signal on any of the four inputs per channel. Any dark signal head (i.e., loss of signal output to field terminals) shall cause the monitor to trip. If channel has plus functions enabled, a "Walk Only" is considered a switch failure.
- b. Each channel can be individually enabled for "plus" function monitoring.

- c. The monitor shall allow early detection of a conflict caused by a continued green signal after the yellow signal is energized, or a yellow signal, which stays energized after the red, is energized. The fault times shall start immediately instead of waiting for another conflicting signal. This shall preclude the presentation of a conflicting signal display at the intersection. Selectivity as a plus feature.
- d. During the all red clearance period (if used), the monitor shall check all inputs for faulty signal display and shall react to these faulty indications during the all red clearance period. Since, during this period, the only inputs that should be active would be the reds, the monitor shall detect any faults such as red/green, red/yellow, green/yellow, and green/red/yellow. Selectiveness as a "plus" feature.
- e. The monitor shall be capable of monitoring for incorrect signals applied at the field terminals of each vehicular movement (green, yellow, and red,
- f. Walk) of a channel, the unit shall begin timing the duration of this condition. If the condition lasts for more than 1000 milliseconds, it shall trigger. The unit may or may not trigger if the condition exists for between 700 milliseconds and 1000 milliseconds.
- f. When the unit triggers, it shall cause the output relay contacts to transfer. These contacts shall remain in this state until the unit is reset by the activation of the control panel. Power interruption shall not reset the conflict monitor.
- g. If the monitor detects a load switch failure condition, the switch failure indicator shall be illuminated and the signal status indicators shall display the channel of the load switch that failed.
- h. After a power outage, before which there was a fault, the monitor shall correctly show the previous fault. This shall include fault type and channel which was in error.
- i. Red fail timing shall be computed for each channel individually. Alternative overlapping red failures on two channels shall not cause the monitor to trip if each channel's red failure does not exceed the red fail timing.
- j. Monitor diagnostics of front panel LED's and major circuit blocks shall be available.
- k. Monitor shall detect (selectiveness from 2 to 15 seconds) on missing yellow cycle. Enable on a per channel basis.
- l. Non-volatile storage of the beginning and end of last 20 latched and non-latched faults. Ability to clear storage.
- m. Monitor and log last 10 occurrences of low AC+ or power outages.

- n. RS232 Printer output.
- o. Dipswitch enable of latching 24V, CVM faults. Dipswitch enable of CVM logging.
- p. The minimum indicators shall be as follows:
  - 01. Power-flashes during low AC and minimum flash time.
  - 02. +24 #1, #2 - shall illuminate if the 24V I or II input goes below 22V threshold voltage.
  - 03. Control Voltage Monitor - shall illuminate when a true voltage (low) is not present on the Control Voltage Monitor input.
  - 04. Conflict - shall illuminate when a conflict has been detected by the monitor.
  - 05. PC Ajar - shall illuminate when the program board is not installed or not seated correctly.
  - 06. Red Fail - shall illuminate when a red failure has been detected.
  - 07. Switch Fail - shall illuminate when a faulty load switch has been detected by the monitor.
  - 08. Yellow Fail - shall illuminate when a short or missing yellow cycle is detected.
  - 09. Microprocessor Fail - shall illuminate when microprocessor ceases to function correctly.
  - 10. Channel and additional information LCD display.
    - ✓ Alphanumeric display for upper and lower case letters.
    - ✓ Single LCD display, NEMA 6 & 12 (16 columns by 4 rows)
    - ✓ Multiple source LCD
    - ✓ Electro-luminescent back lighting

**LCD Normal Display to Include:**

Simultaneous Field Terminal Status for all red, yellow, green and walk terminals.

**LCD Fault Display to Include:**

- Channel status at time of fault
- Time of fault
- Type of failure - conflict, dark fail, switch fail, 24V 1 or 2, CVM, short yellow timing, skipped yellow, time of failure

**Additional LCD Displays Selectiveness:**

- Display of the all permissives as read from the program card

- Date and time
- Software version
- Diagnostics and setup

**Printed Reports Selectiveness:**

- Complete status
- Configuration
- Fault history
- Power history
- Permissives
- Intersection analyzer history

**(86-3.08D) Solid State Switching Devices**

*(Keep when new controller assemblies are contractor furnished)* Load switches shall monitor, with LED's, both input from the controller and output to the field conductors.

Load bays shall be hardwired. Printed circuit load bays shall not be used.

Cabinet wiring, bus bars, terminals, relays, switches, etc. shall have a current rating sufficient for the total maximum signal load at the intersection during any phase of operation.

**(86-3.09A) Flash Transfer Relay**

A red sleeve shall be installed on each flash bus wire.

**(86-3.11) Model 2070N Controller Assembly**

**Traffic Signal Controller Hardware**

*(Keep this section when the contractor is to furnish a controller unit with software.)* The Contractor shall supply the Model 2070N Controller units from the City's existing purchase contract #1793 as specified herein and shall supply (1) of each bid item 1, 2, and 3. The Model 2070N controller and module shall conform to the requirements in "Transportation Electrical Equipment Specifications" (TEES) published by the California Department of Transportation (Caltrans) dated November 1999 as currently amended. The Controller assemblies shall be listed on the current Caltrans Qualified Products List (QPL). If the Model 2070N is not currently on the QPL, the Contractor shall expedite the inclusion of the equipment on that list.

The 2070N Unit Controller Unit shall consist of:

- |               |                                     |
|---------------|-------------------------------------|
| Model 2070-1B | CPU Module                          |
| Model 2070-2B | Field I/O Module for a NEMA Cabinet |

Model 2070-3B	Front Panel Assembly (FPA)
Model 2070-4A	Power Supply Module
Model 2070-5A	VME Cage Assembly
Model 2070-6B	Modem Serial Communications Module
Model 2070-8	NEMA Interface Module physically and electrically attached to the 2070 Unit
2070N	Back Cover

#### Model 2070-1B CPU Module

Shall be a single board resident in Slot A5 consisting of connectors C13S and C14S, Datakey and CPU Module Software.

#### Model 2070-2B Module

Shall consist of the Field Controller Unit, Data key, Serial Communication Circuitry, Module Connectors C12S & C13S mounted on the module front plate, and required resident software.

#### Model 2070-3B Front Panel Assembly

(FPA) shall consist of a Metal Panel with latch assembly and two TSD #1 hinge attaching devices, Assembly PCB, FPA Controller, two Keyboards, AUX Switch, Display B, External Serial Port Connector, CPU Activity LED Indicator, and FP Harness Interface.

#### Model 2070-4A Power Supply Module

Shall be independent, self-contained Module, vented, and cooled by convection only. The Module shall slide into the unit's power supply compartment from the back of the Chassis and be attached to the Back-plane Mounting Surface by its four TSD #3 Devices.

#### Unit Chassis and Model 2070-5A VME Cage Assembly

Shall consist of the metal housing, Serial Motherboard, Back-plane Mounting Surface, Power Supply Module Supports, slot card guides, Wiring Harnesses, and Cover Plate(s). The Model 2070-5 VME cage assembly shall consist of 3U Five Slot/Connector VME Cage, Front Mounting Plate, and PS1 Harness. The VME Cage shall conform to VME Standard IEEE P1014/D12 for 3U Cage. All slot/connectors shall be A24: D16 Interface.

#### Model 2070-6B ASYNC/Modem Serial Communication Module

Is resident in 2070 Unit Slot H1. The data modulation rate shall be 9600 baud.

#### Model 2070-8 NEMA Interface Module Chassis

Shall be made of 0.06 inches (1.524 mm) minimum aluminum sheet and treated with clear chromate. The Module shall consist of the Module Chassis, Module Power Supply, FCU Controller, Parallel Input/Output Ports, Serial Communications Circuits and Module Connectors.

### Model 2070N Back Cover

Shall be made of 0.06 inches (1.524 mm) minimum aluminum sheet and treated with clear chromate. All external screws, except where called out, shall be counter sunk and shall be Phillips flat head stainless steel. The matching nuts shall be permanently captive on the mating surfaces.

### Traffic Signal Controller Software

The Contractor shall install Version 60 compatible and completely functional with Streetwise™ centralized traffic signal controller software for Model 2070N Advanced Traffic Controller (ATC) traffic signal controller prior to delivering the controllers to the City for testing. The most current version of Version 60, at the time of project advertising, shall be fully configured in the Model 2070N ATC controller.

The Contractor shall provide licenses, which include the basic support and integration for use of this software, if necessary.

### Hardware Features

- Meets and exceeds NEMA TS-1 and TS-2 specifications
- Socket mounted IC's
- Program and data memory stored on EEPROM
- Data module option for data transfer to new machine without downloading new data through serial port.
- 20 Position keypad with audible feedback
- Backlit 4x40 character, temperature compensated LCD screen
- Real-time clock accurate to within 0.005% over 24 hour period

### Environmental Specifications

- Operating temperatures of –30 degrees Fahrenheit to +165 degrees Fahrenheit at 95% non-condensing humidity.
- Input voltage of 89 Volts AC to 135 Volts AC at 60Hz

### Operational Specifications

- 16 Phases mapped to any 24 available channel outputs, 4 timing rings
- 16 overlaps mapped to any 24 available channel outputs
- 64 detector inputs per 24 detector inputs
- Fully NTCIP database compliant
- Optional configuration modes i.e., diamond interchange operation
- Built in diagnostic routines

### Actuated Control Specifications

- NEMA TS1, TS2 standard timing
- Call redirection and inhibiting per phase
- Dynamic max times based on volume or density
- 24 channels of output on A-B-C- connectors
- Dimming selectable by color and hertz
- Mappable control source per channel

### Coordination Specifications

- 2 types of NTCIP coordination modes, fixed and floating force-offs
- 7 types of vendor provided alternate coordination modes
- 5 optional modes of walk recycle during coordination
- External coordination I/O
- Critical Intersection Control (CIC) dynamic coordination patterns
- 48 patterns with unique cycle, offset, split times and sequence patterns
- Programmable transition percentages for fast and slow modes
- Selectable coordination point (begin or end of green time) of coordinated phase
- 24 programmable sets of split times
- Coordination status displays
- Manual pattern enable, including flash and free selections

### Preemption Specifications

- 6 selectable fire or rail preempt programs
- 4 selectable transit programs
- Coordination during preempt
- Programmable minimum delay times

### Time of Day Specifications

- 24 programmable day plans selected by time of day
- 100 action plans selecting pattern, 3 possible auxilliary functions, 8 special outputs
- Automatic daylight savings time change
- Day plan copy function
- Manual control screen
- Programmable real time clock
- 48 possible time of day patterns that select alternate timing, phase options, and detector maps

### Detection Specifications

- 64 channels of detection
- Multiple stop bar modes
- Three activity diagnostics per channel
- Alternate detector setup selectable by time of day
- Call, extend, queue, yellow/red locking and added initial per detector
- Switch phase detectors
- Delay inhibit phases
- Volume/occupancy report with dynamic reporting periods
- Red, yellow, green, or combination per channel

### Communication Specifications

- Programmable central system port which communicates up to 57.6 Kbaud

- Programmable system down link port that can communicate up to 57.6
- TS2 SDLC port for internal cabinet I/O control when in full or part TS2 mode
- PC/print port to allow for diagnostic testing without disconnecting the controller from the system.
- Optional frequency shift keyed (FSK) internal hardware modem port up to 9600 baud
- Auxiliary RS232 port for communications to conflict monitor, detector rack, temperature alert, etc.

**Diagnostic Specifications**

- RAM/ROM test diagnostics
- Communication port test diagnostics
- Connector test diagnostics
- All 64 detectors support TS2 type detector diagnostics
- The 8 pedestrian detector inputs support same diagnostics

**“D” Connector Adapter Harness**

The Contractor shall ensure the controller can accommodate the City’s existing “D” as shown in Table 1 connector assignments including emergency vehicle preemption and other features. An adapter harness shall be constructed and provided as necessary. Documentation of the pin outs and a wiring diagram shall be supplied to assist the City in making the needed connections.

**Telemetry**

The external telemetry to and from the controller shall be via the communications module on the controller. An adapter cable shall be constructed and provided as necessary to interface the controller’s communications module to the cabinet’s telemetry interface. The contractor shall provide assistance in the field as needed to assist the City in the installation of the telemetry harness.

**Traffic Signal Controller Installation**

Prior to installation of the traffic signal controllers, the Contractor shall deliver (F.O.B.) the Model 2070N controller assemblies (including all auxiliary equipment required for the controller and cabinet assembly to be operational as specified in these Special Provisions) to the City of Concord Corporation Yard Traffic Operations, 1455 Gasoline Alley, Concord, California for the designated 21 day operational testing period.

The Contractor shall be responsible for the transport of the equipment to the test facilities and from the test facilities to the project site. Deliveries shall be made on Monday through Thursday between 8:00 a.m. and 5:00 p.m.

All shipping cartons and cabinets shall be externally labeled with the name of the final installation location.

The manufacturer of the controller system shall certify to the Engineer that the controller hardware and software has been thoroughly bench and operationally tested, and that as a controller system, all components are operating in conformance with these Special Provisions.

During this time, the signal timings to be used in the field will be installed by City staff.

City staff will install the traffic signal controller.

### **Documentation**

Two manuals shall be supplied for all equipment and components of the system. Documentation shall be supplied explaining the operation of all system features.

### **(86-4.01) Vehicle Signal Faces & Signal Heads**

*(This section shall apply to all indications mounted on signal pole standards)* Until ready for use, new or relocated signal faces shall be securely covered so that no signal indications are visible. A flash hole no larger than one inch in diameter may be placed in front of each lens. Traffic signal heads shall be of black metal construction. Mounting hardware shall be as per July 1992 State Standard Plans (ES-3A), unless otherwise indicated on the Project Plans.

Terminal compartments, Mast Arm Side (MAS) and Mast Arm Top (MAT) mounts, curved washers, and slip fitters shall be bronze; All framework, pedestrian housings, clamshell, and pedestrian button housing shall be factory matte black. LED's per these special provisions shall be furnished and installed by the contractor. Programmed visibility heads shall be furnished factory set at four degrees for through lanes and eight degrees for left turn phases, unless shown otherwise on the plans. All program visibility heads shall be furnished with LED retrofits for all red, yellow, and green indications, warranted for a period of 5-years.

"Knock Out" type seals are not acceptable for sealing unused pipe thread connections to terminal compartments, or top/bottom of signal heads. Connections shall be sealed with threaded fittings with a rubber gasket, or by the use of a "ornamental cap" designed for such purpose.

The Contractor shall exercise care at the time the signal heads are installed to insure that the gaskets provided for the mounting of the heads are installed on the outside of the housing to provide a watertight seal. Gaskets shall not be placed on the inside of the housing.

All back plates shall be of louvered black metal with 5-inch border, unless otherwise indicated on the Project Plans.

Programmed visibility heads shall have dimming circuits; and power to lamp must be automatically removed when rear door is opened.

## A. Circular LEDs, red, yellow, and green

- *(The next few paragraphs apply to the specifications of red, green, and yellow LED indications.)* **General-**This specification covers LED red, green, and yellow LED modules to be used in place of the incandescent lamp, reflector, socket, gasket, and lens assembly of the vehicle signal sections. This special provisions applicable to new construction projects and also to retrofit of existing signalized intersections. The circular red, yellow, and green ball shall be Dialight Model 433 or equal prior to bid. The arrow red, yellow and green shall be three row Dialight Model 432 or equal prior to bid.
- Referenced vehicle type LED modules shall fit in all standard, incandescent vehicle traffic signal housings. Each module shall incorporate a printed circuit board inclusive of all of the LEDs and required circuit components, 39 inch 16 AWG wire leads with strain relief and spade terminals, a rigid housing for protection in shipping, handling and installation, and a one piece neoprene gasket. *Screw-in* type products are not allowed for vehicle signals. The individual LEDs utilized in red, green, and yellow ball type lamps shall utilize the latest technology in thermal management including an integral copper slug that is imbedded into the LEDs. Each individual LED shall be rated to withstand in excess of 1 watt of power at 25° C, during continuous operation. Ball lamps shall contain no more than 18 LEDs.
- Outer lenses for ball type modules shall be made of ultraviolet stabilized polycarbonate, and shall serve to enhance the optical efficiency of the LED traffic signal module. Individual *lens-lets* are specifically not allowed. Red, green, and yellow ball type signals shall incorporate an inner fresnel lens that is sealed to the lamp housing, and serves to collimate the light emitted by the LED light engine. The outer lens shall serve to focus the collimated light, so as to meet ITE intensity and distribution standards. Additionally, red, green, and yellow ball lamps shall almost perfectly, approximate to the motorist, the appearance of an incandescent traffic signal. This means that the surface of red, green, and yellow ball LED lamps shall appear to the motorist as nearly totally uniform in illumination, and have a wide viewing angle that makes it suitable for installation on wide boulevards or single-tethered span wire. This also means that it shall not be apparent that LEDs are used as the light source for red, green, and yellow traffic signal ball type lamps. The external lens surface for all vehicle signals shall be smooth, with no raised features, so as to minimize the collection of dirt, diesel smoke, and other particulate contaminates, and to facilitate periodic cleaning. External lens facets are not allowed. The lens shall be keyed to the housing of the LED signal module to insure the proper orientation and to avoid possible rotation during any handling. External lenses shall be hard-coated in compliance with Caltrans specifications.
- The LEDs shall be mounted and soldered to a printed circuit board. The LED signal module shall be watertight when properly installed in a traffic signal housing.
- LED signal module shall utilize the same mounting hardware used to secure the incandescent lens and gasket assembly, and shall only require a screwdriver or standard installation tool to complete the mounting. The LED signal module

assembly shall weigh less than 5 pounds. For vehicle signals, the incandescent lamp sockets and reflectors shall be removed from the signal head housings, to ensure customer long-term compliance with utility company rebate programs. So as to minimize possible maintenance problems, the LED lamp module may not protrude into the signal visor area more than three-quarters of an inch in depth.

- The housing of the LED signal module shall be marked 'TOP' to designate the proper orientation of the LED signal module in the traffic signal housing. The housing of red, green, and yellow LED ball type traffic signal modules shall utilize a *partial, embedded and integral metal layer*, in its design and construction. Manufacturers part number, date code, and electrical characteristics of the LED signal module shall be visible on the rear of the assembly. A label shall be affixed to back of the red and green ball type modules, that certifies their complete compliance with the July 1998 ITE VTCSH, Part II specification for LED traffic signal modules.
- The LED traffic signal lamp manufacturer shall be ISO 9001 certified and a registered U.S. EPA Energy Star partner. With the exception of yellow ball lamps, all LED lamps shall be Energy Star compliant.
- **Optical**-The light intensity, chromaticity, and distribution for red, green, and yellow ball and red, green, and yellow arrow LED signal modules, and LED pedestrian signals, shall have been tested by Caltrans, and found by same, to be in compliance with Caltrans specifications. Additionally, red and green ball LED lamps shall meet the July, 1998 ITE VTCSH Part II, standards and measurement criteria for LED traffic signal modules.
- The control circuitry shall prevent the current flow through the LEDs in the off state to avoid any false indication as may be perceived by the human eye, during daylight and *evening* hours. The LED traffic signal module shall be operationally compatible with NEMA TS - 1 and NEMA TS - 2 *conflict monitoring* parameters. The intensity of the LED signal module shall not vary by more than 10% over the allowable voltage range.
- Power factor shall be 0.90 or greater, at nominal rated voltage, at 25°C, after 60 minutes of operation. Total harmonic distortion (THD) shall be less than 20% at rated voltage, at 25°C.
- All LED traffic signal modules shall be in compliance with FCC noise regulations and must meet the FCC Title 47, SubPart B Section 15 regulation.
- The red and yellow LEDs shall utilize exclusively AlInGaP technology, either AS (Absorbing Substrate) or TS (Transparent Substrate), and shall not exhibit degradation of more than 30% of their initial light intensity following accelerated life testing (operating at 85 degrees C and 85% humidity, for 1000 hours). AlGaAs technology is not acceptable.
- The green LEDs shall utilize Indium gallium nitride technology. Green LED traffic signal modules shall not be illuminated when the applied voltage is less than 35 VAC. They shall be illuminated (unregulated) when the applied voltage is 45 VAC to 80 VAC. Their illumination shall be in compliance with the July 1998 ITE VTCSH, Part II, when the applied voltage is between 80 VAC and 135 VAC.
- The LED signal modules shall be connected directly to line voltage, 120 Volts AC nominal, and shall be able to operate over the voltage range of 80 VAC to 135 VAC.

- The 12" red ball units shall consume no more than a nominal 10.5 watts at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 13 and 17 watts respectively, at 120 VAC, at 74 degrees centigrade. They shall also have been tested by Caltrans, as a model and type, and found by Caltrans, to be Caltrans compliant
- Green ball LED traffic signal modules shall consume no more than a nominal 11.6 and 14.6 watts for the 8" and 12" lamps respectively, at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 12 and 15 watts respectively, at 120 VAC, at 74 degrees centigrade.
- Yellow ball LED traffic signal modules shall consume no more than a nominal 13 and 22 watts for the 8" and 12" lamps respectively, at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 16 and 25 watts respectively, at 120 VAC, at 74 degrees centigrade.
- Red arrow type LED traffic signal modules shall be temperature-compensated so as to maintain intensity at elevated temperatures. Red, green, and yellow arrow type LED traffic signals shall be tested and documented by CAL TRANS as being in compliance with CAL TRANS intensity standards for red arrows at elevated temperatures.
- Combination green-yellow bi-modal arrows shall utilize two rows of LEDs for each color. Each color shall have a minimum of 72 LEDs. Power consumption shall be 3.3 watts and 6.3 watts respectively, for the green and yellow indications.
- Transient voltage suppression rated at 1500 watts for 1 millisecond and fusing with a maximum rating of 2 amps shall be provided to minimize the effect and repair cost of an extreme over voltage situation or other failure mode.
- **Warranty**-All LED traffic signal modules supplied shall be warranted for 5 years against manufacturing defects.

**(86-4.05) Pedestrian Signal Faces**

*(This section shall apply to all pedestrian signal faces and modules)* All pedestrian signal faces shall be made of international symbol indications.

Pedestrian signals shall utilize Z-Crate type front screens and clamshell mounting (Detail CS) on July 1992 State Standard Plan ES-3B. The housing shall be made of metal construction. The pedestrian indication shall utilize a dual light emitting diode (LED) incorporating a portland orange hand and a lunar white walking man into the module and approved by applicable ITE specifications. The modules shall be Dialight, Leotek, or Precision Solar or an approved equivalent prior to bid. The module shall be interchangeable in signal housings used throughout the city. The module shall utilize a polycarbonate lens to diffuse light while eliminating reflection.

The module shall utilize InGap technology for the white walkman and AllnGap technology for the portland orange hand. The module shall maintain a standard warranty of 60 months free from manufacturer defects. LED's shall be displayed through a diffuser with the smooth surface positioned exteriorally. Outlined symbols are not permitted.

### **Audible Pedestrian Signals**

*(Audible pedestrian signals for the sight impaired shall be included in all projects, but supplied without being installed)*

The Contractor shall furnish Novax Audible Pedestrian signal or City-approved equivalent prior to bid. The audible pedestrian signal shall meet the following specifications:

- Size: 5.00" High, 3.75" Wide, 5.00" Deep
- Power Requirement: 115VAC  $\pm$  20 VAC, 60 Hz, 3 Watts
- Temperature Range: -37 to +74 Degrees Celsius
- Output: 90db per watt at one (1) meter with proportional control, Output will self adjust from a minimum volume setting to 90 decibels based on street level noise.
- The unit shall be completely weatherproof free of exposed wiring.

Audible output sound shall be as follows:

- "Cockoo" North-South audible signal (Electronic Bird Chirp) by method of electronic alternating high and low tones; Period: 1.5 seconds  $\pm$ 20%; Duration of 0.6 seconds  $\pm$ 20%; Frequency base of 1,100 Hz  $\pm$  20%; with frequency deviation +120 Hz  $\pm$ 20%.
- "Peep-Peep" East-West audible signal (Electronic Bird Chirp) by method of electronic varying frequency tone; Period 1.0 seconds  $\pm$ 20%; Duration of 0.2 seconds  $\pm$  20%; Frequency base of 2,800 Hz  $\pm$  20%; with frequency deviation -800 Hz  $\pm$  20%.

### **Countdown Pedestrian Signals**

*(This section should be kept if the engineer specifically calls for this on the plans. The consultant shall verify with the engineer.)*

The contractor shall furnish and install Dialight, Tassimco, Precision Solar, or approved equivalent prior to bid. Only single row outlined symbols and numerals are permitted. With countdown pedestrians signals, the modules shall include a 6" visor. The unit shall countdown the flashing "Don't Walk" prior to the clearance interval.

- LED countdown modules shall fit into existing 16" traffic signal housings built to VTCSH standards without modification to the housing.
- The LED countdown module shall be rated for use in the ambient operating temperature range of -40°C (-40°F) to +74°C (+165°F).
- The LED countdown module shall be completely sealed against dust and moisture intrusion per the requirements of NEMA Standard 250.
- The LED countdown module shall be a single, self-contained device, not requiring on-site assembly for installation into existing traffic signal housing. The assembly of the LED countdown module shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
- Three secured, color-coded (blue, red, white), 36 inches long, 600V, 16 AWG jacketed wires, rated for service at +105°C, are to be provided for electrical connections.

- The measured chromaticity co-ordinates for the "lunar white" walking man and the "Portland orange" hand and digits shall conform to the chromaticity requirements of section 8.04 and figure 1 of the VTCSH standard.
- The chromaticity measurements shall remain unchanged over the input line voltage range of 80 VAC to 135 VAC.
- The LED countdown signal module shall consist of a double overlay message combining the symbols of a hand and walking man and two 7-segment digits.
- The LED's shall be arranged in a manner to form an outline of the symbols. The shape of the outline shall conform to the standard symbols for pedestrian signals.
- The "Portland orange" LED's shall be of the latest AlIn GaP technology and the "lunar white" LED's of the latest In GaN technology.
- The driver board shall regulate the LED drive current on both hand/man messages to compensate for line voltage fluctuations over the range of 80VAC to 135 VAC. The luminous output shall not vary more than 10% over the voltage range and shall not be perceptible to the human eye.
- The drive circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as stated in section 2.1.6, NEMA Standard TS-2, 1992.
- The circuitry shall ensure compatibility and proper triggering and operation of load switches and conflict monitors in signal controllers currently in use by the procuring traffic authority.
- The countdown module shall be compatible with all types of traffic controllers in existence.
- The countdown timer module shall have a microprocessor capable of setting it's own time when connected to a traffic controller.
- The countdown timer module shall continuously monitor the traffic controller for any changes to the pedestrian phase time and re-program itself automatically if needed.
- The countdown module shall register the time for the walk and clearance intervals individually and shall begin counting down from the sum of both interval times.
- When the walk interval is pre-empted, the countdown module shall also pre-empt and skip directly to the clearance interval and countdown to reach 0 at the same time as the solid hand.
- In the cycle following a pre-emption call, when the module completes the walk interval countdown and the clearance interval has not yet started, the module shall display the clearance time and wait for the flashing hand to resume the countdown.
- The countdown module shall have an internal conflict monitor to prevent any possible conflicts between the hand/man signal indications and the time display. When the hand is solid, it shall be impossible to display any time on the display.
- When the countdown module is installed in a co-ordinated system and the walk interval time changes at every cycle, it shall be possible to blank out the walk time and only display the clearance time.
- The countdown module shall have dip-switches for the following user selectable options of display 0 during stand-by, turn on all LEDs for testing, "Co-ordinated" mode, displays clearance time only, disables dimming feature, disables 30 sec. Delay on dimming, and disables countdown display.

- The module shall have a spare input for special applications such as extending or reducing time on demand.
- LED signal modules shall be replaced or repaired if fails to function as intended due to workmanship or material defects within the first 60 months from date of delivery.

**(86-5.01) Vehicle Detectors**

***(86-5.01A(1)) Inductive Loop Detectors***

*(This section shall be included with all loop detectors included in contract.)* One sensor unit shall be provided for each traffic phase shown on the plans. In addition, separate sensor unit lead-in cable shall be provided for each sampler loop, exclusive right-turn lane, and call loop set.

***(86-5.01A(3)) Inductive Loop Detectors***

Each sensor unit shall be of the shelf-mounted, single channel type with delay and extension features. Sensor units shall be Reno A&E, Model "L" with phase green loop compensation, or approved equal.

***(86-5.01A(4)) Construction Materials***

Loop wire shall be Type 2 with THHN insulation (IMSA 51-5 or equivalent). Lead-in cable shall be Type C, 16 AWG stranded (IMSA 50-2 or equivalent).

***(86-5.01A(5)) Inductive Loop Detectors***

All loops shall be "Type E Loop Detector Configuration" with the exception of the circular stop bar loops. The stop bar loops shall be installed per Detail "Modified E Loop" and shall conform to the following:

All circular loops shall be saw-cut. The sides of the slot shall be vertical with a maximum width of 5/8 inch.

Front stop bar loops shall be wound clockwise in a figure eight (8) pattern with three turns. Additional loops behind the stop bar loop shall be spaced at 16 feet center to center, unless otherwise specified.

All loop saw cuts shall be filled with Crafcoc or approved equivalent hot applied modified asphalt sealant for pavement cracks and joints. Excess loop filler shall not exceed 1.5 inches on each side of saw cut.

Curb terminations shall be as per Detail "Type E Modified Loop" Curb Termination.

Installation of new detector loops installed in pavement constructed under Detail pavement rehabilitation projects shall be completed prior to the construction of the final lift of asphalt pavement.

**86-5.02 Pedestrian Push Buttons**

*(Add when pedestrian push buttons are furnished by contractor)* The second paragraph in Section 86-5.02, "Pedestrian Push Buttons", of the State Standard Specifications is amended to read:

The housing shall be metallic and meet requirements of the American Disabilities Act. The assembly shall be weatherproof and shockproof in any weather condition. The unit shall utilize a micro type switch with 301 stainless steel dome inset within the housing rated at ten million operations (Western Pacific Signal Model ADA-1008 or approved equivalent prior to bid).

Specifications are as follows:

- Cap Housing made of Type 606-1 heat-treated aluminum.
- Button-stem entrance on cap shall include 1/8" wide water repelling groove.
- The micro switch shall be used and interchangeable with industry common non-ADA style push button assemblies
- Button cap shall be of Type 303 stainless steel
- Button shall be recessed into aluminum cap housing, 1/8 inch minimum.
- The assembly shall include 3.25 diameter 0.095 thick neoprene gasket and stainless steel mounting screws.
- Maximum travel of button shall not exceed 1/8".

*(Keep if signs are to be furnished by contractor)* The pedestrian push button sign shall designate the symbols for, steady walk, flashing don't walk, and steady don't walk utilizing 4 colors; white, black, orange, and green with the appropriate direction of travel. It shall be ceramic and use brass grommets (see Detail "Pedestrian Sign").

### **(86-6.01) High Pressure Sodium Luminaries**

*(Add when new or modified intersection lighting is in project)* This section applies to Intersection Traffic Signal Lighting. Cobra Head type luminaries shall be General Electric, Type M-400A, Model MDCL **(Insert lamp wattage)** S 1 A 2 1 F MC3 2 or approved equivalent prior to bid.

Luminaries shall contain a locking type mounting receptacle in accordance with EEL-NEMA standards for photoelectric control. The receptacle shall be pre-wired to the terminal board and be of the screw down type. Upon any pole modification containing lighting, the contractor shall obtain street light identification numbers from PG&E and verify rate schedule with the Engineer.

Luminaries shall consist of a precision die-cast aluminum housing, glove ring, and power/module door. At the completion of the project the contractor shall obtain the required PG&E numbers and apply the numerals according to the required specification.

### **(86-6.01A) Ballasts**

*(Add when new or modified intersection lighting is in project)* Ballasts shall operate on 120 VAC with constant wattage auto-regulating (CWA). All 150-watt ballasts shall be 55 volt (Type S-55).

**(86-6.01B) High Pressure Sodium Lamps**

*(Add when new or modified intersection lighting is in project)* Traffic Signal Safety Lighting Lamps shall be high-pressure sodium with a minimum rated life of 24,000 hours.

**(86-6.07A) Photo Electric Controls**

Type IV shall be used unless otherwise indicated and shall have a minimum rated life of 12 years.

**(86-7.01) Removing, Reinstalling or Salvaging Electrical Equipment**

*(Keep at all times except when a new installation may not warrant.)* Salvaged electrical equipment shall be delivered to the City Corporation Yard, 1455 Gasoline Alley, Concord, and stockpiled or as otherwise directed by the Engineer.

Mast arm signal standards shall be delivered by the Contractor to the City Pump Station, 2050 Waterworld Parkway, Concord, or as directed by the Engineer, and stockpiled. The Contractor shall contact the Engineer to schedule the delivery at least 24 hours in advance.

All deliveries shall be completed prior to 3:30 p.m., Monday through Friday on regular workdays.

The Contractor shall provide equipment, as necessary, to safely unload and stockpile the material.

**Battery Back-up System (BBS) or Uninterruptible Power Supply (UPS)**

The contractor shall furnish and install a Tesco brand or approved equivalent prior to bid UPS unit in a separate cabinet mounted alongside the existing controller assembly. The cabinet, inverter, and battery system shall meet these requirements and the details as attached in **Appendix (XX)**. The UPS unit shall be mounted per manufacturer guidelines. The cabinet shall be electrostatically painted Bel Tel Green per engineer's request. The UPS shall follow the specifications shown below:

**Enclosure:**

The enclosure shall be anodized 1/8" aluminum and painted weatherproof enclosure shall house the inverter and batteries. Enclosure shall be TIG welded construction with welding materials specifically designed for the material to be welded. Enclosure shall have fully framed side hinged outer doors with swaged close tolerance sides for flush fit with drip lip and closed cell neoprene flange compressed gaskets. Front door shall incorporate a full-length piano hinge, pad-lockable draw latch (center area on door - latch side), and two pad-lockable welded-in place vandal-proof tabs (one upper area, one lower area on door - latch side, rated at 2000lbs. each). There shall be no exposed nuts, bolts, screws, rivets or other fasteners on the exterior of the enclosure. The inverter shall be mounted in an interior tilt out housing with 800lb rated stops. Battery connectors shall be Anderson Connectors with silver plated contacts. Batteries shall be installed in fixed position framed trays for seismic safety and be readily accessible for

maintenance. Batteries shall be mounted allowing airflow front and back. Enclosure shall include two transfer bypass switches, one for BBS bypass the second for auxiliary generator. All switches must be panel mounted on interior dead front panel board. UV resistant plastic laminated nameplates shall identify all controls and major components. A plastic covered wiring diagram will be attached to the inside of the front door. All components shall be factory wired and conform to required NEMA, NEC and UL standards. A chassis ground point shall be provided. Panel shall be UL 508 Industrial Control Panel rated.

#### BBS Panel Shall Have These Minimum Features

- Generator transfer switch with BBS bypass and 30 amp external reverse service plug.
- BBS bypass and BBS isolation switch.
- Deadfront safety panel board with all switches, indicating fuses, plugs, and isolation fuses for each battery pre-wired with phenolic nameplates.
- All nameplates shall be screwed on phenolic engraved type.
- All wire terminating lugs shall be full wrap around type.
- All batteries shall be captive spaced from external cabinet sides in earthquake proof buckets.
- Cabinet ventilation shall have total of 4 - 4" x 1/4" louvers top and bottom with encapsulated bug screens, cleanable filters and a 100CFM fan to completely exchange air 25 times minimum per minute.
- All DC terminals and connections shall incorporate safety covers such that the safety covers are in place for every normal maintenance mode.
- The unit shall include event counters & total run time counter.

#### BBS Unit Shall Have These Minimum Specifications and Features:

BBS unit shall provide a true sine-wave output with minimum 1400 Volt-Amp continuous capacity. BBS must provide for utility service isolation when in operation. The minimum rating for wattage output will be 950 watts. The BBS shall be capable of running an intersection with LED lights. The unit shall operate off-line, with transfer time of 2 ms or less, with battery condition indicator, with automatic test provisions, and with hot-swappable batteries (all batteries in system). The BBS will automatically recharge batteries from full discharge to 95% capacity within 6 hours. The BBS will provide on-line operation for a minimum input range of 92 to 145 VAC, provide full load % over a temperature range of -37° C (optional adder) to +74° C and be a UL Approved Design. The BBS unit will be delivered with maintenance manuals and schematic diagrams.

- 1400VA 950 Watts
- Surge energy withstand 480 Joules, 6.5Ka
- Common mode clamping 0 ns < 5 ns typical UL 1449
- Conditioned power - Computer quality
- Transient lighting protection - 160 Joules
- Transfer to battery time - 2 ms
- Retransfer to utility - 2 ms

- Each battery shall be 24 volts @ 18 AH with heavy duty Anderson plugs and isolated fused (dead front panel mounted 30 amp) connections to the BBS for greater system reliability and ease of maintenance. Series wiring is unacceptable.
- Fan cooling shall be fused for locked rotor current.
- Cooling air shall be ducted to cool the front and back of each battery with air space on all four sides and top of each battery.
- BBS covers shall be 60% open on both sides to diminish the environmental effects of extreme temperatures.
- Includes a RS232, DB9 Computer Interface Port.
- Low voltage safety design at 24V DC. (Higher voltage DC systems are unacceptable).

BBS Communications Module Shall Contain:

Smart Slot Relay I/O Module;

Input #1 Turn the BBS on.

Input #2 Turn the BBS off.

Input #3 Start the BBS self-test.

Input #4 Shut down the BBS (when on battery).

Output #1 The BBS is on-battery (during a power failure, self test or run time calibration).

Output #2 BBS has a low battery - Programmable.

Output #3 The protected load is not receiving power from the BBS.

Output #4 Replace the BBS batteries.

Output #5 The BBS is overloaded.

Output #6 Any BBS fault or self-test failure.

Batteries:

Batteries shall be maintenance-free, type AGM/VLRA (Absorbed Glass Mat/Valve Regulated Lead Acid), such as APC Smart-BBS RMXL or approved equal. Batteries shall be independently pre-wired and individually fused. Batteries shall be furnished with heavy-duty 50 amp rated silver-plated Anderson Connectors. Batteries shall be lightweight for personnel safety and protection plus ease of installation and maintenance. Batteries with a weight of over 26 lbs. are not acceptable.

Enclosure temperature compensation:

Operating temperature shall be a minimum -37°C to +74°C.

Power System Analyzer and Conflict Resolution Module:

The BBS shall incorporate an integrated Power System Analyzer and Conflict Resolution Module. The Analyzer will evaluate and make limited adjustments to the incoming utility power and will automatically transfer load to the BBS battery back-up power if utility power is lost. When utility power becomes available, the system will automatically return to normal operation. The Conflict Resolution Module will provide automatic BBS failure detection and automatically isolate the failed BBS and transfer the load back to utility power. Once the failure has been corrected, the system will return to normal operation.

Triple Bypass System for offline BBS shall contain the following:

- SPACT- Smart Power Analyzer with Conflict Monitor Isolation and Transfer Module.
- PCM - Power Conflict Monitor
- The PCM is a totally redundant failsafe system. The PCM monitors load bus power available continuously. If load bus power fails for 5ms the PCM will transfer and isolate the BBS and guarantee that commercial power will be locked on.
- Watchdog Timer- Redundant 5ms delay and hard transfer to utility power.
- The outboard Smart Transfer Switch shall not interrupt the normal controller function. Transfer time shall be 2ms.
- Onboard Smart I/O module will execute lockout of battery backup system upon Smart detection of any inverter BBS fault. If BBS resets itself, it will automatically be available for backup.

Smart Battery Charger:

The Smart Battery Charger shall charge from shut off discharge to 95% fully charged in less than 6hrs. Batteries shall be ambient enclosure compensated to less than 120°. The battery charger shall utilize Smart Cell Technology to extend battery life.

Intelligent Battery Management:

The unit shall have a cell guard for longer battery life, improved reliability results from a precision battery charging system, and automatic true-load battery tests. In addition a redundant overcharge protection shall contribute to longer battery life. SmartBoost and SmartTrim shall regulate under and over voltages without switching to battery.

The BBS shall automatically perform a self-test every two weeks to ensure that the user is aware of downgraded batteries prior to any downtime. Self-tests may be performed at anytime through software or pushing a button on the unit.

The BBS battery charging systems shall be microprocessor controlled to precisely charge batteries for faster recharge time and to make the system available more quickly for subsequent power disturbance. The battery system shall be Quickswap system to allow for battery service to allow for safe and easy replacement of batteries while system is up and running. Replacement battery kits shall be made available and shipped in a reusable box for return of exhausted batteries to a recycling center.

Warranty:

Manufacturers shall provide a two (2) year factory-replacement parts warranty on the Battery Backup System. Batteries shall be warranted for full replacement for two (2) years. The warranty shall be included in the total bid price of the Battery Backup System.

**Communications Equipment for Close Circuit Television or Video Image Detection System** *(Select One or Both)*

The Contractor shall furnish and install communications equipment necessary to interconnect **CCTV and/or VIDS** *(Select one or both as it applies to project)* equipment at the intersection of *(Insert Main Street here)* at *(Insert Minor Street here)* with central monitoring and control

equipment at the City Signal Shop as described herein and as shown on the Plans. The communications equipment shall be fully compatible with the **CCTV and/or VIDS** *(Select one or both as it applies to project)* equipment described elsewhere in these Special Provisions and existing City **CCTV and/or VIDS** *(Select one or both as it applies to project)* equipment. The contractor shall provide all the necessary BNC (British Navel Connector) connectors for **CCTV and/or VIDS** *(Select one or both as it applies to project)* installation.

The Communications Equipment shall consist of the following components:

- Twisted pair video transceivers
- Analog data modems

The Contractor shall furnish all materials necessary to provide a complete and functional communications system in accordance with this section of these Special Provisions. Miscellaneous equipment, and materials not mentioned but necessary to provide a complete and fully operational camera assembly shall be furnished by the Contractor as incidental to the work.

All items furnished under this contract shall be new and shall be the latest version, and shall be off the shelf production units. The communications equipment shall be assembled, inspected, and tested in accordance with these Special Provisions prior to delivery to the job site. Installation, operations and maintenance manuals shall accompany assemblies at the time of delivery.

### **Video Transceivers**

*(This number should reflect the amount used between the key intersection and the corporation yard. The consultant should consult with City Staff)* **Number XX** ML928 EQ/A/DPCB video driver/equalizer amplifier from Mil-Lektron shall be supplied for this project. *(Normally, the final leg requires standalone and intermediates repeater locations require rack mount as determined by the shortest route from the Corporation Yard to the CCTV and/or VIDS site.)* The project shall include **Number XX** Equalizer/Amplifier Standalone Model ML9282EQ/A/D and **Number XX** Rack Mounted Model 928 EQ/A/DRM *(Normally, the final leg requires standalone and intermediates repeater locations require rack mount as determined by the shortest route from the Corporation Yard to the CCTV and/or VIDS site.)* The ML928 EQ/A/DPCB Video Driver/Equalizer Amplifier shall be used to transmit video signals over existing City twisted pair copper cable. Vendor contact information is:

Mil-Lektron  
40713 N. 16th St. West  
Palmdale, CA 93551-2140  
(805) 947-8697

Standalone ML928 2EQ/A/D: (Quantity XX)  
Rack Mounted ML928 EQ/A/DRM (Quantity XX)  
Video Transceivers ML 928 EQ/A/DPCB (Quantity XX)

Each ML928 consists of a Video Driver and Video Equalizer Amplifier module. *(These following locations have existing racks that may require Video Driver Equalizer/Amplifier.)*

The unit shall be self-contained and designed for continuous unattended 24-hour operation. A watertight *(Select one or both)* **stand-alone shelf and/or rack mount** version shall be used within the field traffic control cabinet and will be configured with both the Video Driver and Video Equalizer Amplifier modules. A single rack-mount version capable of supporting up to 10 channels shall be used at the City Signal Shop and will be configured with only the Video Equalizer Amplifier module. Modules shall be interchangeable between shelf-mount and rack-mount versions.

The ML928 *(Select one or both)* **stand alone or rack mount**, based on field conditions and location, located in the field traffic control cabinet shall support two channels and be capable of both sending and receiving analog video. The unit shall be configured with two twisted pair video terminals (Input and Output) and one local coaxial BNC video input. If a video signal is detected on the twisted pair input terminals then that signal shall be switched to the twisted pair output terminals and any video present on the coaxial input terminal shall be ignored. If a video signal is not present on the twisted pair input terminals than the coaxial terminal video input signal shall be switched to the twisted pair output terminals. The ML928 shall automatically perform the video switching as described above

The rack-mount version located at the City Signal Shop shall include only the

Equalizer Amplifier modules with one twisted pair video input terminal and one coaxial BNC video output terminal. The unit shall be mounted in an existing EIA 19-inch equipment rack. Cabling interconnect and wiring diagrams are shown on the Plans. The system shall adhere to the following technical specifications:

#### **Video Format**

- NTSC 30 frames per second, analog full motion video
- Color or monochrome
- Resolution up to 1023 scanning lines at 60Hz
- EIA-170 video synchronization signal format

#### **Signal Electronics**

- Frequency Response: 50Hz to 10 Mhz (j 1.0 dB)
- Pre-emphasis. switchable 10 dB
- BNC Input signal level: 0.7 to 1.4 Vpp unbalanced, composite video
- BNC Input impedance: 75 ohm
- Twisted pair input signal: Symmetrical 0.6 to 2 Vpp composite video
- Twisted pair output signal level: 0 to 2.8 Vpp symmetrical, 0 to 1.5 Vpp asymmetrical
- Input/Output impedance: 124, 75, and 50 ohm switchable
- Gain: manual
- Gain adjustment: adjustments located at front edge of driver board
- Test points: accessible at front edge of driver board

#### **Electrical**

- Power supply: 11 SVAC or +15 to ~35VDC
- Current each channel (two channels): 90 mA DC (80mA ~ 11 SVAC)
- Fuses: AC and DC

### **Physical and Environmental**

- Enclosure Polycarbonate, watertight, two channel capability
- Enclosure dimensions: 6 29"L x 4.75"W x 3.54"H (w/o mounting brackets)
- Rack Mount: Standard 19"W x 10"D x 3.5"H, ten channel capability
- Temperature range: -320F to 1600F
- Mil-Lektron shall set and align ML-928's at the Cabinet and at the Corporation Yard.

### **Isolator Panel**

The Camera Isolator Panel provides lightning protection for the **CCTV and/or VIDS** *(Select One or Both)* to provide complete isolation and conditions the video signal for maximum quality prior to interfacing with the ML928 Video Equalizer Amplifier. The Isolator Panel shall include the Mil-Lektron ML-108A-XX *(Input the required number of isolater cards)*, with isolators. It shall also provide a terminal barrier strip to connect the AC Power cables and a ground terminal to be connected to chassis ground. **Number XX** ML-108A -XX *(Select a number of required isolaters)* shall be supplied with a power supply unit.

ML-108A *(Designated total number of image sensors and CCTV for intersection)* 1-6:(Quantity XX)

### **Data Modems**

*(A modem shall be insert for each end of the project, namely the key intersection and corpyard.)* **Number XX** analog data modem shall be supplied for this project. The data modems shall be used to transmit and receive CCTV and/or VIDS control signals over existing City twisted pair copper cable.

The Model 496SA 9600 Baud FSK from GDI (General Devices and Instruments) shall be used. Vendor contact information is:

Sunnyvale General Devices and Instruments Incorporated  
P.O. Box 1330  
Verdi, NV 89439  
(775) 345-8000

GDI Model 496SA (Quantity XX)

The data modems shall be installed and configured from 9600 bps two wire half-duplex operations in a multi-drop channel configuration. The unit shall be self-contained and designed for continuous unattended 24-hour operation. An environmentally hardened stand-alone shelf-mount version shall be used within each field traffic control cabinet and the City Signal Shop. The units at the City Signal Shop shall be shelf-mounted in an existing 19-inch equipment rack. Shelving, and any additional hardware necessary for mounting, within the cabinet, shall be provided by the Contractor.

The system shall adhere to the following minimal technical specifications:

- Data Rate & Format: 0-9600 baud asynchronous
- Line Interface: Private metallic wire, 10 miles minimum distance
- Serial Interface: EIA RS-232 DB-9
- Electrical: 90-135 VAC 60Hz, fused

- Environmental: -30°C to +70°C, 95% humidity non-condensing

### **CLOSED CIRCUIT TELEVISION SURVEILLANCE EQUIPMENT**

*(The following paragraphs apply to the CCTV equipment included with the project)* The Contractor shall furnish and install Closed Circuit Television (CCTV) field equipment as described herein and as shown on the Plans. Communications equipment necessary to support video transmission and control signals between the City Signal Shop and field equipment is described elsewhere, but shall be compatible with CCTV equipment described herein.

The UltraDome™ dome-style CCTV system from Ultrak shall be used. Vendor contact information is:

Ultrak  
1301 Waters Ridge Drive  
Lewisville, TX 75057  
(800) 796-2288  
(972) 353-6400  
(972) 353-6670 Fax      Weather Dome™ KD6:      (Quantity XX)

Each CCTV field assembly shall consist of the following components:

- Dome Enclosure Assembly (camera/lens, pan & tilt/receiver, and mounting hardware)
- Cables
- Power Supply & Surge Protector

The Contractor shall furnish all materials necessary to provide a complete and functional CCTV system in accordance with this section of these Special Provisions. Miscellaneous equipment and materials not mentioned but necessary to provide a complete and fully operational camera assembly shall be furnished by the Contractor as incidental to the work.

All items furnished under this contract shall be new and shall be the latest version, and shall be off the shelf production units.

The camera assemblies shall be assembled, inspected, and tested in accordance with these Special Provisions prior to delivery to the job site. Camera, lens, and environmental enclosure shall be assembled and delivered to the job site as a complete unit. Installation, operations and maintenance manuals shall accompany assemblies at the time of delivery.

Individual components of the camera assembly shall conform to the specifications contained in the following sections:

#### **Dome Enclosure Assembly**

The environmentally controlled WeatherDome™ KD6 and high-speed dome surveillance systems shall be installed in accordance with the following specifications:

## **Weatherdome Enclosure**

### **Material**

The enclosure shall be constructed in two halves using high quality optically graded acrylic. The top half sun shroud shall be highly reflective white acrylic to reflect direct sun rays. The bottom dome shall be vacuum formed, optically graded acrylic, smoke colored. The bottom half shall be a clear to optimize video sensitivity in low light levels.

### **Flange**

Four locking snap fasteners and a rubber gasket shall be used to secure the upper and lower dome while providing a weather-tight fit Quick-release access to the inside of the upper dome is accomplished by releasing the snap fasteners A plastic-coated safety cable shall be used to attach the lower dome/lens to the upper sun shroud to insure against accidentally dropping the lower dome/lens.

### **Dimensions**

Top: 14.68" H x 12.38" Diameter

Bottom: 4.3" H x 9" Diameter

### **Heater/Blower**

The dome enclosure shall be air sealed and equipped with a blower and heater unit.

### **Color Camera/Zoom Lens**

The camera and zoom lens will mount to the internal Pan & Tilt unit. A high sensitivity color 1/4" Super HAD CCO™ shall be used. Camera Model shall be CA447S4N.

Charge Coupled Device (CCD) camera with 470 TVL of horizontal resolution. An 18X optical zoom lens (f=4.1-73.8 mm F1.4AI) shall be used. An integral 4x digital zoom extender will provide a total of 72x-zoom range.

- Support for auto focus and auto iris
- NTSC compliant video with 470 TVL
- Minimum CCD imager resolution of 768 horizontal by 494 vertical active picture elements (380,000 pixels).
- Meet or exceed EIA-170 standards.
- Automatic sensitivity and black level control so that it operates without further adjustment with illumination ranging from full daylight to nightlight.
- Automatic White (Color) Balance control to maintain proper color rendition by automatically referencing to white areas of the scene.
- Automatic Gain Control (AGC) to maintain the output video level to 90% of peak-average setting to optimize video output under varying lighting conditions.

### **Pan & Tilt/Receiver**

Supports high speed, rate proportional control of the camera position. A sealed slip ring mounted on a spring-loaded quick disconnect plate shall be used to install the camera in the dome enclosure. The slip-ring design permits 360 degree non-stop panning at variable speeds from 0.5 to 125 degrees per second, and 0 degrees horizontal to 90

degrees down tilting at variable speeds from 0.5 to 60 degrees per second. Smooth acceleration and precise braking of  $\pm 0.5$  degrees; as well as instant reverse.

The camera can be directed (pan/tilt/zoom) to any one of 100 programmable predefined viewing positions (pre-shots) These positions can be given up to 24 character names for on-screen identification to identify the area being viewed.

A digital on-board receiver shall be used with battery backed memory. All programmed pre-shots and message Ids shall be retained during loss of power. Communications shall be RS-485.

### **Cable Assembly**

The camera cable assembly shall be used to extend all power, communications, and video between the dome enclosure and the power supply & surge protector in the traffic control cabinet. The cable assembly is a standard item from Diamond Electronics and shall be ordered to size (maximum 250 feet) for each location. The cable length shall accommodate required slack as described elsewhere in these Special Provisions.

The composite cable assembly shall consists of the following:

- Twisted pair, low capacity, 22 AWG shielded wire for RS-485 data communication.
- RG-59 75-ohm coax cable for video communications
- Three-conductor power cable for 24VAC.

Each cable assembly shall consist of a composite cable and pre-installed multi-pin connector for connection to a compatible mating connector on the top of the dome enclosure. One end of the cable will mate with the dome enclosure and the other end will terminate in the power supply & surge protector module in the traffic control cabinet.

The cable assembly shall be installed in existing conduit and signal pole standards as shown on the Plans. All cables shall be installed in a continuous run with no splices. The cable will be strain relieved where appropriate and if necessary. The cable shall be routed as shown on the Plans.

All coaxial cables shall be tested for ground isolation and shorts after installation and termination with BNC connectors

### **Power Supply/Surge Protector**

A TR-24/WSPL Power Supply with Surge Protection module shall be installed in the traffic control cabinet to provide isolation and conditioning for all conductors between the dome enclosure and the cabinet (location in the cabinet to be determined by the City's Traffic Operations Personnel). Additionally, this module shall provide 24VAC power for all equipment in the dome enclosure. This is a standard item from Diamond Electronics

The TR-24/WSPL includes conductor termination points, power supply, and surge protection devices attached to a mounting plate. The mounting plate shall be installed within the traffic control cabinet.

**Functional Testing: Closed Circuit TV and Communication Equipment**

The Contractor shall provide the following functional testing for CCTV camera and communications equipment:

Verification that all interconnecting cable installations and connections between all CCTV Surveillance equipment components, associated communications equipment, and electrical service are in accordance with the specifications.

Verification of all remote mode CCTV operations using the central control equipment installed at the City Signal Shop. Testing shall verify correct response of the field CCTV equipment. The field CCTV unit shall be addressed and tested.

The Contractor shall employ the use of a provided NTSC Handheld Test Signal Generator and NTSC waveform monitor to verify proper operation of the video transmission equipment. Testing shall confirm video levels and signal to noise ratio specification

compliance for daytime and nighttime operation. It is expected that this testing will be performed as part of the setup process by the video transmission equipment manufacturer.

- View video images as the lens focal lengths and aperatures of the Lens is varied. The CONTRACTOR shall verify that the camera is focused after each change.
- Verify the correct operation of the auto iris, power zoom and imager protection features
- Verify the correct operation of the Pan and Tilt unit. The Pan and Tilt unit shall be functionally tested over 360 degrees in the horizontal plane and + 90 degrees in the vertical plane.

**Interface Converter**

*(Normally, two should be supplied for every project.)* The RS-232 to RS-485/422 interface converters shall be supplied for this project to convert RS-422 serial communications format used by CCTV control equipment to RS-232 serial communications format used by the data modems. The Model 2085F from Patton Electronics shall be used. Vendor Contact Information:

Patton Electronics  
622 Rickenbacker Drive  
Gaithersburg, Maryland 20879  
301-975-1000

Model 2085F: (Quantity XX)

The converters shall be installed and configured for 9600 bps 2-wire simplex (transmit-only). The units shall be self-contained and designed for continuous unattended 24 hour operation. The devices shall use a terminal block on the RS-485/422 side and shall use a DB25 connector on the RS-232 side. DB25 to DB9 serial interface cables to connect the data modem shall be provided by the contractor.

The system shall adhere to the following minimal specifications:

- Data Rate & Format: 0-115,200 bps asynchronous
- RS-232 Interface: DB25, DCE/DTE switchable (Set for DTE)
- Carrier: Switch selectable either continuous operation or controlled by RTS (Set for Continuous)
- Control Signals: DSR turns "ON" immediately after the terminal raises DTR; DCD runs "ON" after recognizing the receive signal from the line; CTS turns "ON" after the terminal raises RTS.
- RTS/CTS Delay L O msec or 8 msec
- Range: 9 Miles
- Power: Draws operating power from RS-232 data and control signals.
- Temperature: 32 to 122 degrees Fahrenheit
- Size: 2.66 inches x 2.10 inches x 0.73 inches

### **VIDEO IMAGE DETECTION EQUIPMENT (VIDS)**

*(The following paragraphs apply to the video detection provided as a part of the project)* Work under this item shall consist of furnishing and installing Video Image Detection System (VIDS) equipment at each site as described herein and as shown on the Plans. Communications equipment necessary to support video transmission and control signals between central and field equipment is described herein.

The Autoscope Video Image Detection System from Econolite Control Products will be used. Vendor contact information is:

Econolite Control Products, Inc.  
1933 Davis Street, Suite 22  
San Leandro, CC 94577  
(510) 562-3215

Each VIDS field assembly shall consist of the following components:

*(The number should be determined by the approaches.)* **Number XX** Image Sensors (monochrome, solid-state high-resolution camera/lens, enclosure, and mounting hardware).

- Video Image Processor
- Isolation Panel
- Cables

The Contractor shall furnish all materials necessary to provide a complete and functional VIDS system in accordance with this section of these Special Provisions. Miscellaneous equipment, and materials not mentioned but necessary to provide a complete and fully operational camera assembly shall be furnished by the Contractor as incidental to the work.

All items furnished under this contract shall be new and shall be the latest version, and shall be off the shelf production units.

The VIDS equipment shall be assembled, inspected, and tested in accordance with these Special Provisions prior to delivery to the job site. Camera, lens, and environmental enclosure shall be assembled and delivered to the job site as a complete unit. Installation, operations, and maintenance manuals shall accompany assemblies at the time of delivery.

The Contractor shall install the system following procedures in the Autoscope Installation Guide. It is expected that the Contractor shall install, terminate, and test all cables, install isolation panel, and install video image processor.

A qualified representative from Econolite shall re-wire all traffic control cabinets to accept the input/output signals from the VIDS processor, and shall be on-hand for final system

setup and configuration. This shall include establishing and configuring the final detection zones at the intersection as directed by the Engineer. Any additional fine tuning after the intersection has been turned on and up to 21 days thereafter will be completed by representative at no cost to the City.

All in-cabinet work associated with the installation of the VIDS equipment shall be performed in a professional manner. The Engineer will determine the location of VIDS equipment within the cabinet. The Contractor shall install cables in a neat and orderly manner as approved by the Engineer. Any wiring or cabling within the controller cabinet not acceptable by the Engineer shall be corrected at the direction of the Engineer at the Contractor's expense.

The Contractor shall submit for the Engineer's review and approval, all related materials (shop drawings, manufacturer's product information, or any other related information) required for this contract for the VIDS equipment. The Contractor's attention is directed to Item 05-Submittals of Section SP-4 of these Special Provisions.

### **VIDS Processor**

The Autoscope model 2004 machine vision processor will be used to input video signals from the camera sensors and generate various traffic measurements, as well as provide detector output signals to existing NEMA TS-1 and Caltrans Model 170 controllers in the traffic control cabinets. *(Model 2008 should be considered in cases where additional video inputs are required. The 2004 unit only has 4 available inputs to Autoscope.)*

The 2004 will be provided as a shelf-mount unit to be installed at each traffic control cabinet as shown on the Plans. The 2004 consists of the following modules:

- Power Supply Module
- CPU Module
- Video Interface Module (VIM)
- External Interface Module (EIM)

### **Power Supply Module**

The Power Supply Module provides power to the other modules of the 2004.

### **CPU Module**

The Central Processing Unit (CPU) module contains a ten-position mode switch to control the 2004 operating mode, and ten LED's indicating CPU status. The module also includes a DB9 RS-232 communication port for interconnecting the 2004 to the data modem for communications with the central Supervisor PC. The 2004 shall support both 9600 bps and 19,200 bps, no parity, 8 data bits, and one stop bit communications.

### **Video Interface Module**

The Video Interface Module (VIM) is used to interface surveillance video to the 2004. The VIM shall include:

- One video input for a surveillance camera (labeled AUX)
- Four video inputs for detector processing (labeled camera input)
- One video output
- Eight status LED's (labeled Sync and Data)

### **External Interface Module**

The External Interface Module (EIM) shall be used to pass traffic detection data on to the local traffic controller. The module contains a 32-pin input for sensing intersection controller phases (for delay and extension functions), and a 37-pin output for assigning to individual detectors. The 37-pin output port provides discrete outputs to emulate inductive loop detectors.

Both input and output ports shall be compatible with NEMA TS1, Type 2 standards.

### **Image Sensor**

The image sensor consists of a high-resolution monochrome camera lens, environmental enclosure, and mounting hardware. A total of **Number XX** *(Normally, 1 per approach unless focal length, geometric configuration dictate an additional image sensor)* image sensors per location shall interface to the VIDS Processor vial the isolation panel.

The image sensor shall be installed to the signal pole luminaire mast arm as shown on the Plans. The Contractor shall follow the "Installation Procedures Without Junction Box" in the Autoscope Installation Guide. A 75-ohm source-terminated, single-ended video output jack shall be used to connect to the video cable.

The camera and fixed focal length lens will mount within a sealed cylindrical environmental housing with sun shroud. The housing shall be fabricated of seamless aluminum tubing. The housing, sun shroud, and mounting hardware shall be finished with heat reflecting white color weather resistant enamel. The camera/lens shall utilize the rigidity of the environmental housing for strength against shock and vibration. The front of the housing shall be closed with a clear optically flat glass window and not interfere with the viewing angle of the lens.

Each sensor shall be self-contained and designed for continuous unattended 24-hour operation and include the following features:

- Twelve-mm fixed focal length lens with minimum aperture of F/1.2
  - NTSC compliant video with output level of 1.0 V peak-to-peak composite (0.7 V video, 0.3 V sync) signal, polarity black negative, across a 75 ohm load impedance.
  - Minimum CCD imager resolution of 768 horizontal by 493 vertical active picture elements.
  - Meet or exceed EIA-170 standards.
  - Minimum signal-to-noise ratio of 50 dB at 25 C.
- Automatic sensitivity and black level control so that it operates without further adjustment with illumination ranging from full daylight to nightlight. Picture quality to distinguish objects in low light levels without excess interference from undesirable picture attributes (including blooming, transfer smear, vertical register shifting).
  - Switch selectable electronic shutter with shutter speeds ranging from 1/60 of a second (off) to 1/10,000 of a second.
  - Automatic Gain Control (AGC) to maintain the output video level to 90% of peak-average setting to optimize video output under varying lighting conditions.

### **Cables**

A coaxial cable and three-conductor power cable shall be installed between each image sensor and traffic control cabinet. Cables will be strain relieved where appropriate and if necessary. The three-conductor power cable shall be labeled in each pull box with an approved label and shall indicate "120VAC Cam. Power."

### **Coaxial Cables**

The Contractor shall use the standard video cabling kit provided by Econolite to interconnect the video image sensors with the 2004 processor via the isolation panel. All distance between image sensors with the 2004 processor are expected to be less than 1000 feet. The Contractor shall use Belden 8281 RG-59 75-ohm coaxial cable with 20 gauge solid bare copper center conductor (9.9 ohms/M), solid polyethylene insulation dielectric, 96% (min) tinned copper double-braided shield, and black polyethylene outer covering. The Amphenol 31-71032 BNC plug connectors shall be used at both the image sensor and traffic controller cabinet ends of the cable.

All coaxial cables shall be installed in existing conduit and signal pole standards as shown on the Plans. All coaxial cables shall be installed in a continuous run with no splices.

All coaxial cables shall be tested for ground isolation and shorts after installation and termination with BNC connectors. Testing shall follow procedures from the Autoscope Installation Guide.

### **Power Cables**

A three-conductor power cable shall be installed between the isolation panel in the traffic control cabinet and each image sensor to support 115VAC power to each image sensor. Tinned copper conductors shall be minimum 16 gauge, stranded, and with a minimum UL rating of 300 VAC. A polyethylene insulated outer cable jacket shall be used. Type C IMSA 50-2 cable (Atlas Wire & Cable catalog number A-810), or equivalent shall be used.

The wire material and installation procedures shall conform to Section 2 of these Special Provisions. Wiring interconnect details are provided in the Plans.

### **Cabinet Cable Harness**

The Contractor shall use the standard cabinet cable harness (Type 170, and NEMA) provided by Econolite to interconnect the video image processor with the cabinet. It is expected that this work will be performed by a representative from Econolite.

### **Isolator Panel**

*(Add when VIDS equipment is used within scope of project)* The Camera Isolator Panel provides lighting protection for the Autoscope and conditions the video signal for maximum quality prior to interfacing with the 2004 VIM module. The Isolator Panel shall include the Mil-Lektron ML-108A, with six isolators, for isolating and filtering the video signal from the Autoscope sensors. It shall also provide a terminal barrier strip to connect the three-conductor AC power cables to each individual camera sensor.

### **QUALITY ASSURANCE**

*(Keep the next few paragraphs at all times.)* The Contractor will be given one "punch list" for the contract to be completed within 30 calendar days. This will include a "compliance recheck" of the punch list. If the compliance recheck is performed, and it is found that the Contractor has not completed the punch list, the contractor shall receive an additional 15 calendar days to complete the list. The cost of subsequent compliance rechecks will be deducted from any monies due, or which may become due the Contractor.

### **TECHNICAL ASSISTANCE & BACK-UP SERVICES**

The manufacturer's representative shall provide the City with a California telephone number for the ordering of replacement parts that are required and for providing technical advice to City personnel.

The manufacturer shall have on hand at this number a complete file of the City's equipment, including all serial numbers pertinent to this project.

The manufacturer shall have available at the telephone number a person with competence in parts, nomenclature and functional characteristics of the City's signal controller equipment. This person shall be able to provide descriptions, part numbers, prices and availability of the City's requirements.

A fully qualified electronics technician with the capacity to expertly advise on all matters relating to the City's equipment shall be available immediately, or by return telephone call within 24 hours (normal work days only, holidays and weekends excepted).

There shall be no charge to the City for any advice or information provided in this matter.

**WORKMANSHIP**

*(Keep at all times)* All facilities shall be installed in a professional and workmanlike manner. Any portion of the signal system, which is not installed in a professional manner, shall be removed and reinstalled correctly to the satisfaction of the Engineer.

# **APPENDIX I**

## **Concord Signals, Lighting & Electrical System Details**

REVISED 8/3/2001