City of Aliso Viejo Specifications

DRAFT General Specifications and Special Provisions

CITY OF Aliso Viejo
SPECIAL PROVISIONS FOR TRAFFIC SIGNAL INSTALLATION
JULY 2014

All work shall conform to the latest edition of the Caltrans Standard Specifications and the following special provisions.

SUMMARY (SECTION 86-1.01)

Add the following:

The system shall be complete and in operating condition at the time of acceptance of the project.

The contractor shall provide the city with all traffic signal equipment shop drawings prior to ordering the equipment for approval.

Contractor shall provide guarantees for all work, materials, and labor valid for a period of one (1) year from the notice of completion date for the work by the city.

EQUIPMENT LIST AND DRAWINGS (SECTION 86-1.04)

Add the following:

One (1) set of mylar copy, five (5) sets of bond copy, and one (1) set of electronic copy on cd of cabinet schematic diagrams shall be furnished for each traffic signal location. No other type of reproducible material shall be allowed in place of mylar copy.

Updated controller cabinet schematic wiring diagrams shall be provided on 24" x 36" sheets for approval. One schematic wiring diagram shall be provided for left wall, back wall, right wall, and door. The intersection sketch shall be provided on cover sheet with north arrow up.

Contractor shall furnish ~~two (2)~~ maintenance and operation manuals for all controller units, conflict monitors, auxiliary control equipment, vehicle detector sensor units, and amplifiers. The manuals shall be submitted at the time the equipment is delivered for testing. The manuals shall include, but not limited to, the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Detailed circuit analysis
6. Troubleshooting procedure (diagnostic routine)

7. Voltage charts with wave forms
8. Geographical layout of components
9. Schematic diagrams
10. List of replaceable component parts with stock numbers

All manuals and documents furnished by the contractor shall be placed inside a heavy duty, clear plastic envelope. The envelope shall be attached to the inside of the controller cabinet door.

The contractor is required to submit to the engineer full scale "as-built" prints and one (1) electronic copy on cd, prior to the city accepting both installations. The prints shall indicate in **red color** all deviations from the contract plans, such as location of poles, pull boxes and conduit runs, depth of conduit, number of conductors, and other appurtenant work for future reference.

SCHEDULING OF WORK (SECTION 86-1.07)

Add the following:

The contractor shall not begin sub-surface work until approval has been obtained from the city engineer. The contractor shall be responsible to reduce impact to the public by minimizing the time between sub-surface work and above-ground installations.

EXCAVATING AND BACKFILLING (SECTION 86-2.01)

Add the following:

All excavated material shall be removed from the site and backfilled with compacted crushed aggregate base material topped with asphalt concrete on the same working day as removed.

FOUNDATIONS (SECTION 86-2.03)

Add the following:

Contractor shall define exact location of all utilities in the vicinity of the proposed new foundation locations. The exact locations of all foundations for signal equipment and the controller cabinet shall be approved by the engineer prior to the start of any excavation work. Foundations shall be hand-dug until clear of obstructions.

Portland cement concrete shall be minimum class 560-C-3250, Type II/V.

All foundation concrete shall be vibrated to eliminate air pockets.

Controller cabinet foundation forms shall be rigid steel.

STANDARDS, POLES, STEEL PEDESTALS, AND POSTS (SECTION 86-2.04)

Add the following:

Standards, poles, steel pedestals, and posts shall not be erected or installed until the service enclosure is installed, metered, and energized; the controller cabinet wired; the controller test period is completed and passed at test facility; the controller assembly installed; conduits, pull boxes, wiring, and other underground installation is complete and in place; and signal faces, vehicle detection, push buttons, signs, luminaires, and other materials required to complete the installation in its entirety have been inspected, passed inspection, and are in the contractor's possession and available for immediate installation.

Pipe tenons shall be provided as detailed on Caltrans Standard plans ES-7M.

In addition to identifying each pole shaft as detailed on Caltrans Standard Plan ES-7M, the contractor shall also identify each mast arm for all signals and luminaires. The stamped metal identification tag shall be located on the mast arm near the butt end and shall contain the same information required by Caltrans Standard Plan ES-7M. Pole tags shall include name of the manufacturer and shall be visible from the road surface.

CONDUIT (SECTION 86-2.05)

Add the following:

Boring or drilling methods shall be used for the installation of all conduits in existing pavement. Rigid metal conduit to be used as a jacking or drilling rod shall be fitted with suitable drill bits for the size as approved by the engineer. Conduit runs shall be continuous in type material from the beginning to the terminating end of the run.

Type 3 rigid non-metallic schedule 80 PVC conduit shall be used at all locations, and shall be 2" minimum diameter. Approved bell bushing shall be installed at all conduit ends.

All conduits shall enter through the bottom of a pull box and shall terminate 2" above the bottom and shall be located near the end walls to leave the major portion of the box clear.

Conduits terminating in standards or pedestals shall extend not more than 2" vertically above the foundation and shall be sloped toward the handhole opening.

After conductors have been installed, the ends of conduits terminating in pull boxes and controller cabinets shall be sealed with a type of sealing compound approved by the engineer.

All non-metallic type conduits, without a grounding conductor, shall have a bare no. 8 AWG solid copper wire that shall terminate at each pull box and at the ends of conduit runs. Twenty-four (24) inches of the solid copper wire shall be coiled in each pull box.

Conduit runs are shown in schematic form only. Actual installation shall be done in most direct manner. The contractor shall locate the interfering existing underground facilities and the actual installation shall be done in the most direct manner as the existing underground condition permits and as approved by the engineer.

PULL BOXES (SECTION 86-2.06)

Add the following:

Pull boxes, covers and extensions for installation in the ground or in sidewalk areas shall be of the sizes and details shown on the plans and shall be pre-cast of reinforced portland cement concrete (PCC). Plastic pull boxes shall not be used. All pull boxes shall be Christy Concrete Products, Inc. With fiberlyte lid, or approved equal.

Grouting is required at the bottom of all pull boxes.

Pull boxes shall be size no. 5, unless noted otherwise on the construction plans. Pull box lids shall specify “Traffic Signal” on top of each. Pull box extensions shall not be required unless specified by the engineer.

The amount of pull boxes shown on the plans is to be installed as a minimum. The contractor may, at no additional cost to the city, install additional or larger pull boxes to facilitate the contractor's work, with the approval of the engineer.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation

facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

The following "COVER MARKING" shall be added on the top of pull box cover as follows:

- "TRAFFIC SIGNAL": Where pull box contains traffic signal conductors with or without street lighting conductors.
- "STREET LIGHT": Where pull box contains only street light conductors.
- "HIGH VOLTAGE STREET LIGHT": Where pull box contains only street light conductors with street light voltage above 600 volts.
- "SPRINKLER CONTROL": Where pull box contains only sprinkler control conduits.
- "TELEPHONE": Where pull box contains only telephone conductors.
- "EDISON": Where pull box contains only Southern California Edison company conductors.
- "TRAFFIC SIGNAL COMMUNICATIONS": Where pull box contains only signal interconnect cables.

CONDUCTORS AND CABLES (SECTION 86-2.08)

Add the following:

Signal cable shall be installed continuously without splicing from the controller cabinet to each traffic signal pole.

All conductors shall be new and THW type. The contractor shall provide all new conductors.

Signal Interconnect Cable (SIC) shall be twelve (12)-pair #19 AWG and conform to the REA PE 22 specification. Conductors with THHN and THWN installation shall not be

used. Cable shall be multi-colored twisted-pair cable with twelve (12)-pair #19 AWG copper conductors and shall use the standard telephone color code. Cable shall have polyethylene insulation, mylar sheathing, and aluminum shielding.

SIC shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed. Contractor shall make interconnect connections as directed by engineer.

SIC shall be grounded only at the master controller location. At all other locations, sic shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

SIC cable identification tags indicating where the direction SIC is coming from shall be attached to each cable end.

SPLICING AND TERMINATIONS (SECTION 86-2.09D)

Add the following:

No splicing shall be permitted except for I.I.S.N.S., safety lighting and commons. All conductors shall extend from the controller cabinet to the terminal compartment on each pole.

Conductors No. 10 AWG and larger shall be spliced by the use of approved "C" shaped compression connectors. Conductors No. 8 AWG and larger shall be stranded.

Plastic conduits containing power circuit conductors shall have a bare no. 8 AWG solid grounding copper conductor that shall terminate at each pull box at the ends of the conduit run.

Signal Interconnect Cable (SIC) shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed.

Cable shall be grounded only at the master controller location. At all other locations, cable shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

Bonding clamps may be obtained by contacting:

AK Stamping Company, Inc.
1159 U.S. Route 22
Mountainside, New Jersey 07092
(908) 232-7300

SPLICE INSULATION (SECTION 86-2.09E)

Add the following:

The contractor shall use splice insulation "Method B".

BONDING AND GROUNDING (SECTION 86-2.10)

Add the following:

Grounding jumper shall be attached by a 3/16-inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

No. 8 minimum copper bond wire shall be run continuously in all circuits.

SERVICE (SECTION 86-2.11)

Add the following:

Service equipment enclosure shall conform to the following:

1. 120 / 240 volt, Type II-BF one meter service equipment enclosure unless otherwise shown on the plans.

2. Circuit breakers shall be the plug-in type and shall consist of the following:

a.	One (1)	100 AMP 2 Pole	240V Signal and I.I.S.N.S. Main (metered)
b.	One (1)	40 AMP 1 Pole	120V Signal Circuit (metered)
c.	ONE (1)	15 AMP 1 Pole	120V I.I.S.N.S. Circuit (metered)
d.	ONE (1)	15 AMP 1 pole	120V I.I.S.N.S. Photoelectric Control (metered)
e.	ONE (1)	100 AMP 2 Pole	240V Lighting Main (un-metered)
f.	ONE (1)	15 AMP 1 Pole	120V Lighting Circuit (un-metered)
g.	ONE (1)	15 AMP 1 Pole	120V Lighting Photoelectric Control (un-metered)

3. Two (2) delayed response Type V photoelectric control contactor and test switch assemblies with two (2) window shields for lighting and I.I.S.N.S. shall be installed in the service cabinet on the customer section. Photoelectric control contactors shall be as follows:

LUMINAIRES	-	30 AMP
I.I.S.N.S	-	30 AMP

4. Service cabinet shall have a painted exterior finish to match the controller cabinet, as directed by the city.

5. Circuit breakers shall be marked with identifying labels for each circuit breaker.

6. Photoelectric control assembly shall be installed within the circuit breaker compartment of the service cabinet enclosure and accessible to the city after installation of electrical meter.

TESTING (SECTION 86-2.14)

Add the following:

The testing of traffic signal equipment, including controller units, fully-wired signal cabinet and auxiliary equipment as specified in Section 86-3, "controller assemblies", shall be performed by a testing facility designated by the City. Approximately twenty (20) working days will be required for testing and notification of the final results.

Testing facility shall contact City Engineer or its representative when controller assembly is available for inspection.

Contractor is responsible for all the costs involved in testing the controller cabinet assemblies, including transportation to and from the testing facility. Contractor is responsible for ordering and purchasing the controller cabinet assembly as specified in the following section, solid state traffic actuated controllers. Cabinets shall not be released to the contractor until full payment for testing is received by the testing agency.

It shall be the contractor's responsibility to arrange pick-up and delivery of these items to the project site. Any cost involved to deliver and install these items at the project site shall be borne by the contractor, and no additional compensation shall be allowed therefore.

In addition to the five (5) working days of continuous satisfactory operation, called for in section 86-2.14C, "Functional Testing", five (5) more working days of satisfactory operation will be required when the signal system is connected to the City's master system controller.

"Turn-On" of the traffic signal systems shall not be made on a Friday or the day preceding a legal holiday. The City Engineer shall be notified five (5) working days prior to the intended "Turn-On". "Turn-On" shall begin before 10:00 a.m. of the approved day. Contractor must complete a satisfactory "Turn-On" within a pre-approved time period to be determined by the City Engineer. When a "Turn-On" is not completed within the pre-approved time period, it shall be canceled and rescheduled.

The Malfunction Management Unit (MMU) shall be tested in the field before "Turn On".

The contractor shall arrange to have a field representative from the City, a City Signal Technician, a knowledgeable technician from the manufacturer of the traffic signal

controller/ cabinet assembly, and a representative from the battery backup system manufacturers, present at the time of the traffic signal "Turn-On". The representatives shall be fully qualified to work on their respective traffic signal equipment. The manufacturer's representative and city staff shall be notified at least seven (7) working days prior to intersection "Turn-On".

The insulation resistance shall not be less than 100 megohms on all interconnect and loop circuits and 50 megohms for power circuits when the megger tests are performed. Testing shall not be conducted until all control and/or sensor units and probes have been disconnected from the circuit.

CONTROLLER ASSEMBLIES (SECTION 86-3)

Add the following:

CONTROLLER/CABINET ASSEMBLIES

Complete controller/cabinet assembly, including controller, completely wired cabinet and appurtenances shall be supplied by the contractor.

Solid-state traffic actuated controller units, cabinets and auxiliary equipment shall conform to the provisions in Section 86-3, "Controller Assemblies", these special provisions, and NEMA TS-2 Standards.

Contractor shall furnish and install Econolite ~~ASC/3-2100~~ TS2 Type 2 System Controller Unit and appurtenances. Contractor shall provide miscellaneous items as necessary to produce a fully-operational system in accordance with the plans, special provisions, Caltrans Standard Plans and Standard Specifications.

Power distribution panel, inside auxiliary control panel, police panel and all detector termination panels shall be hard wired. No "Plug and Go" connections are allowed.

CABINET ASSEMBLY

Contractor shall furnish and install Type "P" painted cabinet assembly as indicated on the plans that includes the following items:

1. One (1) - fully wired eight (8) phase NEMA TS2 Type 2 "P" painted aluminum cabinet, as indicated on the plans.

2. One (1) - Econolite ~~ASC/3-2100~~ TS2 Type 2 Centracs System Controller Unit with data key and ethernet port.

3. One (1) - malfunction management unit with LCD display (programmed for intersection).

4. One (1) - eight (8) position detector rack(s) with sixteen (16) channels of detection and one (1) bus interface unit, per rack. Two (2) EVP 2-channel card positions are to be provided in each eight (8) position detector rack as required.

5. One (1) sixteen (16) position horizontal load bay.

6. One (1) - controller cabinet power supply.

7. Three (3) - battery back-up system alarm inputs: on battery, flash (programmable percentage battery power remaining), and timer.

9. Signal interconnect block for two (2) 12-Pair No. 19 cables.

15. Centracs intergration and graphics shall be provided for the City's Traffic Management System.

All auxiliary equipment installed in controller cabinet to completely operate an eight-phase traffic signalized intersection.

Prior to fabrication of the cabinet, a review of the completed cabinet take-off shall be conducted by the city representative.

SPECIFICATIONS AND STANDARDS FOR THE CABINET ASSEMBLY:
National electrical manufacturers association, traffic control systems, NEMA standards publication: TS2- latest release.

WARRANTY STATEMENT:
Terms of controller cabinet warranty:

WARRANTY COVERAGE:
The supplier of equipment shall warranty their product to be free from defect in design and operation and that it meets all the requirements of this specification and those incorporated in this document.

LENGTH OF WARRANTY:
The warranty term on a wired signal cabinet shall be a (1) year minimum from date of shipment including the bus interface units and cabinet power supply. Equipment such as the controller and malfunction management unit shall have a (5) year minimum warranty.

CONTROLLER ASSEMBLIES (SECTION 86-3) (CONTINUE)

CABINET CONSTRUCTION

A complete NEMA TS2 Type 2 "P" cabinet shall be supplied. Cabinet shall meet, as a minimum, all applicable sections of the NEMA standard publication. Where differences occur, this specification shall govern. The cabinet shall meet the following criteria:

1. Material shall be aluminum sheet, 5052-H32, with a minimum thickness of 0.125-inch.

2. The cabinet exterior shall be a painted finish as indicated and with a white interior, as directed by the city.

3. The door hinge shall be of the continuous type with a stainless steel hinge pin.

4. The door handle shall be cast aluminum.

5. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet. All seams shall be continuous weld.

6. Cabinet lock shall be of the Corbin No. 2 Type.

7. A roll out computer table shall be mounted at a location designated by the City Representative.

8. The cabinet shall have four (4) sets of cabinet wiring diagrams.

9. The cabinet shall have one (1) set of equipment manuals (Controller, MMU, etc.).

NOTE: NO PLUG-N-GO EQUIPMENT SHALL BE ALLOWED FOR POWER DISTRIBUTION PANEL, INSIDE AUXILIARY CONTROL PANEL AND POLICE PANEL (ONLY HARD WIRING).

SHELVES

~~Three (3) substantial metal shelves extending half way across the back of the cabinet on the left side of the cabinet shall be provided to support the controller unit and auxiliary equipment. One (1) substantial metal shelve extending completely across the back of the cabinet in the top area of the cabinet shall be provided to support the detector rack(s).~~

The shelves shall not interfere with the lowering or removal of the main panel. City Engineer shall approve the design for final location of shelves before final manufacture of cabinet.

EQUIPMENT ACCESSIBILITY

All mounted panels and equipment shall have a minimum tool access clearance of 6".

VENTILATING FAN

The cabinet shall be provided with one (1) thermostatically-controlled ventilation fans, adjustable between 80 to 150 degree F and shall be installed in the top of the cabinet plenum.

AIR FILTER ASSEMBLY

The cabinet air filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

CABINET LIGHT ASSEMBLY

The cabinet shall be equipped with a led lighting fixture mounted on the inside of the cabinet near the front edge. The led light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

The cabinet shall have a gooseneck type lighting fixture that shall be mounted on the inside of the door near the hinge. The gooseneck light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

LIGHTNING SUPPRESSION

The cabinet shall be equipped with an EDCO model SHP-300-10 surge arrester, or city approved equivalent.

POWER PANEL

THE POWER PANEL SHALL HOUSE THE FOLLOWING EQUIPMENT:

1. One (1) 40 AMP main breaker to supply power to the main panel, controller, MMU, and cabinet power supply.

2. One (1) 15 AMP auxiliary breaker to supply power to the fan, light, and FG outlet.

3. One (1) 50 AMP, 125 VAC radio interference line filter.

4. One (1) normally-open, 60 AMP, Crydom model #H[illegible]471 solid state relay, or city approved equivalent.

CONVENIENCE OUTLET

Three (3) duplex outlets shall be supplied, as per the following:

1. The first is for short-term equipment use, 120 Volt AC, 15 AMP NEMA 5-15 GFCI duplex outlet, and shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

2. The second and third are for long-term equipment use, 120 Volt AC, 15 AMP NEMA duplex outlets, and shall be mounted in the upper right corner of the cabinet facing the inside of the cabinet. Power shall be supplied from un-switched filtered power.

INSIDE AUXILIARY CONTROL PANEL SWITCHES

The inside door panel shall contain three (3) switches: Auto/Flash, Auto/Off/On Stop-Time, and power On/Off. Auxiliary door panel switches shall be hard wired; printed circuit boards shall not be used.

1. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally. In the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

2. AUTO/OFF/ON STOP-TIME SWITCH (3-POSITION) - In the auto position, the controller shall be stop timed when the police door Auto/Flash switch is in the flash position or MMU Flash. In the off position, the switch shall release all stop time from controller. In the on position, the switch shall maintain a continuous stop time to the controller.

3. CONTROLLER POWER ON/OFF SWITCH (2-POSITION) - This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

POLICE PANEL SWITCHES

The police panel shall contain two (2) switches: signals On/Off and Auto/Flash. All police panel switches shall be hard wired; printed circuit boards shall not be used.

1. SIGNALS ON/OFF SWITCH (2-POSITION) - In the on position, the field displays shall show either normal operation or flash. In the off position, power shall be

removed from signal heads in the intersection. The controller shall continue to operate. In the off position, the MMU shall not conflict or require reset.

2. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally based on all other switches. In the flash position, power shall not be removed from the controller and stop time shall be applied based on the stop- time switch.

CABINET WIRING

CABLES

All controller and MMU cables shall have sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length and shall not obstruct the visibility of any cabinet equipment or interfere with the intended use of the computer tray.

All cabinet wiring shall the color coded as follows:

PURPLE	=	Flash Color Programming
BROWN	=	Green Signal Wiring
YELLOW	=	Yellow Signal Wiring
RED	=	Red Signal Wiring
BLUE	=	Controller Wiring
GRAY	=	DC Ground Return, Logic Ground
BLACK	=	AC Positive
WHITE	=	AC Negative
GREEN	=	Chassis

MAIN-PANEL AND WIRE TERMINATION

All wires terminated behind the main-panel and other panels shall be soldered. No pressure or solder-less connectors shall be used. Printed circuit boards shall not be used on main panels.

FLASHING OPERATION

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

DETECTOR RACK AND INTERFACE

A minimum of one (1) TS-2 vehicle loop detector rack and one (1) hard wired detector interface panel and necessary cabling shall be provided in each cabinet. Detector rack shall be labeled for each detector channel used and shall correspond with cabinet door

diagram. Each individual rack shall support up to sixteen (16) channels of loop detection, one (1) BIU and two (2) EVP 2-channel cards.

PREEMPTION WIRING:

The cabinet shall be completely-wired for railroad or EVP preemption as needed, if specified on the plan(s).

MAIN PANEL CONFIGURATION

The main panel shall be fully wired in the following configuration:

1. Sixteen (16) horizontal load sockets.
2. Six (6) flash transfer relay sockets.
3. One (1) flasher socket.
4. One main panel BIU rack slot.
5. Wiring for both Type 1 and Type 2 controllers.
6. Wiring for one type 16 MMU.

FIELD TERMINAL LOCATIONS

Field terminals shall be located at the bottom of the main panel and angled forward for easy viewing and wiring. The order shall be from left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

CABINET EQUIPMENT

LOOP DETECTORS, LOAD SWITCHES, FLASHERS, RELAYS

Cabinet shall be equipped with the proper number of loop detectors, load switches, flashers, and relays to perform the intended operation.

CONTROLLER UNIT

Cabinet shall be equipped with one (1) ~~ASC/3-2100~~ Econolite TS2-Type 2 controller complete with the latest Econolite recommended software and operating system, and shall be system ready for communication on the Centracs Traffic Signal Management/Monitoring software. Controller shall be equipped with a 25 pin FSK telemetry module, data key, and ethernet port. Controller shall also allow logging of three (3) alarm inputs as required in the specifications for battery back-up system.

MALFUNCTION MANAGEMENT UNIT (MMU)

Cabinet shall be equipped with NEMA TS2 Type 16 MMU with the latest current released software. MMU jumper cards shall be programmed to specific intersection's requirements. MMU shall also monitor the led blank-out signs for sign operation.

BUS INTERFACE UNIT (BIU)

BIU's shall meet all TS2-1992, section 8 requirements. In addition, all BIU's shall provide three (3) separate front panel indicators: power, valid data, and transmit.

CABINET POWER SUPPLY

The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator led for each of the four (4) power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

INTERCONNECT TERMINATION

Cabinet shall be supplied with interconnect termination blocks, Siemens model no. S66M1-50 and sub-base assembly.

LOAD SWITCH:

All load switches shall meet NEMA TS-2, section 6 requirements and shall have input and output led indications.

FLASHER UNIT

All flasher units shall meet NEMA TS-2, section 6 requirements and shall be EDI model 810, or city approved equivalent.

TELEMETRY INTERFACE PANEL

Cabinet shall be wired with a 25 pin telemetry interface panel and telemetry connecting cable that can communicate with the Ariel Traffic Signal Management/Monitoring master software. The cabinet shall be wired for telemetry transient suppression, EDCO model No. PC642C-00-AD, or city approved equivalent.

INTERSECTION DIAGRAM

An intersection diagram prepared in Autocad shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the auxiliary panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and

north arrow. The top of the diagram will be north and the diagram shall be pre-approved by the City Engineer.

CABINET WIRING DIAGRAM

Cabinet wiring diagrams shall be arranged on three (3) separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second sheet everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the city engineer prior to construction of cabinet assembly.

TESTING FACILITY:

Contractor shall be responsible for having the new cabinet assembly tested at city designated facility prior to being "Turned-On" at the intersection site. The testing facility shall have up to twenty-one days to test the controller assembly.

EQUIPMENT TURN-ON REQUIREMENTS:

The contractor shall arrange to have a City Signal technician, an Econolite Control Products technician, a Myers Power Products, Inc. BBS manufacturer representative present at the time of the controller turn-on. The representatives shall be fully-qualified to work on the controller assembly and related equipment. The manufacturer's representatives and city shall be notified at least (7) working days prior to intersection turn-on.

CENTRACS GRAPHICS & SOFTWARE

One (1) intersection graphic shall be provided for each traffic signal design or modification on the city's Centracs Traffic Signal Management System.

BATTERY BACKUP SYSTEM (SECTION 86-3.02)

[Replace this section with the following:]

SCOPE

The battery backup system (BBS) shall provide uninterruptible reliable emergency power to a traffic intersection in the event of a power failure or interruption. The uninterruptible power supply (UPS) shall provide a minimum of two (2) hours of full run-time operation for an "LED-ONLY" signal intersection. The transfer from utility power to battery power will not interfere with the normal operations of the traffic controller, conflict monitor or any other peripheral devices within the traffic control system. The bbs / ups system shall be comprised as noted below and shall include, but not be limited to: inverter/charger (ups), power transfer switch (pts), batteries, two (2) separate manually

operated non-electronic bypass switches (mbps), a generator plug with flush compartment door, and “on-battery” warning light on top of the bbs enclosure, and all necessary hardware and interconnect wiring.

The system shall be capable of providing power for full run-time operation, flashing mode operation, or a combination of both full and flash mode operation of an intersection. The operation of the flash mode shall be field programmable to activate at various times, battery capacities, or alarm conditions locally using the touch pad or remotely using an industry standard pc’s RS232 and USB interface. BBS shall have an ethernet port.

Field programmability via touch pad or computer interface must be in user friendly, menu driven formats and must not require any external or proprietary software. The BBS shall use hyperterminal to communicate with pc interface. The DB9 connector for the RS232, USB and ethernet interfaces shall be located on the front panel of the UPS. Interface cables shall be pinned for industry standard configuration, no proprietary cable pin out allowed. The system shall be designed for outdoor applications and meet the environmental requirements as detailed herein. The system shall be Myers Power model MP2000™, or equal.

BATTERY BACKUP SYSTEM CONFIGURATION

The battery backup system (BBS) shall include, but not be limited to the following:

1) Inverter/Charger.
2) Power Transfer Relay.
3) Two (2) separate manually operated non-electronic bypass switches in one assembly: one for inverter & one for generator
4) A generator plug with compartment door.
5) An “On Battery” warning light on top of BBS enclosure.
6) All necessary hardware and interconnect wiring.
7) **See Exhibit 1 attached in appendix “A” for connection block diagram.**

All BBS assemblies shall be new and fully assembled by the designated manufacturer/supplier (batteries may be separate). Contractor shall not fabricate or assemble the BBS assemblies, and shall only install and wire the assemblies on the existing signal cabinets.

1. SYSTEM CAPACITY AND RUNTIMES

1.1

The BBS shall be configured such that it provides a minimum of two (2) hours of full run-time operation for an intersection using led traffic and pedestrian signals. The UPS

shall be 2000 VA / 1500 Watts with 80% minimum inverter efficiency. 105 AH batteries shall be utilized at any given intersection.

2. RELAY CONTACTS

2.1
The UPS shall provide the user with 6 sets of fully programmable, relay contacts of type N/O, N/C, panel-mounted, potential free and rated 1 AMP, 120VAC and labeled C1 through C6, **see Appendix "B", Exhibit 2, for wiring diagram**. Each relay's setting shall be programmable to activate under any number of conditions locally using the touch pad or remotely using the RS232, USB or ethernet interface. The available settings for the relays are outlined below.

Relay contacts C1 through C6 can be independently configured to activate under any of the following conditions:

2.1.1 On battery- relay activates when BBS switches to battery power.
2.1.2 Low batery- relay activates when batteries have reached a certain level of remaining useful capacity while on battery power. This number is adjustable from 0 to 100%.
2.1.3 On-battery lamp – relay activates when power transfer switch (PTS) activates.
2.1.4 Alarm- relay activates after a specific or general alarm is detected. These alarm conditions include: line frequency, low output voltage, no temperature probe, overload, batteries not connected, high temperature, and low temperature. The relay can be programmed to activate when any of these alarm conditions are met, or when a specific condition is met.
2.1.5 Fault- relay activates after a specific or general fault is detected. These fault conditions include: short circuit, low battery voltage, high battery voltage, high internal temperature, and excessive overload. The relay is programmed to activate when these fault conditions are met, or when a specific condition is met.
2.1.6 Off-Relay is disabled and will not activate under any condition.

2.2
Default relay settings

2.2.1 Relay C1 shall be set to activate whenever the ups transfers to battery power and shall be labeled "C1 'on Batt – Alarm 2'".
2.2.2 Relay C2 shall be set to activate whenever the UPS activates the "On-Battery Light" on top of the cabinet and shall be labeled "C2 'On-Battery' Light'".
2.2.3 Relays C3 and C4 shall be set to activate whenever the batteries reach an assigned percentage of remaining useful capacity and shall be labeled "C3 'Low Batt – Maint. Required'" and "C4 'Low Batt – Remote Flash'".
2.2.4 Relays C5 and C6 shall be set to activate whenever the UPS has a fault or alarm activated and shall be labeled "C5 'Faults – Maint. Required'" and "C6 'Alarm – Maint. Required'".

2.2.5 Terminal block position 19 & 20 shall be set to activate a self-test. This test confirms that a unit can transfer into and out of battery mode while supporting the output load.

2.2.6 Terminal block position 21 & 22 are activated when the PTS system is “On Battery”.

3. OPERATION

3.1
The manual by pass switch (MBPS) shall be rated at 240 VAC, 40 AMPS minimum.

3.2
The MBPS shall allow replacement of the UPS without having to interrupt power to the intersection. The mbps and power transfer switch (PTS) shall be separate units allowing for the replacement of the BBS or PTS without interrupting power to the intersection.

3.3
The BBS shall use a temperature compensated battery charging system. The charging system shall compensate over a wide range of 2.5 to 4 MV / °C / Cell. The charger shall be rated 10 AMPS at 48VDC.

3.4
The temperature sensor shall be external to the UPS unit. The temperature sensor shall be supplied with 3 meters (9’ 10”) of wire and shall be attached to the side of one (1) battery with aluminum foil heat sensitive tape **only**.

3.5
Batteries shall not be charged when battery temperature exceeds 50°C ± 3°C (122°F).

3.6
The BBS shall automatically monitor on an ongoing basis that battery power is present and available in the event it is needed during a utility outage. A “Battery Not Connected” alarm shall be issued if battery power is not present.

3.7
When utilizing battery power, the BBS output voltage shall be between 110VAC and 125VAC, pure sine wave output with THD < 3% at 60 HZ +/- 3 HZ.

3.8
In the event of ups failure, battery failure or complete battery discharge, the power transfer switch (PTS) shall revert to the utility or line mode (In a De-Energized State) where utility power is supplying the cabinet.

4. ENVIRONMENTAL

The operating temperature for both the inverter/charger (UPS), power transfer switch (PTS) and manual by pass switch (MBPS) shall be -37 °C to +74 °C.

5. PRODUCT COMPATIBILITY

5.1
BBS shall be compatible with all of the following for full phase, flash operation mode or a combination of both full and flash mode operation:

- NEMA Cabinets
- NEMA TS1 Controllers
- NEMA TS2 Controllers
- Electrical Service Pedestals

5.2
The BBS system including 79AH batteries shall fit inside an electrical service pedestal (Myers Meug 35) or an external Myers BC series BBS cabinet. This project will specify a BC100HZG-LH or RH – 48V/30 AMP receptacle and utilizing 105 AH batteries.

6. LOSS / RESTORATION OF UTILITY POWER

6.1
In the event the BBS senses the utility line voltage is outside the HI and LOW limits (100 & 130VAC respectively set as default), the BBS shall transfer the load to battery power.

6.2
The BBS shall return to line mode when the utility power has been restored to above 105 VAC for more than 30 seconds. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB and optional ethernet interfaces.

6.3
The BBS shall return to line mode when the utility power has been restored to below 125 VAC for more than 30 seconds. Or, the BBS shall return to line mode when the utility power is back to nominal. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB or optional ethernet interface.

6.4
The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 65 milliseconds. The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

7. BACK-FEED AND OTHER PROTECTIONS

7.1
The BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service per UL 1778, section 48 "Back-Feed Protection Test". The upstream back-feed voltage from BBS system shall be less than 1 volts AC for the protection of the traffic engineer or a technician.

7.2
The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41 for 2000 Volts AC.

8. MOUNTING / CONFIGURATION

8.1
Mounting method shall be shelf-mount or rack-mount. BBS and PTS units individually shall not exceed 5.25” or 3U in height.

8.2
All necessary hardware for mounting (Shelving, Rack, Harness, etc.) Shall be included in the bid price of the BBS.

8.3
External battery cabinets may be used to meet adequate environmental and physical requirements.

9. FUNCTIONALITY, DISPLAYS, CONTROLS, DIAGNOSTICS AND MAINTENANCE

9.1
The BBS shall include a LCD display to indicate current battery charge status, various input/output voltages, power output, battery temperature, date, time and settings of the various field programmable relays. The same parameters shall be available via RS232, USB and ethernet interfaces for remote monitoring.

9.2
The UPS shall provide the power beyond the temperature that would be field programmable for an external fan located in the same or in a separate battery cabinet. The temperature setting shall be adjustable from the touch pad or remotely via RS232, USB and optional ethernet. The temperature range shall be from +20°C to +55°C in 1 degree C increment.

9.3
All control, programming, maintenance and inquiry shall be accessible via the keyboard on the face of the BBS without the need for the use of any additional equipment or external PC.

9.4
The BBS shall be capable of accepting firmware updates of the non-volatile, read-only memory via serial port communications. The updates shall be accomplished by uploading the software to the BBS over the RS232/USB serial port located on the face of the UPS.

9.5
The buck and boost mode shall be provided in case of extended power variations. The BBS shall have the ability to buck and boost 10% +/-.

9.6
The PTS shall be activated during buck and boost operation. The transfer time shall be less than 10 milliseconds typically to meet plc and other controller requirements.

9.7
The UPS shall be provided with a re-settable inverter event counter and a cumulative inverter timer that is accessible via the LCD screen or remotely via RS232, USB or ethernet.

9.8
The UPS shall be equipped with an event log that stores for a minimum the last 100 events. The events shall be time and date stamped. The event log shall be retrievable via RS232, USB or optional ethernet and from the BBS LCD screen. The event log shall display and print out in plain English when output over the RS232, USB or ethernet ports.

9.9
The BBS shall be capable of performing a self-test, locally from the UPS front panel LCD, or remotely via RS232, USB and optional ethernet interfaces. The duration of the self-test shall be programmable in 1-minute increments from 1 min. To 255 minutes.

9.10
The level for low battery alarm shall be available on the RS232, USB or ethernet connector located on the front face of the BBS. The programmable low battery alarm contact shall be available on RS232 for local or remote access with the incremental adjustment of 0.25 VDC

9.11
Certain maintenance controls such as battery test, BBS inverter On/Off viewing the event log and changing default settings shall be password protected. The UPS shall be provided with a default password. The user can change the password in order to restrict access to sensitive functions.

9.12
The following LED lights conditions shall be used to indicate current status:

Green LED flashing for battery back-up mode
Green LED steady on for normal line mode operation

Red LED flashing for alarm conditions
Red LED steady on for fault conditions

9.13
BBS shall be easily replaced and installed (complete turnkey system with all necessary hardware). BBS shall not require any special tools for installation.

10. BATTERY SYSTEM

10.1
Individual batteries shall be 12 VDC type and shall be easily replaced and commercially available off the shelf.

10.2
The battery system used in the BBS shall consist of (4) 105 AH batteries and for safety, shall be of a voltage not to exceed 60 VDC. Batteries shall be provided with quick disconnect terminals and a polarized-keyed battery cable for easy field installation.

10.3
Batteries shall be certified to operate over a temperature range –20°C to +74°C

10.4
Batteries shall indicate maximum recharge data and recharging cycles.

10.5
Recharge time for the battery from protective low cutoff to 80% or more of full battery charge capacity, shall not exceed twenty (20) hours.

10.6

A) Batteries individual batteries shall be:

- Voltage Rating: 12V Type
- Amp-Hour Rating: 105 AMP-Hour Minimum
- Group Size: 31 Minimum
- Easily Replaced and Commercially Available Off the Shelf.

B) Batteries used for each BBS shall consist of (4) batteries. All batteries must meet their specifications out of the box immediately after the initial 24-hour top off charge. Batteries that require cycling to meet the AH rating specifications are not acceptable.

C) Batteries shall be able to withstand extreme temperature, deep cycle, sealed prismatic lead-calcium based AGM/VRLA (absorbed glass MAT/VALVE regulated lead acid) batteries.

D) Batteries shall have a manufacturer's warranty of (2) years full replacement. The warranty shall cover any battery that does not meet 80% of its original reserve capability during the warranty period.

E) The batteries shall be provided with appropriate interconnect wiring and a corrosion-resistant stationary mounting tray with a non-heated battery mat appropriate for the cabinet into which they will be installed.

F) Batteries shall indicate maximum recharge data and recharging cycles.

G) Battery harness:

1) Battery interconnect wiring shall be via a two-part modular harness.

2) Part I shall be equipped with red (+) and black (-) 30.48 cm (12") cabling that can be permanently connected to the positive and negative posts of each battery. Each red and black pair shall be terminated into an anderson style power pole connector or equivalent.

3) Part II shall be equipped with the mating power pole style connector for the batteries and a single, insulated power pole style connection to the inverter/charger unit. Harness shall be fully insulated and constructed to allow batteries to be quickly and easily connected in any order to ensure proper polarity and circuit configuration.

4) Power pole connectors may be either one-piece or two-piece. If a two-piece connector is used, a locking pin shall be used to prevent the connectors from separating.

5) All battery interconnect harness wiring shall be UL style 1015 CSA TEW or welding style cable or equivalent, all of proper gauge with respect to design current and with sufficient strand count for flexibility and ease of handling.

6) Battery terminals shall be covered and insulated with molded boots so as to prevent accidental shorting.

H) Each BBS system shall be supplied with an individual charge battery manager – Myers Power Products, Inc. Model #[illegible]930-48 with Myers part #CTSPBCK-37 battery string cable. The battery manager shall be provided to automatically balance the battery charge voltage on all batteries in the string to within ±100MV between any two batteries. The balancer shall allow for any single 12V battery within the battery string to be replaced at any time throughout the warranty period and not require the purchase of new batteries, to install the battery covered under the warranty.

10.7
The BBS enclosure shall be a NEMA 3R rated side-mount cabinet and installed on the left/right side of the traffic signal cabinet with a left/right hand door swing. The enclosure will house the batteries, UPS (BBS), (2) manual bypass switches, power transfer relay, generator connection compartment, on-battery light (external), other control panels and all wiring & harnesses. The cabinet must meet the requirements for NEMA 3R enclosure and **must be manufacture by Myers Power Products, model: BC100HZG-48LH-UPS, see Appendix "C", exhibit 3 for details**. . The housing must have the dimensions so that it may easily be attached the side of 'P' type signal cabinet. Dimensions of the enclosure shall not exceed 48"H x 22" W x 16.5" D. The BBS enclosure must not interfere with the opening of the signal cabinet door.

The complete enclosure and door must be made from .125" thick raw aluminum. All external seams must be continuously welded. The door opening must have a double flange for weather sealing purposes.

A. **DOOR:** The cabinet must have a door to provide access to the complete cabinet interior. The door must include a continuous piano hinge made of 14-gauge stainless steel and a .120" diameter stainless steel hinge pin. The hinge must be attached to the enclosure and the door with close end pop rivets. The door must have a three (3) point locking mechanism with rollers at the ends for the latch rods. The key lock must be a Corbin cylinder lock with two No. 2 keys provided for each cabinet. When the door is opened it must have stops at 90 and 130 degrees. A continuous neoprene gasket must be used to weatherproof the enclosure when the door is closed. **The door swing (hinge side) shall be as noted on plans.**

B. **VENTILATION FAN:** A fan must be mounted in the air baffle at the top of the cabinet with an air outlet built into the overhang. The fan must be thermostatically controlled. The bottom of the door must be louvered to allow airflow. A removable dust filter must be located behind the vent.

C. **FINISH:** The enclosure shall be painted finish to match controller cabinet (unless otherwise specified by the city).

D. **FEATURES:** An "On Battery" factory installed high impact red light option shall be installed on top of the BBS enclosure, and be a minimum of 2.5 inches in diameter. The "On Battery" LED shall operate from the DC voltage of the UPS to notify that the UPS is on battery power without opening the door. The light will be wired to and controlled by the UPS power module. The enclosure shall be designed to shelf mount the UPS and power transfer switch (PTS). When the UPS is mounted into the enclosure it must be mounted to accommodate straight-on horizontal viewing of the LCD screen

on the UPS. Two (2) battery shelves with rubber battery mats (non-heated) shall be provided.

E. **GENERATOR CONNECTION:** A factory-installed flush mount generator compartment with neoprene gaskets for weatherproofing shall be installed in the enclosure. The generator compartment shall include a locking 30 AMP plug, L5-30P, for connecting of a portable AC generator. A manual transfer switch shall be mounted within the BBS cabinet to allow for transferring from utility power to generator power. The generator door will provide a cable slot to allow for closing of the door when the generator is plugged in and to lock the cable inside of the compartment. The door shall include a Corbin Type 2 lock.

F. **MOUNTING:** The BBS cabinet will be mounted to the side of the traffic signal control cabinet with six (6) stainless steel hex head bolts, ¼" x 20". All holes will be field drilled by the contractor to accommodate the specific situation. A grommet must be supplied to protect the cable in a field drilled 1.5" to 2" hole for cable connection to the existing traffic controller. The BBS manufacturer shall supply all the mounting hardware, bolts, washers, nuts, gaskets, bushings, grommets, etc., necessary to install the BBS cabinet in a safe and weatherproof manner. The contractor shall supply the caulking.

G. WIRING AND PROGRAMMING

Contractor shall install a BBS terminal connection block in signal cabinet to provide direct connection from electrical service to BBS. The contractor shall be responsible to completely wire the battery backup system, <u>including contact wiring and programming as follows</u>:

1) Contact 1 (C1) – "On-Battery" (Signal Cabinet 'Alarm #2').
2) Contact 2 (c2) – "On-Battery Lamp".
3) Contact 3 (C3) – "Low Battery" (Signal Cabinet 'Maintenance Required' Alarm).
4) Contact 4 (C4) – "Low Battery" (Signal Cabinet 'Remote Flash' Activation').
5) Contact 5 (C5) – "BBS Faults" (Signal Cabinet 'Maintenance Required' Alarm).
6) Contact 6 (C6) – "BBS Alarms" (Signal Cabinet 'Maintenance Required' Alarm).

<u>IMPORTANT:</u> Existing traffic signal cabinets may be from different manufacturers. An approved method shall be determined by the contractor/BBS supplier for wiring between the BBS and signal cabinet for "Flash Activation" during the "Low Battery" period. The contractor shall be responsible for obtaining approval by the city, or its designated representative, once a method(s) is determined for the remote (automatic) flash activation in order to provide consistency in citywide installation.

TURN-ON:
Upon final installation at the project location, the contractor shall "Turn-On" and test the BBS system. The contractor shall arrange to have a knowledgeable technician from the BBS manufacturer present at the time of the BBS "Turn-On". The representative shall be fully-qualified to work on their respective BBS equipment and its connectivity to various types and manufacturers of traffic signal cabinets. The manufacturer's representative and city engineer shall be notified at least seven (7) working days prior to intersection "Turn-On".

Testing shall include BBS operation in the "On-Battery" mode (minimum run time of 5 minutes then check battery voltage and record), "Low Battery" mode (Flash), and verification that alarm and fault relay contacts are properly functioning.

Upon satisfactory "Turn-On" at the project location, the city engineer shall be notified within three (3) days, for city staff field-verification of all tests performed.

11. SERVICE AND WARRANTY

11.1
Manufacturer shall provide a two (2) year warranty. Under this warranty, the manufacturer will send out a replacement within two business days of the call notifying them of an issue. The replacement unit may be either a new unit or a re-manufactured unit that is up to the latest revision.

12. SPECIFICATIONS

INPUT SPECIFICATIONS

Nominal Input Voltage 120VAC, Single Phase
Input Voltage Range 120VAC +/- 25%
Input Frequency 60 Hz +/- 5%

OUTPUT SPECIFICATIONS

Nominal Output Voltage 120VAC, Single Phase
Power Rating 2000VA (1500 Watts)
Output Frequency 60 Hz (+/- 5%)
Voltage Wave Form Sine Wave, THD < 3%
Efficiency (Nominal) 95-97%

MECHANICAL SIZE

Inverter / Charger 17” Wide X 5.25” High (3u) X 10” Deep
Pts Assembly 17” Wide X 5.25” High (3u) X 7” Deep
Weight Under 50 Lbs

COMMUNICATIONS

SERIAL AND NETWORK COMMUNICATIONS INTERFACE

The BBS shall have serial and ethernet communications interfaces for user configuration and management. The user serial port shall be an EIA-232 (DB9-Female) connector. The ethernet port shall be an RJ45, EIA 568B pin out connector.

USER CONFIGURATION MENUS

All BBS configuration and system menus shall be accessible and programmable from the RS-232 port and from the ethernet port below. Additionally, all log files shall be available through these ports.

QUALITY ASSURANCE

QUALITY ASSURANCE

Each BBS shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two quality assurance procedures: (1) design QA (see below) and (2) production QA. The production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved.

QA PROCESS

QA process and test results documentation shall be kept on file for a minimum period of seven years.

QA APPROVAL

Battery backup system designs not satisfying design QA testing and production QA testing requirements shall not be labeled, advertised, or sold as conforming to this specification.

TESTING

For design qualification testing, as a minimum, the following will be tested for compliance to the specifications:

A. Minimum of two hours of run time while operating in backup mode, at full load.
B. Proper operations of all relay contacts.
C. Inverter output voltage, frequency, harmonic distortion, and efficiency, when in backup mode.

D. All power transfer voltage levels and all modes of operation.
E. Power transfer time from loss of utility line voltage to stabilized inverter line voltage from batteries.
F. Backfeed voltage to utility when in backup mode.
G. IEEE/ANSI C.62.41 compliance.
H. Battery charger operation.
I. Event counter and runtime meter accuracy.
J. User ability to control, monitor, get reports, and configure the system through the standard RS-232 and ethernet ports.
K. Complete physical inspection of the system for quality workmanship.

PRODUCTION QUALITY CONTROL TESTING

Production quality control tests shall consist of all of the above listed tests and shall be performed on each new system prior to shipment. Failure to meet requirements of any of these tests shall be cause for rejection. The manufacturer shall retain test results for seven years.

100-HOUR BURN-IN-PERIOD

Each BBS shall be given a minimum 100-hour burn-in period to eliminate any premature failures. The burn-in period can be a combination of running in backup mode with a full load and running in charger mode.

VISUAL INSPECTION

Each system shall be visually inspected for any exterior physical damage or assembly anomalies. Any defects shall be cause for rejection.

TRAFFIC SIGNAL FACES AND FITTINGS (SECTION 86-4)

Add the following:

All optical vehicle signal indication units shall utilize the Light Emitting Diode (LED) type signal modules. The led signal module units provided shall be manufactured by "Dialight Corporation" or approved equal and shall meet ITE specifications. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

All signal heads shall be supplied by the same manufacturer, and shall be made of metal with 12-in diameter Dialight or approved equal LED modules. Visors shall be full circle type.

In addition to Section 86-4.04, "Signal Mounting Assemblies," of the Caltrans Standard Specifications, the following special provisions shall apply whenever a terminal compartment is required:

The terminal block shall be mounted vertically and to the side of the cable inlet guide. Sufficient lateral spacing shall be provided to allow pulling and connecting of incoming

conductors without removal of the terminal block mounting screws. A minimum of one-inch (1") clearance shall be provided between the terminal block and all inside walls of the terminal compartment. The terminal compartment shall be provided with a captive hinged access door. With the door open, there shall be a minimum of ten-by-four-inch (10" x 4") access to the terminal compartment for the connection and inspection of the terminal block. The door shall be equipped with a neoprene gasket, permanently secured, to prevent water from entering the terminal compartment and captive screws for securing door. The mounting bolt spacing and cable guide location shall be as dimensioned on drawing ES-4D of the Caltrans Standard Plans.

METAL SIGNAL SECTIONS (SECTION 86-4.01A(1))

Add the following:

Metal signal faces shall be provided with metal backplates.

PEDESTRIAN SIGNAL FACES (SECTION 86-4.03)

Add the following:

All optical pedestrian signal units shall be of the Light Emitting Diode (LED) type. The LED module units provided shall be Dialight Corporation or approved equal and shall meet ITE specification. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

Pedestrian signals shall be type a with egg crate type screens and shall have a countdown timer function. The pedestrian head housing and door shall be green and made of metal with no plastic parts, and shall be 16 inches by 18 inches.

Pedestrian signal ground wires shall not have splices between the poles and the controller cabinet. All pedestrian signal ground wires shall be joined and grounded within the controller cabinet.

DETECTORS (SECTION 86-5)

Add the following:

Loop detector conductors shall be Type "2".

Loop detector lead-in cables shall be Type "B".

Circular detector loops shall be Type "E" per Caltrans Standard Plan, 6 feet in diameter. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of 3/4 inch.

Circular detector loops for bicycle and motorcycle detection shall be Modified Caltrans Standard Plan Type “E”, 6 feet in diamater with 1 diagonal wire cut inside the circle and set back 1 foot before the lead cross walk stripe or limit line. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of ¾ inch.

All cuts shall be sealed with a sealant on the same day the slots are cut in accordance with the hot-melt rubberized asphalt sealant per Section 86-5.01A(5) of the Caltrans Standard Specifications. All loops shall have 2-1/8 inch clearance of sealer above loop wires.

Loop wires in home runs, beginning at each loop, shall be tightly twisted together with a minimum of five (5) turns per foot. Home runs shall be cut to a sufficient width to accommodate the twisted wire.

All loops shall be connected in series. Splices shall use butt-splice connectors and shall be soldered by the hot-iron. No open flame shall be used on soldered connections. All loop wires including loop conductors shall be installed on the same day the slots are cut.

Wires for each loop shall be marked with bands of colored tape to designate loop number, starting at the number 1 lane and proceeding to the number 2 lane, and so on.

PEDESTRIAN PUSH BUTTON ASSEMBLIES (SECTION 86-5.02)

Add the following:

Pedestrian push buttons shall be ADA compliant (2” Diameter), Type B, Polara Bulldog No. BLD3-Y (momentary, non-latching), with a stainless steel button, yellow body on a green color frame. Pedestrian push button signs shall conform to the details shown on the plans, except that the message and symbol shall conform to California sign specification sheet R10-3. Fasteners shall be stainless steel tamper-proof screws for pedestrians push-button assemblies. Pedestrian calls to the controller shall be independent, by phase, and not as concurrent thru-phase pairs.

LIGHTING (SECTION 86-6)

Replace with the following:

Luminaires shall be 120 V Cooper Lighting Navion LED Series Roadway Luminaires, part No. NVN-AE-02-E-U-T3-10K-U-AP or No. NVN-AE-03-E-U-T3-10K-U-AP as indicated on plans, or approved equal. Luminaires shall be 120 V, 107 W, and without photocell.

The luminaire shall provide true ninety-degree (90°) cutoff with no light emitted above the horizontal.

The luminaire optical assembly shall be sealed, water-tight, and filtered to prevent contamination from infiltration of gaseous and particulate matter. The LED's shall be factory preset to produce a full cutoff IES Type III light distribution.

INTERNALLY ILLUMINATED STREET NAME SIGNS (SECTION 86-6.09)

Add the following:

All IISNS and hardware shall be new. The materials and workmanship shall be of the best quality for the purpose.

All IISNS shall be "**National Edge Lit Led IISNS"**, or approved equal.

The contractor shall furnish and install **Led Edge Lit Internally Illuminated Street Name Signs** manufactured by national sign incorporated or approved equal. Model: **NAIM-72-LED EDGE LIT-D-DG3** with mounting hardware.

The visible message shall be displayed from both sides of the signs and be reflectorized. Signs shall have white legends, symbols, arrows, and 3/4 " border on green background. The legend shall be as shown on the plans.

The style and spacing of letters, figures, and arrows shall conform to the current standards established by the State of California, Department of Transportation. Side margins and spacing may be compressed when necessary to stay within sign length.

The full size IISNS layout shall be submitted to the city engineer for approval prior to fabrication. It shall be the responsibility of the contractor to keep the engineer informed of all operations requiring inspection or approval prior to proceeding with fabrication.

Affixed to one side of each panel shall be white 3M diamond grade reflective sheeting. Each panel shall be screened a "GREEN" color background as indicated on the plans. Manufacturing of panels shall conform to 3M specifications for installation of diamond grade reflective sheeting.

Photocell and receptacle shall be omitted.

All IISNS shall be 18" x 72" (unless otherwise identified as 18" x 96") double-sided and shall be mounted with hinged, adjustable or telescoping type brackets approved by the engineer.

IISNS must be guaranteed for a minimum of five (5) years.

OVERHEAD REFLECTORIZED STREET NAME SIGN

These specifications define requirements for overhead reflectorized street name signs:

I. GENERAL

A. WORKMANSHIP:

All items shall be new; the materials and workmanship shall be of the best quality for the purpose.

B. DRAWINGS:

All sign layouts shall be the contractor's responsibility and shall be in accordance to the State of California - sign specifications chart guidelines.

C. WARRANTY:

Any sign delivered under this contract which does not conform to these specifications shall be replaced by the contractor at no cost to the City.

II. DETAILED REQUIREMENTS

A. BASE METAL:

1. DESCRIPTION

The base metal substrate shall be new aluminum alloy 3003-H14 or 5052-H32.

The thickness of the aluminum shall be 1/20". The material shall be subject to inspection prior to degreasing and chromate conversion coating operations. Alloy and temper designations shall be verified by mill test certifications.

2. SHEARING:

All sign panel edges shall be shear-trimmed or roll-slit to produce neat edges and square corners. Sign panel edges shall be straight within 1/32" from the straight plane. Edge delimitation or incomplete coverage of the base metal substrate up to and coincident with the cut edge of the sign panel shall be sufficient basis for rejection of the entire sign panel.

3. PRETREATMENT:

All treatment tanks and/or spray-applied systems must be performed on the contractor premises, to ensure proper adhesion of reflective sheeting materials. All treatment tanks or spray applied systems shall be charged with fresh

chemicals at least once a year. If pretreatment is performed by immersion methods, the tanks must be sufficient size to accommodate the complete panel. Titration equipment shall be available for the inspectors to check the solutions strengths. The cleaned and coated base metal shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, the panels shall be protected at all times from contact or exposure to grease, oils, dust or other contaminates.

The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light tightly adherent chromate conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with Section 5, "Recommended Processing Methods" of ASTM designation B-449. The coating weight shall be (30-100 mg/sq.ft.), a Class 1 coating.

B. SIGN MESSAGE AND REFLECTORIZED MATERIAL:

1. Sign panels with identical legends shall be displayed on both sides of the sign frame unless otherwise indicated.

   Letter size, style, spacing, arrows, and figures shall conform to the current standards established by the State of California, Department of Transportation.

   a) The legends or street name shall be 8" upper case and 6" lower case. Series E shall be used.

   b) Message layout shall be per State of California-Sign Specifications, Code G7-1(CA). Side margins and spacing may be compressed when necessary to stay within sign length.

   c) 1” border

2. 3M diamond grade VIP reflective sheeting (wide-angle prismatic lens reflective sheeting) or equal, shall be on both fore and background. The standard color shall be white legends, letters, and borders, on a green background. No cut out legends, letters, or border shall be used.

C. SIGN FRAME AND PANEL CONSTRUCTION:

The size of the sign will be 18"x72" or 18"x96".

1. FRAMES:

The frame shall be aluminum channel extrusion, 1¼"x1¼"x1/8" wall thickness. Alloy 6063-T5. All joints of the aluminum channel shall be miter cut to form a 45-degree angle at each corner. The frame shall be welded with an inert gas shield-arc welding process using 4043 electrode filler wire in accordance with good shop practice. The width of the filler wire shall be equal to the wall thickness of the channel being welded.

The top of the frame will have two 2"x2"x¼" wall thickness channel members welded and fastened to the frame with stainless steel bolt, washer, nylon nuts and cotter pins. The adjustable swing assembly will be attached to these members.

2. ASSEMBLY:

A sign panel shall be fastened to both sides of the channel frame to make a double-faced unit. Each sign panel must be a continuous sheet, no vertical or horizontal splices to make up one panel.

The sign panels shall be affixed to the frame with 3/16" diameter blind pop rivets, alloy 5052, or a type approved by the engineer. They must be aluminum approved. The exposed face of the rivet shall be of similar shade and compatible with face color of the finished sign. The rivets shall be placed through the face of the sign with the wall of the channel placed against the back of the sign panel. Rivets shall be placed no closer than ½" from the edge of the sign panel and a maximum of 8" apart from one another. All rivets must penetrate the web of the channel frame for proper grip strength between sign panel and frame.

The swing hinge is attached to the 2"x2" channel member with a ¼" stainless steel bolt and bronze bushing. Then secured with a non-lock nut.

D. MOUNTING ASSEMBLIES:

1. SIGNAL MAST ARM MOUNTING:

The top of the sign frame shall have two free swinging mounting brackets. They shall be of all aluminum, bronze, and stainless steel parts. The 5" long stainless steel bolt for fine adjustments shall have nuts and lock washers, or self locking nuts and cotter key. The bracket assembly shall permit the sign to swing perpendicular to the support hardware.

The mounting bracket location shall be 18" from the outside edge for the 18"x72" sign, and 24" for the 18"x96" sign.

The mounting brackets shall be aluminum, connected to the mast arm by band straps.

When installation of the sign to the mast arm is complete, the sign should swing freely 70-90 degrees in both directions when moved by the installer.

2. VERTICAL POLE SHAFT MOUNTING:

The extruded aluminum sign support channel shall be made from Alloy-6061-T6. The top portion of the extrusion shall have a continuous inverted "T" slot. This section shall accommodate the positionable stainless steel fittings and clamps providing complete freedom of alignment within this slot forming an integral clamping system. The channel shall be compatible with the current system used to fasten the sign face to the channel support. The sign support system herein described shall conform to AASHTO's standard specifications for structural supports for highway signs, luminaires and traffic signals (latest revision) and be rated for specified wind velocities.

Universal channel clamps shall be fabricated from Type 304 stainless steel. Clamps shall be formed from 16 gauge stainless steel, formed by tapering uniformly from each end toward the center to a depth of ½" forming a modified "V" on the bottom of the clamp. This shall be referred as the "saddle". Locked within the "saddle" shall be a portion of the unit referred to as the insert plate which shall be fabricated from 14 gauge Type 304 stainless steel and form a shallow "U". The legs of the "U" shall be 1" high and 1&1/16" wide with an aperture designed to permit passage of a 3/4" stainless steel band or buckle strap. The opening shall be 3/4"x3/16" vertically on the one inch dimension and shall be in from the edge closest to the "U" of the "Saddle". The base of the "U" shall be ½" wide by 2½" long where it is designed to slide in the inverted "T" slotted section of the extruded aluminum sign support channel.

Band straps shall have a minimum thickness of 0.03" and be made of stainless steel.

3. STREET SIGN MASTARM MOUNTING:

Contractor shall provide and install a cantilever street sign mastarm and shall comply with section 86-2.04, "Standards, Steel Pedestals and Posts", of the standard specifications and these special provisions

The cantilever arm for the reflectorized street name sign shall connect to the signal standard with a clamp style arm connection manufactured by Valmont Industries or an approved equal. The arm shall be welded to the clamp connection and extend horizontally from the standard two (2) feet longer than the specified sign size. The free end of the arm shall be capped and welded. The reflectorized sign shall be centered about the arm. The arm shall have a 3&7/8" O.D. and a thickness of 0.1196 inch.

Sign shall be mounted to the street sign mastarm as described in item #1 above, "Signal Mastarm Mounting".

E. FINISH:

The finished sign shall be flat within a ratio of 0.40inch per linear foot when measured across the plane of each panel from opposite corners or at any location on the panel. All finished signs shall have a smooth flat surface without defects or objectionable marks of any kind on either the front or the back faces. All letters and designs shall be clearly cut and sharply defined.

The appearance of the sign face shall be uniform throughout and shall be free of wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles or blemishes that may impair the serviceability, detract of the sign when viewed from a distance of twenty-five (25) feet.

The finished sign shall be clean and free from all burrs, sharp edges, loose rivets and aluminum marks.

Signs with any defects or damage that affect their appearance and quality workmanlike manner with all sign surfaces and edges free of defects. No repairs shall be made to the face sheet without the approval of the engineer.

City of Laguna Hills Specifications

General Specifications and Special Provisions

CITY OF Laguna Hills
SPECIAL PROVISIONS FOR TRAFFIC SIGNAL INSTALLATION
JULY 2014

All work shall conform to the latest edition of the Caltrans Standard Specifications and the following special provisions.

SUMMARY (SECTION 86-1.01)

Add the following:

The system shall be complete and in operating condition at the time of acceptance of the project.

The contractor shall provide the city with all traffic signal equipment shop drawings prior to ordering the equipment for approval.

Contractor shall provide guarantees for all work, materials, and labor valid for a period of one (1) year from the notice of completion date for the work by the city.

EQUIPMENT LIST AND DRAWINGS (SECTION 86-1.04)

Add the following:

One (1) set of mylar copy, five (5) sets of bond copy, and one (1) set of electronic copy on cd of cabinet schematic diagrams shall be furnished for each traffic signal location. No other type of reproducible material shall be allowed in place of mylar copy.

Updated controller cabinet schematic wiring diagrams shall be provided on 24" x 36" sheets for approval. One schematic wiring diagram shall be provided for left wall, back wall, right wall, and door. The intersection sketch shall be provided on cover sheet with north arrow up.

Contractor shall furnish ~~two (2)~~ maintenance and operation manuals for all controller units, conflict monitors, auxiliary control equipment, vehicle detector sensor units, and amplifiers. The manuals shall be submitted at the time the equipment is delivered for testing. The manuals shall include, but not limited to, the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Detailed circuit analysis
6. Troubleshooting procedure (diagnostic routine)

7. Voltage charts with wave forms
8. Geographical layout of components
9. Schematic diagrams
10. List of replaceable component parts with stock numbers

All manuals and documents furnished by the contractor shall be placed inside a heavy duty, clear plastic envelope. The envelope shall be attached to the inside of the controller cabinet door.

The contractor is required to submit to the engineer full scale "as-built" prints and one (1) electronic copy on cd, prior to the city accepting both installations. The prints shall indicate in **red color** all deviations from the contract plans, such as location of poles, pull boxes and conduit runs, depth of conduit, number of conductors, and other appurtenant work for future reference.

SCHEDULING OF WORK (SECTION 86-1.07)

Add the following:

The contractor shall not begin sub-surface work until approval has been obtained from the city engineer. The contractor shall be responsible to reduce impact to the public by minimizing the time between sub-surface work and above-ground installations.

EXCAVATING AND BACKFILLING (SECTION 86-2.01)

Add the following:

All excavated material shall be removed from the site and backfilled with compacted crushed aggregate base material topped with asphalt concrete on the same working day as removed.

FOUNDATIONS (SECTION 86-2.03)

Add the following:

Contractor shall define exact location of all utilities in the vicinity of the proposed new foundation locations. The exact locations of all foundations for signal equipment and the controller cabinet shall be approved by the engineer prior to the start of any excavation work. Foundations shall be hand-dug until clear of obstructions.

Portland cement concrete shall be minimum class 560-C-3250, Type II/V.

All foundation concrete shall be vibrated to eliminate air pockets.

Controller cabinet foundation forms shall be rigid steel.

STANDARDS, POLES, STEEL PEDESTALS, AND POSTS (SECTION 86-2.04)

Add the following:

Standards, poles, steel pedestals, and posts shall not be erected or installed until the service enclosure is installed, metered, and energized; the controller cabinet wired; the controller test period is completed and passed at test facility; the controller assembly installed; conduits, pull boxes, wiring, and other underground installation is complete and in place; and signal faces, vehicle detection, push buttons, signs, luminaires, and other materials required to complete the installation in its entirety have been inspected, passed inspection, and are in the contractor's possession and available for immediate installation.

Pipe tenons shall be provided as detailed on Caltrans Standard plans ES-7M.

In addition to identifying each pole shaft as detailed on Caltrans Standard Plan ES-7M, the contractor shall also identify each mast arm for all signals and luminaires. The stamped metal identification tag shall be located on the mast arm near the butt end and shall contain the same information required by Caltrans Standard Plan ES-7M. Pole tags shall include name of the manufacturer and shall be visible from the road surface.

CONDUIT (SECTION 86-2.05)

Add the following:

Boring or drilling methods shall be used for the installation of all conduits in existing pavement. Rigid metal conduit to be used as a jacking or drilling rod shall be fitted with suitable drill bits for the size as approved by the engineer. Conduit runs shall be continuous in type material from the beginning to the terminating end of the run.

Type 3 rigid non-metallic schedule 80 PVC conduit shall be used at all locations, and shall be 2" minimum diameter. Approved bell bushing shall be installed at all conduit ends.

All conduits shall enter through the bottom of a pull box and shall terminate 2" above the bottom and shall be located near the end walls to leave the major portion of the box clear.

Conduits terminating in standards or pedestals shall extend not more than 2" vertically above the foundation and shall be sloped toward the handhole opening.

After conductors have been installed, the ends of conduits terminating in pull boxes and controller cabinets shall be sealed with a type of sealing compound approved by the engineer.

All non-metallic type conduits, without a grounding conductor, shall have a bare no. 8 AWG solid copper wire that shall terminate at each pull box and at the ends of conduit runs. Twenty-four (24) inches of the solid copper wire shall be coiled in each pull box.

Conduit runs are shown in schematic form only. Actual installation shall be done in most direct manner. The contractor shall locate the interfering existing underground facilities and the actual installation shall be done in the most direct manner as the existing underground condition permits and as approved by the engineer.

PULL BOXES (SECTION 86-2.06)

Add the following:

Pull boxes, covers and extensions for installation in the ground or in sidewalk areas shall be of the sizes and details shown on the plans and shall be pre-cast of reinforced portland cement concrete (PCC). Plastic pull boxes shall not be used. All pull boxes shall be Christy Concrete Products, Inc. With fiberlyte lid, or approved equal.

Grouting is required at the bottom of all pull boxes.

Pull boxes shall be size no. 5, unless noted otherwise on the construction plans. Pull box lids shall specify “Traffic Signal” on top of each. Pull box extensions shall not be required unless specified by the engineer.

The amount of pull boxes shown on the plans is to be installed as a minimum. The contractor may, at no additional cost to the city, install additional or larger pull boxes to facilitate the contractor's work, with the approval of the engineer.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation

facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

The following "COVER MARKING" shall be added on the top of pull box cover as follows:

- "TRAFFIC SIGNAL": Where pull box contains traffic signal conductors with or without street lighting conductors.
- "STREET LIGHT": Where pull box contains only street light conductors.
- "HIGH VOLTAGE STREET LIGHT": Where pull box contains only street light conductors with street light voltage above 600 volts.
- "SPRINKLER CONTROL": Where pull box contains only sprinkler control conduits.
- "TELEPHONE": Where pull box contains only telephone conductors.
- "EDISON": Where pull box contains only Southern California Edison company conductors.
- "TRAFFIC SIGNAL COMMUNICATIONS": Where pull box contains only signal interconnect cables.

CONDUCTORS AND CABLES (SECTION 86-2.08)

Add the following:

Signal cable shall be installed continuously without splicing from the controller cabinet to each traffic signal pole.

All conductors shall be new and THW type. The contractor shall provide all new conductors.

Signal Interconnect Cable (SIC) shall be twelve (12)-pair #19 AWG and conform to the REA PE 22 specification. Conductors with THHN and THWN installation shall not be

used. Cable shall be multi-colored twisted-pair cable with twelve (12)-pair #19 AWG copper conductors and shall use the standard telephone color code. Cable shall have polyethylene insulation, mylar sheathing, and aluminum shielding.

SIC shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed. Contractor shall make interconnect connections as directed by engineer.

SIC shall be grounded only at the master controller location. At all other locations, sic shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

SIC cable identification tags indicating where the direction SIC is coming from shall be attached to each cable end.

SPLICING AND TERMINATIONS (SECTION 86-2.09D)

Add the following:

No splicing shall be permitted except for I.I.S.N.S., safety lighting and commons. All conductors shall extend from the controller cabinet to the terminal compartment on each pole.

Conductors No. 10 AWG and larger shall be spliced by the use of approved "C" shaped compression connectors. Conductors No. 8 AWG and larger shall be stranded.

Plastic conduits containing power circuit conductors shall have a bare no. 8 AWG solid grounding copper conductor that shall terminate at each pull box at the ends of the conduit run.

Signal Interconnect Cable (SIC) shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed.

Cable shall be grounded only at the master controller location. At all other locations, cable shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

Bonding clamps may be obtained by contacting:

AK Stamping Company, Inc.
1159 U.S. Route 22
Mountainside, New Jersey 07092
(908) 232-7300

SPLICE INSULATION (SECTION 86-2.09E)

Add the following:

The contractor shall use splice insulation "Method B".

BONDING AND GROUNDING (SECTION 86-2.10)

Add the following:

Grounding jumper shall be attached by a 3/16-inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

No. 8 minimum copper bond wire shall be run continuously in all circuits.

SERVICE (SECTION 86-2.11)

Add the following:

Service equipment enclosure shall conform to the following:

1. 120 / 240 volt, Type II-BF one meter service equipment enclosure unless otherwise shown on the plans.

2. Circuit breakers shall be the plug-in type and shall consist of the following:

a.	One (1)	100 AMP 2 Pole	240V Signal and I.I.S.N.S. Main (metered)
b.	One (1)	40 AMP 1 Pole	120V Signal Circuit (metered)
c.	ONE (1)	15 AMP 1 Pole	120V I.I.S.N.S. Circuit (metered)
d.	ONE (1)	15 AMP 1 pole	120V I.I.S.N.S. Photoelectric Control (metered)
e.	ONE (1)	100 AMP 2 Pole	240V Lighting Main (un-metered)
f.	ONE (1)	15 AMP 1 Pole	120V Lighting Circuit (un-metered)
g.	ONE (1)	15 AMP 1 Pole	120V Lighting Photoelectric Control (un-metered)

3. Two (2) delayed response Type V photoelectric control contactor and test switch assemblies with two (2) window shields for lighting and I.I.S.N.S. shall be installed in the service cabinet on the customer section. Photoelectric control contactors shall be as follows:

LUMINAIRES	-	30 AMP
I.I.S.N.S	-	30 AMP

4. Service cabinet shall have a painted exterior finish to match the controller cabinet, as directed by the city.

5. Circuit breakers shall be marked with identifying labels for each circuit breaker.

6. Photoelectric control assembly shall be installed within the circuit breaker compartment of the service cabinet enclosure and accessible to the city after installation of electrical meter.

TESTING (SECTION 86-2.14)

Add the following:

The testing of traffic signal equipment, including controller units, fully-wired signal cabinet and auxiliary equipment as specified in Section 86-3, "controller assemblies", shall be performed by a testing facility designated by the City. Approximately twenty (20) working days will be required for testing and notification of the final results.

Testing facility shall contact City Engineer or its representative when controller assembly is available for inspection.

Contractor is responsible for all the costs involved in testing the controller cabinet assemblies, including transportation to and from the testing facility. Contractor is responsible for ordering and purchasing the controller cabinet assembly as specified in the following section, solid state traffic actuated controllers. Cabinets shall not be released to the contractor until full payment for testing is received by the testing agency.

It shall be the contractor's responsibility to arrange pick-up and delivery of these items to the project site. Any cost involved to deliver and install these items at the project site shall be borne by the contractor, and no additional compensation shall be allowed therefore.

In addition to the five (5) working days of continuous satisfactory operation, called for in section 86-2.14C, "Functional Testing", five (5) more working days of satisfactory operation will be required when the signal system is connected to the City's master system controller.

"Turn-On" of the traffic signal systems shall not be made on a Friday or the day preceding a legal holiday. The City Engineer shall be notified five (5) working days prior to the intended "Turn-On". "Turn-On" shall begin before 10:00 a.m. of the approved day. Contractor must complete a satisfactory "Turn-On" within a pre-approved time period to be determined by the City Engineer. When a "Turn-On" is not completed within the pre-approved time period, it shall be canceled and rescheduled.

The Malfunction Management Unit (MMU) shall be tested in the field before "Turn On".

The contractor shall arrange to have a field representative from the City, a City Signal Technician, a knowledgeable technician from the manufacturer of the traffic signal

controller/ cabinet assembly, and a representative from the battery backup system manufacturers, present at the time of the traffic signal "Turn-On". The representatives shall be fully qualified to work on their respective traffic signal equipment. The manufacturer's representative and city staff shall be notified at least seven (7) working days prior to intersection "Turn-On".

The insulation resistance shall not be less than 100 megohms on all interconnect and loop circuits and 50 megohms for power circuits when the megger tests are performed. Testing shall not be conducted until all control and/or sensor units and probes have been disconnected from the circuit.

CONTROLLER ASSEMBLIES (SECTION 86-3)

Add the following:

CONTROLLER/CABINET ASSEMBLIES

Complete controller/cabinet assembly, including controller, completely wired cabinet and appurtenances shall be supplied by the contractor.

Solid-state traffic actuated controller units, cabinets and auxiliary equipment shall conform to the provisions in Section 86-3, "Controller Assemblies", these special provisions, and NEMA TS-2 Standards.

Contractor shall furnish and install Econolite ~~ASC/3-2100~~ TS2 Type 2 System Controller Unit and appurtenances. Contractor shall provide miscellaneous items as necessary to produce a fully-operational system in accordance with the plans, special provisions, Caltrans Standard Plans and Standard Specifications.

Power distribution panel, inside auxiliary control panel, police panel and all detector termination panels shall be hard wired. No "Plug and Go" connections are allowed.

CABINET ASSEMBLY

Contractor shall furnish and install Type "P" painted cabinet assembly as indicated on the plans that includes the following items:

1. One (1) - fully wired eight (8) phase NEMA TS2 Type 2 "P" painted aluminum cabinet, as indicated on the plans.

2. One (1) - Econolite ~~ASC/3-2100~~ TS2 Type 2 Centracs System Controller Unit with data key and ethernet port.

3. One (1) - malfunction management unit with LCD display (programmed for intersection).

4. One (1) - eight (8) position detector rack(s) with sixteen (16) channels of detection and one (1) bus interface unit, per rack. Two (2) EVP 2-channel card positions are to be provided in each eight (8) position detector rack as required.

5. One (1) sixteen (16) position horizontal load bay.

6. One (1) - controller cabinet power supply.

7. Three (3) - battery back-up system alarm inputs: on battery, flash (programmable percentage battery power remaining), and timer.

9. Signal interconnect block for two (2) 12-Pair No. 19 cables.

15. Centracs intergration and graphics shall be provided for the City's Traffic Management System.

All auxiliary equipment installed in controller cabinet to completely operate an eight-phase traffic signalized intersection.

Prior to fabrication of the cabinet, a review of the completed cabinet take-off shall be conducted by the city representative.

SPECIFICATIONS AND STANDARDS FOR THE CABINET ASSEMBLY:
National electrical manufacturers association, traffic control systems, NEMA standards publication: TS2- latest release.

WARRANTY STATEMENT:
Terms of controller cabinet warranty:

WARRANTY COVERAGE:
The supplier of equipment shall warranty their product to be free from defect in design and operation and that it meets all the requirements of this specification and those incorporated in this document.

LENGTH OF WARRANTY:
The warranty term on a wired signal cabinet shall be a (1) year minimum from date of shipment including the bus interface units and cabinet power supply. Equipment such as the controller and malfunction management unit shall have a (5) year minimum warranty.

CONTROLLER ASSEMBLIES (SECTION 86-3) (CONTINUE)

CABINET CONSTRUCTION

A complete NEMA TS2 Type 2 "P" cabinet shall be supplied. Cabinet shall meet, as a minimum, all applicable sections of the NEMA standard publication. Where differences occur, this specification shall govern. The cabinet shall meet the following criteria:

1. Material shall be aluminum sheet, 5052-H32, with a minimum thickness of 0.125-inch.

2. The cabinet exterior shall be a painted finish as indicated and with a white interior, as directed by the city.

3. The door hinge shall be of the continuous type with a stainless steel hinge pin.

4. The door handle shall be cast aluminum.

5. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet. All seams shall be continuous weld.

6. Cabinet lock shall be of the Corbin No. 2 Type.

7. A roll out computer table shall be mounted at a location designated by the City Representative.

8. The cabinet shall have four (4) sets of cabinet wiring diagrams.

9. The cabinet shall have one (1) set of equipment manuals (Controller, MMU, etc.).

NOTE: NO PLUG-N-GO EQUIPMENT SHALL BE ALLOWED FOR POWER DISTRIBUTION PANEL, INSIDE AUXILIARY CONTROL PANEL AND POLICE PANEL (ONLY HARD WIRING).

SHELVES

~~Three (3) substantial metal shelves extending half way across the back of the cabinet on the left side of the cabinet shall be provided to support the controller unit and auxiliary equipment. One (1) substantial metal shelve extending completely across the back of the cabinet in the top area of the cabinet shall be provided to support the detector rack(s).~~

The shelves shall not interfere with the lowering or removal of the main panel. City Engineer shall approve the design for final location of shelves before final manufacture of cabinet.

EQUIPMENT ACCESSIBILITY

All mounted panels and equipment shall have a minimum tool access clearance of 6".

VENTILATING FAN

The cabinet shall be provided with one (1) thermostatically-controlled ventilation fans, adjustable between 80 to 150 degree F and shall be installed in the top of the cabinet plenum.

AIR FILTER ASSEMBLY

The cabinet air filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

CABINET LIGHT ASSEMBLY

The cabinet shall be equipped with a led lighting fixture mounted on the inside of the cabinet near the front edge. The led light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

The cabinet shall have a gooseneck type lighting fixture that shall be mounted on the inside of the door near the hinge. The gooseneck light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

LIGHTNING SUPPRESSION

The cabinet shall be equipped with an EDCO model SHP-300-10 surge arrester, or city approved equivalent.

POWER PANEL

THE POWER PANEL SHALL HOUSE THE FOLLOWING EQUIPMENT:

1. One (1) 40 AMP main breaker to supply power to the main panel, controller, MMU, and cabinet power supply.

2. One (1) 15 AMP auxiliary breaker to supply power to the fan, light, and FG outlet.

3. One (1) 50 AMP, 125 VAC radio interference line filter.

4. One (1) normally-open, 60 AMP, Crydom model #H[illegible]471 solid state relay, or city approved equivalent.

CONVENIENCE OUTLET

Three (3) duplex outlets shall be supplied, as per the following:

1. The first is for short-term equipment use, 120 Volt AC, 15 AMP NEMA 5-15 GFCI duplex outlet, and shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

2. The second and third are for long-term equipment use, 120 Volt AC, 15 AMP NEMA duplex outlets, and shall be mounted in the upper right corner of the cabinet facing the inside of the cabinet. Power shall be supplied from un-switched filtered power.

INSIDE AUXILIARY CONTROL PANEL SWITCHES

The inside door panel shall contain three (3) switches: Auto/Flash, Auto/Off/On Stop-Time, and power On/Off. Auxiliary door panel switches shall be hard wired; printed circuit boards shall not be used.

1. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally. In the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

2. AUTO/OFF/ON STOP-TIME SWITCH (3-POSITION) - In the auto position, the controller shall be stop timed when the police door Auto/Flash switch is in the flash position or MMU Flash. In the off position, the switch shall release all stop time from controller. In the on position, the switch shall maintain a continuous stop time to the controller.

3. CONTROLLER POWER ON/OFF SWITCH (2-POSITION) - This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

POLICE PANEL SWITCHES

The police panel shall contain two (2) switches: signals On/Off and Auto/Flash. All police panel switches shall be hard wired; printed circuit boards shall not be used.

1. SIGNALS ON/OFF SWITCH (2-POSITION) - In the on position, the field displays shall show either normal operation or flash. In the off position, power shall be

removed from signal heads in the intersection. The controller shall continue to operate. In the off position, the MMU shall not conflict or require reset.

2. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally based on all other switches. In the flash position, power shall not be removed from the controller and stop time shall be applied based on the stop- time switch.

CABINET WIRING

CABLES

All controller and MMU cables shall have sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length and shall not obstruct the visibility of any cabinet equipment or interfere with the intended use of the computer tray.

All cabinet wiring shall the color coded as follows:

PURPLE	=	Flash Color Programming
BROWN	=	Green Signal Wiring
YELLOW	=	Yellow Signal Wiring
RED	=	Red Signal Wiring
BLUE	=	Controller Wiring
GRAY	=	DC Ground Return, Logic Ground
BLACK	=	AC Positive
WHITE	=	AC Negative
GREEN	=	Chassis

MAIN-PANEL AND WIRE TERMINATION

All wires terminated behind the main-panel and other panels shall be soldered. No pressure or solder-less connectors shall be used. Printed circuit boards shall not be used on main panels.

FLASHING OPERATION

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

DETECTOR RACK AND INTERFACE

A minimum of one (1) TS-2 vehicle loop detector rack and one (1) hard wired detector interface panel and necessary cabling shall be provided in each cabinet. Detector rack shall be labeled for each detector channel used and shall correspond with cabinet door

diagram. Each individual rack shall support up to sixteen (16) channels of loop detection, one (1) BIU and two (2) EVP 2-channel cards.

PREEMPTION WIRING:

The cabinet shall be completely-wired for railroad or EVP preemption as needed, if specified on the plan(s).

MAIN PANEL CONFIGURATION

The main panel shall be fully wired in the following configuration:

1. Sixteen (16) horizontal load sockets.
2. Six (6) flash transfer relay sockets.
3. One (1) flasher socket.
4. One main panel BIU rack slot.
5. Wiring for both Type 1 and Type 2 controllers.
6. Wiring for one type 16 MMU.

FIELD TERMINAL LOCATIONS

Field terminals shall be located at the bottom of the main panel and angled forward for easy viewing and wiring. The order shall be from left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

CABINET EQUIPMENT

LOOP DETECTORS, LOAD SWITCHES, FLASHERS, RELAYS

Cabinet shall be equipped with the proper number of loop detectors, load switches, flashers, and relays to perform the intended operation.

CONTROLLER UNIT

Cabinet shall be equipped with one (1) ~~ASC/3-2100~~ Econolite TS2-Type 2 controller complete with the latest Econolite recommended software and operating system, and shall be system ready for communication on the Centracs Traffic Signal Management/Monitoring software. Controller shall be equipped with a 25 pin FSK telemetry module, data key, and ethernet port. Controller shall also allow logging of three (3) alarm inputs as required in the specifications for battery back-up system.

MALFUNCTION MANAGEMENT UNIT (MMU)

Cabinet shall be equipped with NEMA TS2 Type 16 MMU with the latest current released software. MMU jumper cards shall be programmed to specific intersection's requirements. MMU shall also monitor the led blank-out signs for sign operation.

BUS INTERFACE UNIT (BIU)

BIU's shall meet all TS2-1992, section 8 requirements. In addition, all BIU's shall provide three (3) separate front panel indicators: power, valid data, and transmit.

CABINET POWER SUPPLY

The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator led for each of the four (4) power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

INTERCONNECT TERMINATION

Cabinet shall be supplied with interconnect termination blocks, Siemens model no. S66M1-50 and sub-base assembly.

LOAD SWITCH:

All load switches shall meet NEMA TS-2, section 6 requirements and shall have input and output led indications.

FLASHER UNIT

All flasher units shall meet NEMA TS-2, section 6 requirements and shall be EDI model 810, or city approved equivalent.

TELEMETRY INTERFACE PANEL

Cabinet shall be wired with a 25 pin telemetry interface panel and telemetry connecting cable that can communicate with the Ariel Traffic Signal Management/Monitoring master software. The cabinet shall be wired for telemetry transient suppression, EDCO model No. PC642C-00-AD, or city approved equivalent.

INTERSECTION DIAGRAM

An intersection diagram prepared in Autocad shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the auxiliary panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and

north arrow. The top of the diagram will be north and the diagram shall be pre-approved by the City Engineer.

CABINET WIRING DIAGRAM

Cabinet wiring diagrams shall be arranged on three (3) separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second sheet everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the city engineer prior to construction of cabinet assembly.

TESTING FACILITY:

Contractor shall be responsible for having the new cabinet assembly tested at city designated facility prior to being "Turned-On" at the intersection site. The testing facility shall have up to twenty-one days to test the controller assembly.

EQUIPMENT TURN-ON REQUIREMENTS:

The contractor shall arrange to have a City Signal technician, an Econolite Control Products technician, a Myers Power Products, Inc. BBS manufacturer representative present at the time of the controller turn-on. The representatives shall be fully-qualified to work on the controller assembly and related equipment. The manufacturer's representatives and city shall be notified at least (7) working days prior to intersection turn-on.

CENTRACS GRAPHICS & SOFTWARE

One (1) intersection graphic shall be provided for each traffic signal design or modification on the city's Centracs Traffic Signal Management System.

BATTERY BACKUP SYSTEM (SECTION 86-3.02)

[Replace this section with the following:]

SCOPE

The battery backup system (BBS) shall provide uninterruptible reliable emergency power to a traffic intersection in the event of a power failure or interruption. The uninterruptible power supply (UPS) shall provide a minimum of two (2) hours of full run-time operation for an "LED-ONLY" signal intersection. The transfer from utility power to battery power will not interfere with the normal operations of the traffic controller, conflict monitor or any other peripheral devices within the traffic control system. The bbs / ups system shall be comprised as noted below and shall include, but not be limited to: inverter/charger (ups), power transfer switch (pts), batteries, two (2) separate manually

operated non-electronic bypass switches (mbps), a generator plug with flush compartment door, and “on-battery” warning light on top of the bbs enclosure, and all necessary hardware and interconnect wiring.

The system shall be capable of providing power for full run-time operation, flashing mode operation, or a combination of both full and flash mode operation of an intersection. The operation of the flash mode shall be field programmable to activate at various times, battery capacities, or alarm conditions locally using the touch pad or remotely using an industry standard pc’s RS232 and USB interface. BBS shall have an ethernet port.

Field programmability via touch pad or computer interface must be in user friendly, menu driven formats and must not require any external or proprietary software. The BBS shall use hyperterminal to communicate with pc interface. The DB9 connector for the RS232, USB and ethernet interfaces shall be located on the front panel of the UPS. Interface cables shall be pinned for industry standard configuration, no proprietary cable pin out allowed. The system shall be designed for outdoor applications and meet the environmental requirements as detailed herein. The system shall be Myers Power model MP2000™, or equal.

BATTERY BACKUP SYSTEM CONFIGURATION

The battery backup system (BBS) shall include, but not be limited to the following:

1) Inverter/Charger.
2) Power Transfer Relay.
3) Two (2) separate manually operated non-electronic bypass switches in one assembly: one for inverter & one for generator
4) A generator plug with compartment door.
5) An “On Battery” warning light on top of BBS enclosure.
6) All necessary hardware and interconnect wiring.
7) **See Exhibit 1 attached in appendix “A” for connection block diagram.**

All BBS assemblies shall be new and fully assembled by the designated manufacturer/supplier (batteries may be separate). Contractor shall not fabricate or assemble the BBS assemblies, and shall only install and wire the assemblies on the existing signal cabinets.

1. SYSTEM CAPACITY AND RUNTIMES

1.1

The BBS shall be configured such that it provides a minimum of two (2) hours of full run-time operation for an intersection using led traffic and pedestrian signals. The UPS

shall be 2000 VA / 1500 Watts with 80% minimum inverter efficiency. 105 AH batteries shall be utilized at any given intersection.

2. RELAY CONTACTS

2.1
The UPS shall provide the user with 6 sets of fully programmable, relay contacts of type N/O, N/C, panel-mounted, potential free and rated 1 AMP, 120VAC and labeled C1 through C6, **see Appendix "B", Exhibit 2, for wiring diagram**. Each relay's setting shall be programmable to activate under any number of conditions locally using the touch pad or remotely using the RS232, USB or ethernet interface. The available settings for the relays are outlined below.

Relay contacts C1 through C6 can be independently configured to activate under any of the following conditions:

2.1.1 On battery- relay activates when BBS switches to battery power.
2.1.2 Low batery- relay activates when batteries have reached a certain level of remaining useful capacity while on battery power. This number is adjustable from 0 to 100%.
2.1.3 On-battery lamp – relay activates when power transfer switch (PTS) activates.
2.1.4 Alarm- relay activates after a specific or general alarm is detected. These alarm conditions include: line frequency, low output voltage, no temperature probe, overload, batteries not connected, high temperature, and low temperature. The relay can be programmed to activate when any of these alarm conditions are met, or when a specific condition is met.
2.1.5 Fault- relay activates after a specific or general fault is detected. These fault conditions include: short circuit, low battery voltage, high battery voltage, high internal temperature, and excessive overload. The relay is programmed to activate when these fault conditions are met, or when a specific condition is met.
2.1.6 Off-Relay is disabled and will not activate under any condition.

2.2
Default relay settings

2.2.1 Relay C1 shall be set to activate whenever the ups transfers to battery power and shall be labeled "C1 'on Batt – Alarm 2'".
2.2.2 Relay C2 shall be set to activate whenever the UPS activates the "On-Battery Light" on top of the cabinet and shall be labeled "C2 'On-Battery' Light'".
2.2.3 Relays C3 and C4 shall be set to activate whenever the batteries reach an assigned percentage of remaining useful capacity and shall be labeled "C3 'Low Batt – Maint. Required'" and "C4 'Low Batt – Remote Flash'".
2.2.4 Relays C5 and C6 shall be set to activate whenever the UPS has a fault or alarm activated and shall be labeled "C5 'Faults – Maint. Required'" and "C6 'Alarm – Maint. Required'".

2.2.5 Terminal block position 19 & 20 shall be set to activate a self-test. This test confirms that a unit can transfer into and out of battery mode while supporting the output load.

2.2.6 Terminal block position 21 & 22 are activated when the PTS system is “On Battery”.

3. OPERATION

3.1
The manual by pass switch (MBPS) shall be rated at 240 VAC, 40 AMPS minimum.

3.2
The MBPS shall allow replacement of the UPS without having to interrupt power to the intersection. The mbps and power transfer switch (PTS) shall be separate units allowing for the replacement of the BBS or PTS without interrupting power to the intersection.

3.3
The BBS shall use a temperature compensated battery charging system. The charging system shall compensate over a wide range of 2.5 to 4 MV / °C / Cell. The charger shall be rated 10 AMPS at 48VDC.

3.4
The temperature sensor shall be external to the UPS unit. The temperature sensor shall be supplied with 3 meters (9’ 10”) of wire and shall be attached to the side of one (1) battery with aluminum foil heat sensitive tape **only**.

3.5
Batteries shall not be charged when battery temperature exceeds 50°C ± 3°C (122°F).

3.6
The BBS shall automatically monitor on an ongoing basis that battery power is present and available in the event it is needed during a utility outage. A “Battery Not Connected” alarm shall be issued if battery power is not present.

3.7
When utilizing battery power, the BBS output voltage shall be between 110VAC and 125VAC, pure sine wave output with THD < 3% at 60 HZ +/- 3 HZ.

3.8
In the event of ups failure, battery failure or complete battery discharge, the power transfer switch (PTS) shall revert to the utility or line mode (In a De-Energized State) where utility power is supplying the cabinet.

4. ENVIRONMENTAL

The operating temperature for both the inverter/charger (UPS), power transfer switch (PTS) and manual by pass switch (MBPS) shall be -37 °C to +74 °C.

5. PRODUCT COMPATIBILITY

5.1
BBS shall be compatible with all of the following for full phase, flash operation mode or a combination of both full and flash mode operation:

- NEMA Cabinets
- NEMA TS1 Controllers
- NEMA TS2 Controllers
- Electrical Service Pedestals

5.2
The BBS system including 79AH batteries shall fit inside an electrical service pedestal (Myers Meug 35) or an external Myers BC series BBS cabinet. This project will specify a BC100HZG-LH or RH – 48V/30 AMP receptacle and utilizing 105 AH batteries.

6. LOSS / RESTORATION OF UTILITY POWER

6.1
In the event the BBS senses the utility line voltage is outside the HI and LOW limits (100 & 130VAC respectively set as default), the BBS shall transfer the load to battery power.

6.2
The BBS shall return to line mode when the utility power has been restored to above 105 VAC for more than 30 seconds. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB and optional ethernet interfaces.

6.3
The BBS shall return to line mode when the utility power has been restored to below 125 VAC for more than 30 seconds. Or, the BBS shall return to line mode when the utility power is back to nominal. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB or optional ethernet interface.

6.4
The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 65 milliseconds. The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

7. BACK-FEED AND OTHER PROTECTIONS

7.1
The BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service per UL 1778, section 48 "Back-Feed Protection Test". The upstream back-feed voltage from BBS system shall be less than 1 volts AC for the protection of the traffic engineer or a technician.

7.2
The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41 for 2000 Volts AC.

8. MOUNTING / CONFIGURATION

8.1
Mounting method shall be shelf-mount or rack-mount. BBS and PTS units individually shall not exceed 5.25” or 3U in height.

8.2
All necessary hardware for mounting (Shelving, Rack, Harness, etc.) Shall be included in the bid price of the BBS.

8.3
External battery cabinets may be used to meet adequate environmental and physical requirements.

9. FUNCTIONALITY, DISPLAYS, CONTROLS, DIAGNOSTICS AND MAINTENANCE

9.1
The BBS shall include a LCD display to indicate current battery charge status, various input/output voltages, power output, battery temperature, date, time and settings of the various field programmable relays. The same parameters shall be available via RS232, USB and ethernet interfaces for remote monitoring.

9.2
The UPS shall provide the power beyond the temperature that would be field programmable for an external fan located in the same or in a separate battery cabinet. The temperature setting shall be adjustable from the touch pad or remotely via RS232, USB and optional ethernet. The temperature range shall be from +20°C to +55°C in 1 degree C increment.

9.3
All control, programming, maintenance and inquiry shall be accessible via the keyboard on the face of the BBS without the need for the use of any additional equipment or external PC.

9.4
The BBS shall be capable of accepting firmware updates of the non-volatile, read-only memory via serial port communications. The updates shall be accomplished by uploading the software to the BBS over the RS232/USB serial port located on the face of the UPS.

9.5
The buck and boost mode shall be provided in case of extended power variations. The BBS shall have the ability to buck and boost 10% +/-.

9.6
The PTS shall be activated during buck and boost operation. The transfer time shall be less than 10 milliseconds typically to meet plc and other controller requirements.

9.7
The UPS shall be provided with a re-settable inverter event counter and a cumulative inverter timer that is accessible via the LCD screen or remotely via RS232, USB or ethernet.

9.8
The UPS shall be equipped with an event log that stores for a minimum the last 100 events. The events shall be time and date stamped. The event log shall be retrievable via RS232, USB or optional ethernet and from the BBS LCD screen. The event log shall display and print out in plain English when output over the RS232, USB or ethernet ports.

9.9
The BBS shall be capable of performing a self-test, locally from the UPS front panel LCD, or remotely via RS232, USB and optional ethernet interfaces. The duration of the self-test shall be programmable in 1-minute increments from 1 min. To 255 minutes.

9.10
The level for low battery alarm shall be available on the RS232, USB or ethernet connector located on the front face of the BBS. The programmable low battery alarm contact shall be available on RS232 for local or remote access with the incremental adjustment of 0.25 VDC

9.11
Certain maintenance controls such as battery test, BBS inverter On/Off viewing the event log and changing default settings shall be password protected. The UPS shall be provided with a default password. The user can change the password in order to restrict access to sensitive functions.

9.12
The following LED lights conditions shall be used to indicate current status:

Green LED flashing for battery back-up mode
Green LED steady on for normal line mode operation

Red LED flashing for alarm conditions
Red LED steady on for fault conditions

9.13
BBS shall be easily replaced and installed (complete turnkey system with all necessary hardware). BBS shall not require any special tools for installation.

10. BATTERY SYSTEM

10.1
Individual batteries shall be 12 VDC type and shall be easily replaced and commercially available off the shelf.

10.2
The battery system used in the BBS shall consist of (4) 105 AH batteries and for safety, shall be of a voltage not to exceed 60 VDC. Batteries shall be provided with quick disconnect terminals and a polarized-keyed battery cable for easy field installation.

10.3
Batteries shall be certified to operate over a temperature range –20°C to +74°C

10.4
Batteries shall indicate maximum recharge data and recharging cycles.

10.5
Recharge time for the battery from protective low cutoff to 80% or more of full battery charge capacity, shall not exceed twenty (20) hours.

10.6

A) Batteries individual batteries shall be:

- Voltage Rating: 12V Type
- Amp-Hour Rating: 105 AMP-Hour Minimum
- Group Size: 31 Minimum
- Easily Replaced and Commercially Available Off the Shelf.

B) Batteries used for each BBS shall consist of (4) batteries. All batteries must meet their specifications out of the box immediately after the initial 24-hour top off charge. Batteries that require cycling to meet the AH rating specifications are not acceptable.

C) Batteries shall be able to withstand extreme temperature, deep cycle, sealed prismatic lead-calcium based AGM/VRLA (absorbed glass MAT/VALVE regulated lead acid) batteries.

D) Batteries shall have a manufacturer's warranty of (2) years full replacement. The warranty shall cover any battery that does not meet 80% of its original reserve capability during the warranty period.

E) The batteries shall be provided with appropriate interconnect wiring and a corrosion-resistant stationary mounting tray with a non-heated battery mat appropriate for the cabinet into which they will be installed.

F) Batteries shall indicate maximum recharge data and recharging cycles.

G) Battery harness:

1) Battery interconnect wiring shall be via a two-part modular harness.

2) Part I shall be equipped with red (+) and black (-) 30.48 cm (12") cabling that can be permanently connected to the positive and negative posts of each battery. Each red and black pair shall be terminated into an anderson style power pole connector or equivalent.

3) Part II shall be equipped with the mating power pole style connector for the batteries and a single, insulated power pole style connection to the inverter/charger unit. Harness shall be fully insulated and constructed to allow batteries to be quickly and easily connected in any order to ensure proper polarity and circuit configuration.

4) Power pole connectors may be either one-piece or two-piece. If a two-piece connector is used, a locking pin shall be used to prevent the connectors from separating.

5) All battery interconnect harness wiring shall be UL style 1015 CSA TEW or welding style cable or equivalent, all of proper gauge with respect to design current and with sufficient strand count for flexibility and ease of handling.

6) Battery terminals shall be covered and insulated with molded boots so as to prevent accidental shorting.

H) Each BBS system shall be supplied with an individual charge battery manager – Myers Power Products, Inc. Model #[illegible]930-48 with Myers part #CTSPBCK-37 battery string cable. The battery manager shall be provided to automatically balance the battery charge voltage on all batteries in the string to within ±100MV between any two batteries. The balancer shall allow for any single 12V battery within the battery string to be replaced at any time throughout the warranty period and not require the purchase of new batteries, to install the battery covered under the warranty.

10.7
The BBS enclosure shall be a NEMA 3R rated side-mount cabinet and installed on the left/right side of the traffic signal cabinet with a left/right hand door swing. The enclosure will house the batteries, UPS (BBS), (2) manual bypass switches, power transfer relay, generator connection compartment, on-battery light (external), other control panels and all wiring & harnesses. The cabinet must meet the requirements for NEMA 3R enclosure and **must be manufacture by Myers Power Products, model: BC100HZG-48LH-UPS, see Appendix "C", exhibit 3 for details**. . The housing must have the dimensions so that it may easily be attached the side of 'P' type signal cabinet. Dimensions of the enclosure shall not exceed 48"H x 22" W x 16.5" D. The BBS enclosure must not interfere with the opening of the signal cabinet door.

The complete enclosure and door must be made from .125" thick raw aluminum. All external seams must be continuously welded. The door opening must have a double flange for weather sealing purposes.

A. **DOOR:** The cabinet must have a door to provide access to the complete cabinet interior. The door must include a continuous piano hinge made of 14-gauge stainless steel and a .120" diameter stainless steel hinge pin. The hinge must be attached to the enclosure and the door with close end pop rivets. The door must have a three (3) point locking mechanism with rollers at the ends for the latch rods. The key lock must be a Corbin cylinder lock with two No. 2 keys provided for each cabinet. When the door is opened it must have stops at 90 and 130 degrees. A continuous neoprene gasket must be used to weatherproof the enclosure when the door is closed. **The door swing (hinge side) shall be as noted on plans.**

B. **VENTILATION FAN:** A fan must be mounted in the air baffle at the top of the cabinet with an air outlet built into the overhang. The fan must be thermostatically controlled. The bottom of the door must be louvered to allow airflow. A removable dust filter must be located behind the vent.

C. **FINISH:** The enclosure shall be painted finish to match controller cabinet (unless otherwise specified by the city).

D. **FEATURES:** An "On Battery" factory installed high impact red light option shall be installed on top of the BBS enclosure, and be a minimum of 2.5 inches in diameter. The "On Battery" LED shall operate from the DC voltage of the UPS to notify that the UPS is on battery power without opening the door. The light will be wired to and controlled by the UPS power module. The enclosure shall be designed to shelf mount the UPS and power transfer switch (PTS). When the UPS is mounted into the enclosure it must be mounted to accommodate straight-on horizontal viewing of the LCD screen

on the UPS. Two (2) battery shelves with rubber battery mats (non-heated) shall be provided.

E. **GENERATOR CONNECTION:** A factory-installed flush mount generator compartment with neoprene gaskets for weatherproofing shall be installed in the enclosure. The generator compartment shall include a locking 30 AMP plug, L5-30P, for connecting of a portable AC generator. A manual transfer switch shall be mounted within the BBS cabinet to allow for transferring from utility power to generator power. The generator door will provide a cable slot to allow for closing of the door when the generator is plugged in and to lock the cable inside of the compartment. The door shall include a Corbin Type 2 lock.

F. **MOUNTING:** The BBS cabinet will be mounted to the side of the traffic signal control cabinet with six (6) stainless steel hex head bolts, ¼" x 20". All holes will be field drilled by the contractor to accommodate the specific situation. A grommet must be supplied to protect the cable in a field drilled 1.5" to 2" hole for cable connection to the existing traffic controller. The BBS manufacturer shall supply all the mounting hardware, bolts, washers, nuts, gaskets, bushings, grommets, etc., necessary to install the BBS cabinet in a safe and weatherproof manner. The contractor shall supply the caulking.

G. WIRING AND PROGRAMMING

Contractor shall install a BBS terminal connection block in signal cabinet to provide direct connection from electrical service to BBS. The contractor shall be responsible to completely wire the battery backup system, <u>including contact wiring and programming as follows</u>:

1) Contact 1 (C1) – "On-Battery" (Signal Cabinet 'Alarm #2').
2) Contact 2 (c2) – "On-Battery Lamp".
3) Contact 3 (C3) – "Low Battery" (Signal Cabinet 'Maintenance Required' Alarm).
4) Contact 4 (C4) – "Low Battery" (Signal Cabinet 'Remote Flash' Activation').
5) Contact 5 (C5) – "BBS Faults" (Signal Cabinet 'Maintenance Required' Alarm).
6) Contact 6 (C6) – "BBS Alarms" (Signal Cabinet 'Maintenance Required' Alarm).

<u>IMPORTANT:</u> Existing traffic signal cabinets may be from different manufacturers. An approved method shall be determined by the contractor/BBS supplier for wiring between the BBS and signal cabinet for "Flash Activation" during the "Low Battery" period. The contractor shall be responsible for obtaining approval by the city, or its designated representative, once a method(s) is determined for the remote (automatic) flash activation in order to provide consistency in citywide installation.

TURN-ON:
Upon final installation at the project location, the contractor shall "Turn-On" and test the BBS system. The contractor shall arrange to have a knowledgeable technician from the BBS manufacturer present at the time of the BBS "Turn-On". The representative shall be fully-qualified to work on their respective BBS equipment and its connectivity to various types and manufacturers of traffic signal cabinets. The manufacturer's representative and city engineer shall be notified at least seven (7) working days prior to intersection "Turn-On".

Testing shall include BBS operation in the "On-Battery" mode (minimum run time of 5 minutes then check battery voltage and record), "Low Battery" mode (Flash), and verification that alarm and fault relay contacts are properly functioning.

Upon satisfactory "Turn-On" at the project location, the city engineer shall be notified within three (3) days, for city staff field-verification of all tests performed.

11. SERVICE AND WARRANTY

11.1
Manufacturer shall provide a two (2) year warranty. Under this warranty, the manufacturer will send out a replacement within two business days of the call notifying them of an issue. The replacement unit may be either a new unit or a re-manufactured unit that is up to the latest revision.

12. SPECIFICATIONS

INPUT SPECIFICATIONS

Nominal Input Voltage 120VAC, Single Phase
Input Voltage Range 120VAC +/- 25%
Input Frequency 60 Hz +/- 5%

OUTPUT SPECIFICATIONS

Nominal Output Voltage 120VAC, Single Phase
Power Rating 2000VA (1500 Watts)
Output Frequency 60 Hz (+/- 5%)
Voltage Wave Form Sine Wave, THD < 3%
Efficiency (Nominal) 95-97%

MECHANICAL SIZE

Inverter / Charger 17” Wide X 5.25” High (3u) X 10” Deep
Pts Assembly 17” Wide X 5.25” High (3u) X 7” Deep
Weight Under 50 Lbs

COMMUNICATIONS

SERIAL AND NETWORK COMMUNICATIONS INTERFACE

The BBS shall have serial and ethernet communications interfaces for user configuration and management. The user serial port shall be an EIA-232 (DB9-Female) connector. The ethernet port shall be an RJ45, EIA 568B pin out connector.

USER CONFIGURATION MENUS

All BBS configuration and system menus shall be accessible and programmable from the RS-232 port and from the ethernet port below. Additionally, all log files shall be available through these ports.

QUALITY ASSURANCE

QUALITY ASSURANCE

Each BBS shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two quality assurance procedures: (1) design QA (see below) and (2) production QA. The production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved.

QA PROCESS

QA process and test results documentation shall be kept on file for a minimum period of seven years.

QA APPROVAL

Battery backup system designs not satisfying design QA testing and production QA testing requirements shall not be labeled, advertised, or sold as conforming to this specification.

TESTING

For design qualification testing, as a minimum, the following will be tested for compliance to the specifications:

A. Minimum of two hours of run time while operating in backup mode, at full load.
B. Proper operations of all relay contacts.
C. Inverter output voltage, frequency, harmonic distortion, and efficiency, when in backup mode.

D. All power transfer voltage levels and all modes of operation.
E. Power transfer time from loss of utility line voltage to stabilized inverter line voltage from batteries.
F. Backfeed voltage to utility when in backup mode.
G. IEEE/ANSI C.62.41 compliance.
H. Battery charger operation.
I. Event counter and runtime meter accuracy.
J. User ability to control, monitor, get reports, and configure the system through the standard RS-232 and ethernet ports.
K. Complete physical inspection of the system for quality workmanship.

PRODUCTION QUALITY CONTROL TESTING

Production quality control tests shall consist of all of the above listed tests and shall be performed on each new system prior to shipment. Failure to meet requirements of any of these tests shall be cause for rejection. The manufacturer shall retain test results for seven years.

100-HOUR BURN-IN-PERIOD

Each BBS shall be given a minimum 100-hour burn-in period to eliminate any premature failures. The burn-in period can be a combination of running in backup mode with a full load and running in charger mode.

VISUAL INSPECTION

Each system shall be visually inspected for any exterior physical damage or assembly anomalies. Any defects shall be cause for rejection.

TRAFFIC SIGNAL FACES AND FITTINGS (SECTION 86-4)

Add the following:

All optical vehicle signal indication units shall utilize the Light Emitting Diode (LED) type signal modules. The led signal module units provided shall be manufactured by "Dialight Corporation" or approved equal and shall meet ITE specifications. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

All signal heads shall be supplied by the same manufacturer, and shall be made of metal with 12-in diameter Dialight or approved equal LED modules. Visors shall be full circle type.

In addition to Section 86-4.04, "Signal Mounting Assemblies," of the Caltrans Standard Specifications, the following special provisions shall apply whenever a terminal compartment is required:

The terminal block shall be mounted vertically and to the side of the cable inlet guide. Sufficient lateral spacing shall be provided to allow pulling and connecting of incoming

conductors without removal of the terminal block mounting screws. A minimum of one-inch (1") clearance shall be provided between the terminal block and all inside walls of the terminal compartment. The terminal compartment shall be provided with a captive hinged access door. With the door open, there shall be a minimum of ten-by-four-inch (10" x 4") access to the terminal compartment for the connection and inspection of the terminal block. The door shall be equipped with a neoprene gasket, permanently secured, to prevent water from entering the terminal compartment and captive screws for securing door. The mounting bolt spacing and cable guide location shall be as dimensioned on drawing ES-4D of the Caltrans Standard Plans.

METAL SIGNAL SECTIONS (SECTION 86-4.01A(1))

Add the following:

Metal signal faces shall be provided with metal backplates.

PEDESTRIAN SIGNAL FACES (SECTION 86-4.03)

Add the following:

All optical pedestrian signal units shall be of the Light Emitting Diode (LED) type. The LED module units provided shall be Dialight Corporation or approved equal and shall meet ITE specification. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

Pedestrian signals shall be type a with egg crate type screens and shall have a countdown timer function. The pedestrian head housing and door shall be green and made of metal with no plastic parts, and shall be 16 inches by 18 inches.

Pedestrian signal ground wires shall not have splices between the poles and the controller cabinet. All pedestrian signal ground wires shall be joined and grounded within the controller cabinet.

DETECTORS (SECTION 86-5)

Add the following:

Loop detector conductors shall be Type "2".

Loop detector lead-in cables shall be Type "B".

Circular detector loops shall be Type "E" per Caltrans Standard Plan, 6 feet in diameter. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of 3/4 inch.

Circular detector loops for bicycle and motorcycle detection shall be Modified Caltrans Standard Plan Type “E”, 6 feet in diamater with 1 diagonal wire cut inside the circle and set back 1 foot before the lead cross walk stripe or limit line. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of ¾ inch.

All cuts shall be sealed with a sealant on the same day the slots are cut in accordance with the hot-melt rubberized asphalt sealant per Section 86-5.01A(5) of the Caltrans Standard Specifications. All loops shall have 2-1/8 inch clearance of sealer above loop wires.

Loop wires in home runs, beginning at each loop, shall be tightly twisted together with a minimum of five (5) turns per foot. Home runs shall be cut to a sufficient width to accommodate the twisted wire.

All loops shall be connected in series. Splices shall use butt-splice connectors and shall be soldered by the hot-iron. No open flame shall be used on soldered connections. All loop wires including loop conductors shall be installed on the same day the slots are cut.

Wires for each loop shall be marked with bands of colored tape to designate loop number, starting at the number 1 lane and proceeding to the number 2 lane, and so on.

PEDESTRIAN PUSH BUTTON ASSEMBLIES (SECTION 86-5.02)

Add the following:

Pedestrian push buttons shall be ADA compliant (2” Diameter), Type B, Polara Bulldog No. BLD3-Y (momentary, non-latching), with a stainless steel button, yellow body on a green color frame. Pedestrian push button signs shall conform to the details shown on the plans, except that the message and symbol shall conform to California sign specification sheet R10-3. Fasteners shall be stainless steel tamper-proof screws for pedestrians push-button assemblies. Pedestrian calls to the controller shall be independent, by phase, and not as concurrent thru-phase pairs.

LIGHTING (SECTION 86-6)

Replace with the following:

Luminaires shall be 120 V Cooper Lighting Navion LED Series Roadway Luminaires, part No. NVN-AE-02-E-U-T3-10K-U-AP or No. NVN-AE-03-E-U-T3-10K-U-AP as indicated on plans, or approved equal. Luminaires shall be 120 V, 107 W, and without photocell.

The luminaire shall provide true ninety-degree (90°) cutoff with no light emitted above the horizontal.

The luminaire optical assembly shall be sealed, water-tight, and filtered to prevent contamination from infiltration of gaseous and particulate matter. The LED's shall be factory preset to produce a full cutoff IES Type III light distribution.

INTERNALLY ILLUMINATED STREET NAME SIGNS (SECTION 86-6.09)

Add the following:

All IISNS and hardware shall be new. The materials and workmanship shall be of the best quality for the purpose.

All IISNS shall be "**National Edge Lit Led IISNS"**, or approved equal.

The contractor shall furnish and install **Led Edge Lit Internally Illuminated Street Name Signs** manufactured by national sign incorporated or approved equal. Model: **NAIM-72-LED EDGE LIT-D-DG3** with mounting hardware.

The visible message shall be displayed from both sides of the signs and be reflectorized. Signs shall have white legends, symbols, arrows, and 3/4 " border on green background. The legend shall be as shown on the plans.

The style and spacing of letters, figures, and arrows shall conform to the current standards established by the State of California, Department of Transportation. Side margins and spacing may be compressed when necessary to stay within sign length.

The full size IISNS layout shall be submitted to the city engineer for approval prior to fabrication. It shall be the responsibility of the contractor to keep the engineer informed of all operations requiring inspection or approval prior to proceeding with fabrication.

Affixed to one side of each panel shall be white 3M diamond grade reflective sheeting. Each panel shall be screened a "GREEN" color background as indicated on the plans. Manufacturing of panels shall conform to 3M specifications for installation of diamond grade reflective sheeting.

Photocell and receptacle shall be omitted.

All IISNS shall be 18" x 72" (unless otherwise identified as 18" x 96") double-sided and shall be mounted with hinged, adjustable or telescoping type brackets approved by the engineer.

IISNS must be guaranteed for a minimum of five (5) years.

OVERHEAD REFLECTORIZED STREET NAME SIGN

These specifications define requirements for overhead reflectorized street name signs:

I. GENERAL

A. WORKMANSHIP:

All items shall be new; the materials and workmanship shall be of the best quality for the purpose.

B. DRAWINGS:

All sign layouts shall be the contractor's responsibility and shall be in accordance to the State of California - sign specifications chart guidelines.

C. WARRANTY:

Any sign delivered under this contract which does not conform to these specifications shall be replaced by the contractor at no cost to the City.

II. DETAILED REQUIREMENTS

A. BASE METAL:

1. DESCRIPTION

The base metal substrate shall be new aluminum alloy 3003-H14 or 5052-H32.

The thickness of the aluminum shall be 1/20". The material shall be subject to inspection prior to degreasing and chromate conversion coating operations. Alloy and temper designations shall be verified by mill test certifications.

2. SHEARING:

All sign panel edges shall be shear-trimmed or roll-slit to produce neat edges and square corners. Sign panel edges shall be straight within 1/32" from the straight plane. Edge delimitation or incomplete coverage of the base metal substrate up to and coincident with the cut edge of the sign panel shall be sufficient basis for rejection of the entire sign panel.

3. PRETREATMENT:

All treatment tanks and/or spray-applied systems must be performed on the contractor premises, to ensure proper adhesion of reflective sheeting materials. All treatment tanks or spray applied systems shall be charged with fresh

chemicals at least once a year. If pretreatment is performed by immersion methods, the tanks must be sufficient size to accommodate the complete panel. Titration equipment shall be available for the inspectors to check the solutions strengths. The cleaned and coated base metal shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, the panels shall be protected at all times from contact or exposure to grease, oils, dust or other contaminates.

The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light tightly adherent chromate conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with Section 5, "Recommended Processing Methods" of ASTM designation B-449. The coating weight shall be (30-100 mg/sq.ft.), a Class 1 coating.

B. SIGN MESSAGE AND REFLECTORIZED MATERIAL:

1. Sign panels with identical legends shall be displayed on both sides of the sign frame unless otherwise indicated.

   Letter size, style, spacing, arrows, and figures shall conform to the current standards established by the State of California, Department of Transportation.

   a) The legends or street name shall be 8" upper case and 6" lower case. Series E shall be used.

   b) Message layout shall be per State of California-Sign Specifications, Code G7-1(CA). Side margins and spacing may be compressed when necessary to stay within sign length.

   c) 1” border

2. 3M diamond grade VIP reflective sheeting (wide-angle prismatic lens reflective sheeting) or equal, shall be on both fore and background. The standard color shall be white legends, letters, and borders, on a green background. No cut out legends, letters, or border shall be used.

C. SIGN FRAME AND PANEL CONSTRUCTION:

The size of the sign will be 18"x72" or 18"x96".

1. FRAMES:

The frame shall be aluminum channel extrusion, 1¼"x1¼"x1/8" wall thickness. Alloy 6063-T5. All joints of the aluminum channel shall be miter cut to form a 45-degree angle at each corner. The frame shall be welded with an inert gas shield-arc welding process using 4043 electrode filler wire in accordance with good shop practice. The width of the filler wire shall be equal to the wall thickness of the channel being welded.

The top of the frame will have two 2"x2"x¼" wall thickness channel members welded and fastened to the frame with stainless steel bolt, washer, nylon nuts and cotter pins. The adjustable swing assembly will be attached to these members.

2. ASSEMBLY:

A sign panel shall be fastened to both sides of the channel frame to make a double-faced unit. Each sign panel must be a continuous sheet, no vertical or horizontal splices to make up one panel.

The sign panels shall be affixed to the frame with 3/16" diameter blind pop rivets, alloy 5052, or a type approved by the engineer. They must be aluminum approved. The exposed face of the rivet shall be of similar shade and compatible with face color of the finished sign. The rivets shall be placed through the face of the sign with the wall of the channel placed against the back of the sign panel. Rivets shall be placed no closer than ½" from the edge of the sign panel and a maximum of 8" apart from one another. All rivets must penetrate the web of the channel frame for proper grip strength between sign panel and frame.

The swing hinge is attached to the 2"x2" channel member with a ¼" stainless steel bolt and bronze bushing. Then secured with a non-lock nut.

D. MOUNTING ASSEMBLIES:

1. SIGNAL MAST ARM MOUNTING:

The top of the sign frame shall have two free swinging mounting brackets. They shall be of all aluminum, bronze, and stainless steel parts. The 5" long stainless steel bolt for fine adjustments shall have nuts and lock washers, or self locking nuts and cotter key. The bracket assembly shall permit the sign to swing perpendicular to the support hardware.

The mounting bracket location shall be 18" from the outside edge for the 18"x72" sign, and 24" for the 18"x96" sign.

The mounting brackets shall be aluminum, connected to the mast arm by band straps.

When installation of the sign to the mast arm is complete, the sign should swing freely 70-90 degrees in both directions when moved by the installer.

2. VERTICAL POLE SHAFT MOUNTING:

The extruded aluminum sign support channel shall be made from Alloy-6061-T6. The top portion of the extrusion shall have a continuous inverted "T" slot. This section shall accommodate the positionable stainless steel fittings and clamps providing complete freedom of alignment within this slot forming an integral clamping system. The channel shall be compatible with the current system used to fasten the sign face to the channel support. The sign support system herein described shall conform to AASHTO's standard specifications for structural supports for highway signs, luminaires and traffic signals (latest revision) and be rated for specified wind velocities.

Universal channel clamps shall be fabricated from Type 304 stainless steel. Clamps shall be formed from 16 gauge stainless steel, formed by tapering uniformly from each end toward the center to a depth of ½" forming a modified "V" on the bottom of the clamp. This shall be referred as the "saddle". Locked within the "saddle" shall be a portion of the unit referred to as the insert plate which shall be fabricated from 14 gauge Type 304 stainless steel and form a shallow "U". The legs of the "U" shall be 1" high and 1&1/16" wide with an aperture designed to permit passage of a 3/4" stainless steel band or buckle strap. The opening shall be 3/4"x3/16" vertically on the one inch dimension and shall be in from the edge closest to the "U" of the "Saddle". The base of the "U" shall be ½" wide by 2½" long where it is designed to slide in the inverted "T" slotted section of the extruded aluminum sign support channel.

Band straps shall have a minimum thickness of 0.03" and be made of stainless steel.

3. STREET SIGN MASTARM MOUNTING:

Contractor shall provide and install a cantilever street sign mastarm and shall comply with section 86-2.04, "Standards, Steel Pedestals and Posts", of the standard specifications and these special provisions

The cantilever arm for the reflectorized street name sign shall connect to the signal standard with a clamp style arm connection manufactured by Valmont Industries or an approved equal. The arm shall be welded to the clamp connection and extend horizontally from the standard two (2) feet longer than the specified sign size. The free end of the arm shall be capped and welded. The reflectorized sign shall be centered about the arm. The arm shall have a 3&7/8" O.D. and a thickness of 0.1196 inch.

Sign shall be mounted to the street sign mastarm as described in item #1 above, "Signal Mastarm Mounting".

E. FINISH:

The finished sign shall be flat within a ratio of 0.40inch per linear foot when measured across the plane of each panel from opposite corners or at any location on the panel. All finished signs shall have a smooth flat surface without defects or objectionable marks of any kind on either the front or the back faces. All letters and designs shall be clearly cut and sharply defined.

The appearance of the sign face shall be uniform throughout and shall be free of wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles or blemishes that may impair the serviceability, detract of the sign when viewed from a distance of twenty-five (25) feet.

The finished sign shall be clean and free from all burrs, sharp edges, loose rivets and aluminum marks.

Signs with any defects or damage that affect their appearance and quality workmanlike manner with all sign surfaces and edges free of defects. No repairs shall be made to the face sheet without the approval of the engineer.

City of Lake Forest Specifications

General Specifications and Special Provisions

CITY OF LAKE FOREST
SPECIAL PROVISIONS FOR TRAFFIC SIGNAL INSTALLATION
JULY 2014

All work shall conform to the latest edition of the Caltrans Standard Specifications and the following special provisions.

SUMMARY (SECTION 86-1.01)

Add the following:

The system shall be complete and in operating condition at the time of acceptance of the project.

The contractor shall provide the city with all traffic signal equipment shop drawings prior to ordering the equipment for approval.

Contractor shall provide guarantees for all work, materials, and labor valid for a period of one (1) year from the notice of completion date for the work by the city.

EQUIPMENT LIST AND DRAWINGS (SECTION 86-1.04)

Add the following:

One (1) set of mylar copy, five (5) sets of bond copy, and one (1) set of electronic copy on cd of cabinet schematic diagrams shall be furnished for each traffic signal location. No other type of reproducible material shall be allowed in place of mylar copy.

Updated controller cabinet schematic wiring diagrams shall be provided on 24" x 36" sheets for approval. One schematic wiring diagram shall be provided for left wall, back wall, right wall, and door. The intersection sketch shall be provided on cover sheet with north arrow up.

Contractor shall furnish ~~two (2)~~ maintenance and operation manuals for all controller units, conflict monitors, auxiliary control equipment, vehicle detector sensor units, and amplifiers. The manuals shall be submitted at the time the equipment is delivered for testing. The manuals shall include, but not limited to, the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Detailed circuit analysis
6. Troubleshooting procedure (diagnostic routine)

7. Voltage charts with wave forms
8. Geographical layout of components
9. Schematic diagrams
10. List of replaceable component parts with stock numbers

All manuals and documents furnished by the contractor shall be placed inside a heavy duty, clear plastic envelope. The envelope shall be attached to the inside of the controller cabinet door.

The contractor is required to submit to the engineer full scale "as-built" prints and one (1) electronic copy on cd, prior to the city accepting both installations. The prints shall indicate in **red color** all deviations from the contract plans, such as location of poles, pull boxes and conduit runs, depth of conduit, number of conductors, and other appurtenant work for future reference.

SCHEDULING OF WORK (SECTION 86-1.07)

Add the following:

The contractor shall not begin sub-surface work until approval has been obtained from the city engineer. The contractor shall be responsible to reduce impact to the public by minimizing the time between sub-surface work and above-ground installations.

EXCAVATING AND BACKFILLING (SECTION 86-2.01)

Add the following:

All excavated material shall be removed from the site and backfilled with compacted crushed aggregate base material topped with asphalt concrete on the same working day as removed.

FOUNDATIONS (SECTION 86-2.03)

Add the following:

Contractor shall define exact location of all utilities in the vicinity of the proposed new foundation locations. The exact locations of all foundations for signal equipment and the controller cabinet shall be approved by the engineer prior to the start of any excavation work. Foundations shall be hand-dug until clear of obstructions.

Portland cement concrete shall be minimum class 560-C-3250, Type II/V.

All foundation concrete shall be vibrated to eliminate air pockets.

Controller cabinet foundation forms shall be rigid steel.

STANDARDS, POLES, STEEL PEDESTALS, AND POSTS (SECTION 86-2.04)

Add the following:

Standards, poles, steel pedestals, and posts shall not be erected or installed until the service enclosure is installed, metered, and energized; the controller cabinet wired; the controller test period is completed and passed at test facility; the controller assembly installed; conduits, pull boxes, wiring, and other underground installation is complete and in place; and signal faces, vehicle detection, push buttons, signs, luminaires, and other materials required to complete the installation in its entirety have been inspected, passed inspection, and are in the contractor's possession and available for immediate installation.

Pipe tenons shall be provided as detailed on Caltrans Standard plans ES-7M.

In addition to identifying each pole shaft as detailed on Caltrans Standard Plan ES-7M, the contractor shall also identify each mast arm for all signals and luminaires. The stamped metal identification tag shall be located on the mast arm near the butt end and shall contain the same information required by Caltrans Standard Plan ES-7M. Pole tags shall include name of the manufacturer and shall be visible from the road surface.

CONDUIT (SECTION 86-2.05)

Add the following:

Boring or drilling methods shall be used for the installation of all conduits in existing pavement. Rigid metal conduit to be used as a jacking or drilling rod shall be fitted with suitable drill bits for the size as approved by the engineer. Conduit runs shall be continuous in type material from the beginning to the terminating end of the run.

Type 3 rigid non-metallic schedule 80 PVC conduit shall be used at all locations, and shall be 2" minimum diameter. Approved bell bushing shall be installed at all conduit ends.

All conduits shall enter through the bottom of a pull box and shall terminate 2" above the bottom and shall be located near the end walls to leave the major portion of the box clear.

Conduits terminating in standards or pedestals shall extend not more than 2" vertically above the foundation and shall be sloped toward the handhole opening.

After conductors have been installed, the ends of conduits terminating in pull boxes and controller cabinets shall be sealed with a type of sealing compound approved by the engineer.

All non-metallic type conduits, without a grounding conductor, shall have a bare no. 8 AWG solid copper wire that shall terminate at each pull box and at the ends of conduit runs. Twenty-four (24) inches of the solid copper wire shall be coiled in each pull box.

Conduit runs are shown in schematic form only. Actual installation shall be done in most direct manner. The contractor shall locate the interfering existing underground facilities and the actual installation shall be done in the most direct manner as the existing underground condition permits and as approved by the engineer.

PULL BOXES (SECTION 86-2.06)

Add the following:

Pull boxes, covers and extensions for installation in the ground or in sidewalk areas shall be of the sizes and details shown on the plans and shall be pre-cast of reinforced portland cement concrete (PCC). Plastic pull boxes shall not be used. All pull boxes shall be Christy Concrete Products, Inc. With fiberlyte lid, or approved equal.

Grouting is required at the bottom of all pull boxes.

Pull boxes shall be size no. 5, unless noted otherwise on the construction plans. Pull box lids shall specify “Traffic Signal” on top of each. Pull box extensions shall not be required unless specified by the engineer.

The amount of pull boxes shown on the plans is to be installed as a minimum. The contractor may, at no additional cost to the city, install additional or larger pull boxes to facilitate the contractor's work, with the approval of the engineer.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation

facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

The following "COVER MARKING" shall be added on the top of pull box cover as follows:

- "TRAFFIC SIGNAL": Where pull box contains traffic signal conductors with or without street lighting conductors.
- "STREET LIGHT": Where pull box contains only street light conductors.
- "HIGH VOLTAGE STREET LIGHT": Where pull box contains only street light conductors with street light voltage above 600 volts.
- "SPRINKLER CONTROL": Where pull box contains only sprinkler control conduits.
- "TELEPHONE": Where pull box contains only telephone conductors.
- "EDISON": Where pull box contains only Southern California Edison company conductors.
- "TRAFFIC SIGNAL COMMUNICATIONS": Where pull box contains only signal interconnect cables.

CONDUCTORS AND CABLES (SECTION 86-2.08)

Add the following:

Signal cable shall be installed continuously without splicing from the controller cabinet to each traffic signal pole.

All conductors shall be new and THW type. The contractor shall provide all new conductors.

Signal Interconnect Cable (SIC) shall be twelve (12)-pair #19 AWG and conform to the REA PE 22 specification. Conductors with THHN and THWN installation shall not be

used. Cable shall be multi-colored twisted-pair cable with twelve (12)-pair #19 AWG copper conductors and shall use the standard telephone color code. Cable shall have polyethylene insulation, mylar sheathing, and aluminum shielding.

SIC shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed. Contractor shall make interconnect connections as directed by engineer.

SIC shall be grounded only at the master controller location. At all other locations, sic shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

SIC cable identification tags indicating where the direction SIC is coming from shall be attached to each cable end.

SPLICING AND TERMINATIONS (SECTION 86-2.09D)

Add the following:

No splicing shall be permitted except for I.I.S.N.S., safety lighting and commons. All conductors shall extend from the controller cabinet to the terminal compartment on each pole.

Conductors No. 10 AWG and larger shall be spliced by the use of approved "C" shaped compression connectors. Conductors No. 8 AWG and larger shall be stranded.

Plastic conduits containing power circuit conductors shall have a bare no. 8 AWG solid grounding copper conductor that shall terminate at each pull box at the ends of the conduit run.

Signal Interconnect Cable (SIC) shall be installed continuously between intersection controller cabinets and/or splice cabinets, as noted on plans. Splicing of signal interconnect cable shall not be allowed.

Cable shall be grounded only at the master controller location. At all other locations, cable shields shall be bonded together with cable bonding clamps (A.K. Stamping Company, Inc. Part No. A-1037) and insulated wire, and all exposed metal parts taped.

Bonding clamps may be obtained by contacting:

AK Stamping Company, Inc.
1159 U.S. Route 22
Mountainside, New Jersey 07092
(908) 232-7300

SPLICE INSULATION (SECTION 86-2.09E)

Add the following:

The contractor shall use splice insulation "Method B".

BONDING AND GROUNDING (SECTION 86-2.10)

Add the following:

Grounding jumper shall be attached by a 3/16-inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

No. 8 minimum copper bond wire shall be run continuously in all circuits.

SERVICE (SECTION 86-2.11)

Add the following:

Service equipment enclosure shall conform to the following:

1. 120 / 240 volt, Type II-BF one meter service equipment enclosure unless otherwise shown on the plans.

2. Circuit breakers shall be the plug-in type and shall consist of the following:

a.	One (1)	100 AMP 2 Pole	240V Signal and I.I.S.N.S. Main (metered)
b.	One (1)	40 AMP 1 Pole	120V Signal Circuit (metered)
c.	ONE (1)	15 AMP 1 Pole	120V I.I.S.N.S. Circuit (metered)
d.	ONE (1)	15 AMP 1 pole	120V I.I.S.N.S. Photoelectric Control (metered)
e.	ONE (1)	100 AMP 2 Pole	240V Lighting Main (un-metered)
f.	ONE (1)	15 AMP 1 Pole	120V Lighting Circuit (un-metered)
g.	ONE (1)	15 AMP 1 Pole	120V Lighting Photoelectric Control (un-metered)

3. Two (2) delayed response Type V photoelectric control contactor and test switch assemblies with two (2) window shields for lighting and I.I.S.N.S. shall be installed in the service cabinet on the customer section. Photoelectric control contactors shall be as follows:

LUMINAIRES	-	30 AMP
I.I.S.N.S	-	30 AMP

4. Service cabinet shall have a painted exterior finish to match the controller cabinet, as directed by the city.

5. Circuit breakers shall be marked with identifying labels for each circuit breaker.

6. Photoelectric control assembly shall be installed within the circuit breaker compartment of the service cabinet enclosure and accessible to the city after installation of electrical meter.

TESTING (SECTION 86-2.14)

Add the following:

The testing of traffic signal equipment, including controller units, fully-wired signal cabinet and auxiliary equipment as specified in Section 86-3, "controller assemblies", shall be performed by a testing facility designated by the City. Approximately twenty (20) working days will be required for testing and notification of the final results.

Testing facility shall contact City Engineer or its representative when controller assembly is available for inspection.

Contractor is responsible for all the costs involved in testing the controller cabinet assemblies, including transportation to and from the testing facility. Contractor is responsible for ordering and purchasing the controller cabinet assembly as specified in the following section, solid state traffic actuated controllers. Cabinets shall not be released to the contractor until full payment for testing is received by the testing agency.

It shall be the contractor's responsibility to arrange pick-up and delivery of these items to the project site. Any cost involved to deliver and install these items at the project site shall be borne by the contractor, and no additional compensation shall be allowed therefore.

In addition to the five (5) working days of continuous satisfactory operation, called for in section 86-2.14C, "Functional Testing", five (5) more working days of satisfactory operation will be required when the signal system is connected to the City's master system controller.

"Turn-On" of the traffic signal systems shall not be made on a Friday or the day preceding a legal holiday. The City Engineer shall be notified five (5) working days prior to the intended "Turn-On". "Turn-On" shall begin before 10:00 a.m. of the approved day. Contractor must complete a satisfactory "Turn-On" within a pre-approved time period to be determined by the City Engineer. When a "Turn-On" is not completed within the pre-approved time period, it shall be canceled and rescheduled.

The Malfunction Management Unit (MMU) shall be tested in the field before "Turn On".

The contractor shall arrange to have a field representative from the City, a City Signal Technician, a knowledgeable technician from the manufacturer of the traffic signal

controller/ cabinet assembly, and a representative from the battery backup system manufacturers, present at the time of the traffic signal "Turn-On". The representatives shall be fully qualified to work on their respective traffic signal equipment. The manufacturer's representative and city staff shall be notified at least seven (7) working days prior to intersection "Turn-On".

The insulation resistance shall not be less than 100 megohms on all interconnect and loop circuits and 50 megohms for power circuits when the megger tests are performed. Testing shall not be conducted until all control and/or sensor units and probes have been disconnected from the circuit.

CONTROLLER ASSEMBLIES (SECTION 86-3)

Add the following:

CONTROLLER/CABINET ASSEMBLIES

Complete controller/cabinet assembly, including controller, completely wired cabinet and appurtenances shall be supplied by the contractor.

Solid-state traffic actuated controller units, cabinets and auxiliary equipment shall conform to the provisions in Section 86-3, "Controller Assemblies", these special provisions, and NEMA TS-2 Standards.

Contractor shall furnish and install Econolite ~~ASC/3-2100~~ TS2 Type 2 System Controller Unit and appurtenances. Contractor shall provide miscellaneous items as necessary to produce a fully-operational system in accordance with the plans, special provisions, Caltrans Standard Plans and Standard Specifications.

Power distribution panel, inside auxiliary control panel, police panel and all detector termination panels shall be hard wired. No "Plug and Go" connections are allowed.

CABINET ASSEMBLY

Contractor shall furnish and install Type "P" painted cabinet assembly as indicated on the plans that includes the following items:

1. One (1) - fully wired eight (8) phase NEMA TS2 Type 2 "P" painted aluminum cabinet, as indicated on the plans.

2. One (1) - Econolite ~~ASC/3-2100~~ TS2 Type 2 Centracs System Controller Unit with data key and ethernet port.

3. One (1) - malfunction management unit with LCD display (programmed for intersection).

4. One (1) - eight (8) position detector rack(s) with sixteen (16) channels of detection and one (1) bus interface unit, per rack. Two (2) EVP 2-channel card positions are to be provided in each eight (8) position detector rack as required.

5. One (1) sixteen (16) position horizontal load bay.

6. One (1) - controller cabinet power supply.

7. Three (3) - battery back-up system alarm inputs: on battery, flash (programmable percentage battery power remaining), and timer.

9. Signal interconnect block for two (2) 12-Pair No. 19 cables.

15. Centracs intergration and graphics shall be provided for the City's Traffic Management System.

All auxiliary equipment installed in controller cabinet to completely operate an eight-phase traffic signalized intersection.

Prior to fabrication of the cabinet, a review of the completed cabinet take-off shall be conducted by the city representative.

SPECIFICATIONS AND STANDARDS FOR THE CABINET ASSEMBLY:
National electrical manufacturers association, traffic control systems, NEMA standards publication: TS2- latest release.

WARRANTY STATEMENT:
Terms of controller cabinet warranty:

WARRANTY COVERAGE:
The supplier of equipment shall warranty their product to be free from defect in design and operation and that it meets all the requirements of this specification and those incorporated in this document.

LENGTH OF WARRANTY:
The warranty term on a wired signal cabinet shall be a (1) year minimum from date of shipment including the bus interface units and cabinet power supply. Equipment such as the controller and malfunction management unit shall have a (5) year minimum warranty.

CONTROLLER ASSEMBLIES (SECTION 86-3) (CONTINUE)

CABINET CONSTRUCTION

A complete NEMA TS2 Type 2 "P" cabinet shall be supplied. Cabinet shall meet, as a minimum, all applicable sections of the NEMA standard publication. Where differences occur, this specification shall govern. The cabinet shall meet the following criteria:

1. Material shall be aluminum sheet, 5052-H32, with a minimum thickness of 0.125-inch.

2. The cabinet exterior shall be a painted finish as indicated and with a white interior, as directed by the city.

3. The door hinge shall be of the continuous type with a stainless steel hinge pin.

4. The door handle shall be cast aluminum.

5. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet. All seams shall be continuous weld.

6. Cabinet lock shall be of the Corbin No. 2 Type.

7. A roll out computer table shall be mounted at a location designated by the City Representative.

8. The cabinet shall have four (4) sets of cabinet wiring diagrams.

9. The cabinet shall have one (1) set of equipment manuals (Controller, MMU, etc.).

NOTE: NO PLUG-N-GO EQUIPMENT SHALL BE ALLOWED FOR POWER DISTRIBUTION PANEL, INSIDE AUXILIARY CONTROL PANEL AND POLICE PANEL (ONLY HARD WIRING).

SHELVES

~~Three (3) substantial metal shelves extending half way across the back of the cabinet on the left side of the cabinet shall be provided to support the controller unit and auxiliary equipment. One (1) substantial metal shelve extending completely across the back of the cabinet in the top area of the cabinet shall be provided to support the detector rack(s).~~

The shelves shall not interfere with the lowering or removal of the main panel. City Engineer shall approve the design for final location of shelves before final manufacture of cabinet.

EQUIPMENT ACCESSIBILITY

All mounted panels and equipment shall have a minimum tool access clearance of 6".

VENTILATING FAN

The cabinet shall be provided with one (1) thermostatically-controlled ventilation fans, adjustable between 80 to 150 degree F and shall be installed in the top of the cabinet plenum.

AIR FILTER ASSEMBLY

The cabinet air filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

CABINET LIGHT ASSEMBLY

The cabinet shall be equipped with a led lighting fixture mounted on the inside of the cabinet near the front edge. The led light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

The cabinet shall have a gooseneck type lighting fixture that shall be mounted on the inside of the door near the hinge. The gooseneck light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

LIGHTNING SUPPRESSION

The cabinet shall be equipped with an EDCO model SHP-300-10 surge arrester, or city approved equivalent.

POWER PANEL

THE POWER PANEL SHALL HOUSE THE FOLLOWING EQUIPMENT:

1. One (1) 40 AMP main breaker to supply power to the main panel, controller, MMU, and cabinet power supply.

2. One (1) 15 AMP auxiliary breaker to supply power to the fan, light, and FG outlet.

3. One (1) 50 AMP, 125 VAC radio interference line filter.

4. One (1) normally-open, 60 AMP, Crydom model #H[illegible]471 solid state relay, or city approved equivalent.

CONVENIENCE OUTLET

Three (3) duplex outlets shall be supplied, as per the following:

1. The first is for short-term equipment use, 120 Volt AC, 15 AMP NEMA 5-15 GFCI duplex outlet, and shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

2. The second and third are for long-term equipment use, 120 Volt AC, 15 AMP NEMA duplex outlets, and shall be mounted in the upper right corner of the cabinet facing the inside of the cabinet. Power shall be supplied from un-switched filtered power.

INSIDE AUXILIARY CONTROL PANEL SWITCHES

The inside door panel shall contain three (3) switches: Auto/Flash, Auto/Off/On Stop-Time, and power On/Off. Auxiliary door panel switches shall be hard wired; printed circuit boards shall not be used.

1. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally. In the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

2. AUTO/OFF/ON STOP-TIME SWITCH (3-POSITION) - In the auto position, the controller shall be stop timed when the police door Auto/Flash switch is in the flash position or MMU Flash. In the off position, the switch shall release all stop time from controller. In the on position, the switch shall maintain a continuous stop time to the controller.

3. CONTROLLER POWER ON/OFF SWITCH (2-POSITION) - This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

POLICE PANEL SWITCHES

The police panel shall contain two (2) switches: signals On/Off and Auto/Flash. All police panel switches shall be hard wired; printed circuit boards shall not be used.

1. SIGNALS ON/OFF SWITCH (2-POSITION) - In the on position, the field displays shall show either normal operation or flash. In the off position, power shall be

removed from signal heads in the intersection. The controller shall continue to operate. In the off position, the MMU shall not conflict or require reset.

2. AUTO/FLASH SWITCH (2-POSITION) - In the auto position, the intersection shall operate normally based on all other switches. In the flash position, power shall not be removed from the controller and stop time shall be applied based on the stop- time switch.

CABINET WIRING

CABLES

All controller and MMU cables shall have sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length and shall not obstruct the visibility of any cabinet equipment or interfere with the intended use of the computer tray.

All cabinet wiring shall the color coded as follows:

PURPLE	=	Flash Color Programming
BROWN	=	Green Signal Wiring
YELLOW	=	Yellow Signal Wiring
RED	=	Red Signal Wiring
BLUE	=	Controller Wiring
GRAY	=	DC Ground Return, Logic Ground
BLACK	=	AC Positive
WHITE	=	AC Negative
GREEN	=	Chassis

MAIN-PANEL AND WIRE TERMINATION

All wires terminated behind the main-panel and other panels shall be soldered. No pressure or solder-less connectors shall be used. Printed circuit boards shall not be used on main panels.

FLASHING OPERATION

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

DETECTOR RACK AND INTERFACE

A minimum of one (1) TS-2 vehicle loop detector rack and one (1) hard wired detector interface panel and necessary cabling shall be provided in each cabinet. Detector rack shall be labeled for each detector channel used and shall correspond with cabinet door

diagram. Each individual rack shall support up to sixteen (16) channels of loop detection, one (1) BIU and two (2) EVP 2-channel cards.

PREEMPTION WIRING:

The cabinet shall be completely-wired for railroad or EVP preemption as needed, if specified on the plan(s).

MAIN PANEL CONFIGURATION

The main panel shall be fully wired in the following configuration:

1. Sixteen (16) horizontal load sockets.
2. Six (6) flash transfer relay sockets.
3. One (1) flasher socket.
4. One main panel BIU rack slot.
5. Wiring for both Type 1 and Type 2 controllers.
6. Wiring for one type 16 MMU.

FIELD TERMINAL LOCATIONS

Field terminals shall be located at the bottom of the main panel and angled forward for easy viewing and wiring. The order shall be from left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

CABINET EQUIPMENT

LOOP DETECTORS, LOAD SWITCHES, FLASHERS, RELAYS

Cabinet shall be equipped with the proper number of loop detectors, load switches, flashers, and relays to perform the intended operation.

CONTROLLER UNIT

Cabinet shall be equipped with one (1) ~~ASC/3-2100~~ Econolite TS2-Type 2 controller complete with the latest Econolite recommended software and operating system, and shall be system ready for communication on the Centracs Traffic Signal Management/Monitoring software. Controller shall be equipped with a 25 pin FSK telemetry module, data key, and ethernet port. Controller shall also allow logging of three (3) alarm inputs as required in the specifications for battery back-up system.

MALFUNCTION MANAGEMENT UNIT (MMU)

Cabinet shall be equipped with NEMA TS2 Type 16 MMU with the latest current released software. MMU jumper cards shall be programmed to specific intersection's requirements. MMU shall also monitor the led blank-out signs for sign operation.

BUS INTERFACE UNIT (BIU)

BIU's shall meet all TS2-1992, section 8 requirements. In addition, all BIU's shall provide three (3) separate front panel indicators: power, valid data, and transmit.

CABINET POWER SUPPLY

The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator led for each of the four (4) power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

INTERCONNECT TERMINATION

Cabinet shall be supplied with interconnect termination blocks, Siemens model no. S66M1-50 and sub-base assembly.

LOAD SWITCH:

All load switches shall meet NEMA TS-2, section 6 requirements and shall have input and output led indications.

FLASHER UNIT

All flasher units shall meet NEMA TS-2, section 6 requirements and shall be EDI model 810, or city approved equivalent.

TELEMETRY INTERFACE PANEL

Cabinet shall be wired with a 25 pin telemetry interface panel and telemetry connecting cable that can communicate with the Ariel Traffic Signal Management/Monitoring master software. The cabinet shall be wired for telemetry transient suppression, EDCO model No. PC642C-00-AD, or city approved equivalent.

INTERSECTION DIAGRAM

An intersection diagram prepared in Autocad shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the auxiliary panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and

north arrow. The top of the diagram will be north and the diagram shall be pre-approved by the City Engineer.

CABINET WIRING DIAGRAM

Cabinet wiring diagrams shall be arranged on three (3) separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second sheet everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the city engineer prior to construction of cabinet assembly.

TESTING FACILITY:

Contractor shall be responsible for having the new cabinet assembly tested at city designated facility prior to being "Turned-On" at the intersection site. The testing facility shall have up to twenty-one days to test the controller assembly.

EQUIPMENT TURN-ON REQUIREMENTS:

The contractor shall arrange to have a City Signal technician, an Econolite Control Products technician, a Myers Power Products, Inc. BBS manufacturer representative present at the time of the controller turn-on. The representatives shall be fully-qualified to work on the controller assembly and related equipment. The manufacturer's representatives and city shall be notified at least (7) working days prior to intersection turn-on.

CENTRACS GRAPHICS & SOFTWARE

One (1) intersection graphic shall be provided for each traffic signal design or modification on the city's Centracs Traffic Signal Management System.

BATTERY BACKUP SYSTEM (SECTION 86-3.02)

[Replace this section with the following:]

SCOPE

The battery backup system (BBS) shall provide uninterruptible reliable emergency power to a traffic intersection in the event of a power failure or interruption. The uninterruptible power supply (UPS) shall provide a minimum of two (2) hours of full run-time operation for an "LED-ONLY" signal intersection. The transfer from utility power to battery power will not interfere with the normal operations of the traffic controller, conflict monitor or any other peripheral devices within the traffic control system. The bbs / ups system shall be comprised as noted below and shall include, but not be limited to: inverter/charger (ups), power transfer switch (pts), batteries, two (2) separate manually

operated non-electronic bypass switches (mbps), a generator plug with flush compartment door, and “on-battery” warning light on top of the bbs enclosure, and all necessary hardware and interconnect wiring.

The system shall be capable of providing power for full run-time operation, flashing mode operation, or a combination of both full and flash mode operation of an intersection. The operation of the flash mode shall be field programmable to activate at various times, battery capacities, or alarm conditions locally using the touch pad or remotely using an industry standard pc’s RS232 and USB interface. BBS shall have an ethernet port.

Field programmability via touch pad or computer interface must be in user friendly, menu driven formats and must not require any external or proprietary software. The BBS shall use hyperterminal to communicate with pc interface. The DB9 connector for the RS232, USB and ethernet interfaces shall be located on the front panel of the UPS. Interface cables shall be pinned for industry standard configuration, no proprietary cable pin out allowed. The system shall be designed for outdoor applications and meet the environmental requirements as detailed herein. The system shall be Myers Power model MP2000™, or equal.

BATTERY BACKUP SYSTEM CONFIGURATION

The battery backup system (BBS) shall include, but not be limited to the following:

1) Inverter/Charger.
2) Power Transfer Relay.
3) Two (2) separate manually operated non-electronic bypass switches in one assembly: one for inverter & one for generator
4) A generator plug with compartment door.
5) An “On Battery” warning light on top of BBS enclosure.
6) All necessary hardware and interconnect wiring.
7) **See Exhibit 1 attached in appendix “A” for connection block diagram.**

All BBS assemblies shall be new and fully assembled by the designated manufacturer/supplier (batteries may be separate). Contractor shall not fabricate or assemble the BBS assemblies, and shall only install and wire the assemblies on the existing signal cabinets.

1. SYSTEM CAPACITY AND RUNTIMES

1.1

The BBS shall be configured such that it provides a minimum of two (2) hours of full run-time operation for an intersection using led traffic and pedestrian signals. The UPS

shall be 2000 VA / 1500 Watts with 80% minimum inverter efficiency. 105 AH batteries shall be utilized at any given intersection.

2. RELAY CONTACTS

2.1
The UPS shall provide the user with 6 sets of fully programmable, relay contacts of type N/O, N/C, panel-mounted, potential free and rated 1 AMP, 120VAC and labeled C1 through C6, **see Appendix "B", Exhibit 2, for wiring diagram**. Each relay's setting shall be programmable to activate under any number of conditions locally using the touch pad or remotely using the RS232, USB or ethernet interface. The available settings for the relays are outlined below.

Relay contacts C1 through C6 can be independently configured to activate under any of the following conditions:

2.1.1 On battery- relay activates when BBS switches to battery power.
2.1.2 Low batery- relay activates when batteries have reached a certain level of remaining useful capacity while on battery power. This number is adjustable from 0 to 100%.
2.1.3 On-battery lamp – relay activates when power transfer switch (PTS) activates.
2.1.4 Alarm- relay activates after a specific or general alarm is detected. These alarm conditions include: line frequency, low output voltage, no temperature probe, overload, batteries not connected, high temperature, and low temperature. The relay can be programmed to activate when any of these alarm conditions are met, or when a specific condition is met.
2.1.5 Fault- relay activates after a specific or general fault is detected. These fault conditions include: short circuit, low battery voltage, high battery voltage, high internal temperature, and excessive overload. The relay is programmed to activate when these fault conditions are met, or when a specific condition is met.
2.1.6 Off-Relay is disabled and will not activate under any condition.

2.2
Default relay settings

2.2.1 Relay C1 shall be set to activate whenever the ups transfers to battery power and shall be labeled "C1 'on Batt – Alarm 2'".
2.2.2 Relay C2 shall be set to activate whenever the UPS activates the "On-Battery Light" on top of the cabinet and shall be labeled "C2 'On-Battery' Light'".
2.2.3 Relays C3 and C4 shall be set to activate whenever the batteries reach an assigned percentage of remaining useful capacity and shall be labeled "C3 'Low Batt – Maint. Required'" and "C4 'Low Batt – Remote Flash'".
2.2.4 Relays C5 and C6 shall be set to activate whenever the UPS has a fault or alarm activated and shall be labeled "C5 'Faults – Maint. Required'" and "C6 'Alarm – Maint. Required'".

2.2.5 Terminal block position 19 & 20 shall be set to activate a self-test. This test confirms that a unit can transfer into and out of battery mode while supporting the output load.

2.2.6 Terminal block position 21 & 22 are activated when the PTS system is “On Battery”.

3. OPERATION

3.1
The manual by pass switch (MBPS) shall be rated at 240 VAC, 40 AMPS minimum.

3.2
The MBPS shall allow replacement of the UPS without having to interrupt power to the intersection. The mbps and power transfer switch (PTS) shall be separate units allowing for the replacement of the BBS or PTS without interrupting power to the intersection.

3.3
The BBS shall use a temperature compensated battery charging system. The charging system shall compensate over a wide range of 2.5 to 4 MV / °C / Cell. The charger shall be rated 10 AMPS at 48VDC.

3.4
The temperature sensor shall be external to the UPS unit. The temperature sensor shall be supplied with 3 meters (9’ 10”) of wire and shall be attached to the side of one (1) battery with aluminum foil heat sensitive tape **only**.

3.5
Batteries shall not be charged when battery temperature exceeds 50°C ± 3°C (122°F).

3.6
The BBS shall automatically monitor on an ongoing basis that battery power is present and available in the event it is needed during a utility outage. A “Battery Not Connected” alarm shall be issued if battery power is not present.

3.7
When utilizing battery power, the BBS output voltage shall be between 110VAC and 125VAC, pure sine wave output with THD < 3% at 60 HZ +/- 3 HZ.

3.8
In the event of ups failure, battery failure or complete battery discharge, the power transfer switch (PTS) shall revert to the utility or line mode (In a De-Energized State) where utility power is supplying the cabinet.

4. ENVIRONMENTAL

The operating temperature for both the inverter/charger (UPS), power transfer switch (PTS) and manual by pass switch (MBPS) shall be -37 °C to +74 °C.

5. PRODUCT COMPATIBILITY

5.1
BBS shall be compatible with all of the following for full phase, flash operation mode or a combination of both full and flash mode operation:

- NEMA Cabinets
- NEMA TS1 Controllers
- NEMA TS2 Controllers
- Electrical Service Pedestals

5.2
The BBS system including 79AH batteries shall fit inside an electrical service pedestal (Myers Meug 35) or an external Myers BC series BBS cabinet. This project will specify a BC100HZG-LH or RH – 48V/30 AMP receptacle and utilizing 105 AH batteries.

6. LOSS / RESTORATION OF UTILITY POWER

6.1
In the event the BBS senses the utility line voltage is outside the HI and LOW limits (100 & 130VAC respectively set as default), the BBS shall transfer the load to battery power.

6.2
The BBS shall return to line mode when the utility power has been restored to above 105 VAC for more than 30 seconds. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB and optional ethernet interfaces.

6.3
The BBS shall return to line mode when the utility power has been restored to below 125 VAC for more than 30 seconds. Or, the BBS shall return to line mode when the utility power is back to nominal. This line qualification time can be adjusted to 3, 10 or 30 seconds locally using the touch pad or remotely using the RS232, USB or optional ethernet interface.

6.4
The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 65 milliseconds. The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

7. BACK-FEED AND OTHER PROTECTIONS

7.1
The BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service per UL 1778, section 48 "Back-Feed Protection Test". The upstream back-feed voltage from BBS system shall be less than 1 volts AC for the protection of the traffic engineer or a technician.

7.2
The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41 for 2000 Volts AC.

8. MOUNTING / CONFIGURATION

8.1
Mounting method shall be shelf-mount or rack-mount. BBS and PTS units individually shall not exceed 5.25” or 3U in height.

8.2
All necessary hardware for mounting (Shelving, Rack, Harness, etc.) Shall be included in the bid price of the BBS.

8.3
External battery cabinets may be used to meet adequate environmental and physical requirements.

9. FUNCTIONALITY, DISPLAYS, CONTROLS, DIAGNOSTICS AND MAINTENANCE

9.1
The BBS shall include a LCD display to indicate current battery charge status, various input/output voltages, power output, battery temperature, date, time and settings of the various field programmable relays. The same parameters shall be available via RS232, USB and ethernet interfaces for remote monitoring.

9.2
The UPS shall provide the power beyond the temperature that would be field programmable for an external fan located in the same or in a separate battery cabinet. The temperature setting shall be adjustable from the touch pad or remotely via RS232, USB and optional ethernet. The temperature range shall be from +20°C to +55°C in 1 degree C increment.

9.3
All control, programming, maintenance and inquiry shall be accessible via the keyboard on the face of the BBS without the need for the use of any additional equipment or external PC.

9.4
The BBS shall be capable of accepting firmware updates of the non-volatile, read-only memory via serial port communications. The updates shall be accomplished by uploading the software to the BBS over the RS232/USB serial port located on the face of the UPS.

9.5
The buck and boost mode shall be provided in case of extended power variations. The BBS shall have the ability to buck and boost 10% +/-.

9.6
The PTS shall be activated during buck and boost operation. The transfer time shall be less than 10 milliseconds typically to meet plc and other controller requirements.

9.7
The UPS shall be provided with a re-settable inverter event counter and a cumulative inverter timer that is accessible via the LCD screen or remotely via RS232, USB or ethernet.

9.8
The UPS shall be equipped with an event log that stores for a minimum the last 100 events. The events shall be time and date stamped. The event log shall be retrievable via RS232, USB or optional ethernet and from the BBS LCD screen. The event log shall display and print out in plain English when output over the RS232, USB or ethernet ports.

9.9
The BBS shall be capable of performing a self-test, locally from the UPS front panel LCD, or remotely via RS232, USB and optional ethernet interfaces. The duration of the self-test shall be programmable in 1-minute increments from 1 min. To 255 minutes.

9.10
The level for low battery alarm shall be available on the RS232, USB or ethernet connector located on the front face of the BBS. The programmable low battery alarm contact shall be available on RS232 for local or remote access with the incremental adjustment of 0.25 VDC

9.11
Certain maintenance controls such as battery test, BBS inverter On/Off viewing the event log and changing default settings shall be password protected. The UPS shall be provided with a default password. The user can change the password in order to restrict access to sensitive functions.

9.12
The following LED lights conditions shall be used to indicate current status:

Green LED flashing for battery back-up mode
Green LED steady on for normal line mode operation

Red LED flashing for alarm conditions
Red LED steady on for fault conditions

9.13
BBS shall be easily replaced and installed (complete turnkey system with all necessary hardware). BBS shall not require any special tools for installation.

10. BATTERY SYSTEM

10.1
Individual batteries shall be 12 VDC type and shall be easily replaced and commercially available off the shelf.

10.2
The battery system used in the BBS shall consist of (4) 105 AH batteries and for safety, shall be of a voltage not to exceed 60 VDC. Batteries shall be provided with quick disconnect terminals and a polarized-keyed battery cable for easy field installation.

10.3
Batteries shall be certified to operate over a temperature range –20°C to +74°C

10.4
Batteries shall indicate maximum recharge data and recharging cycles.

10.5
Recharge time for the battery from protective low cutoff to 80% or more of full battery charge capacity, shall not exceed twenty (20) hours.

10.6

A) Batteries individual batteries shall be:

- Voltage Rating: 12V Type
- Amp-Hour Rating: 105 AMP-Hour Minimum
- Group Size: 31 Minimum
- Easily Replaced and Commercially Available Off the Shelf.

B) Batteries used for each BBS shall consist of (4) batteries. All batteries must meet their specifications out of the box immediately after the initial 24-hour top off charge. Batteries that require cycling to meet the AH rating specifications are not acceptable.

C) Batteries shall be able to withstand extreme temperature, deep cycle, sealed prismatic lead-calcium based AGM/VRLA (absorbed glass MAT/VALVE regulated lead acid) batteries.

D) Batteries shall have a manufacturer's warranty of (2) years full replacement. The warranty shall cover any battery that does not meet 80% of its original reserve capability during the warranty period.

E) The batteries shall be provided with appropriate interconnect wiring and a corrosion-resistant stationary mounting tray with a non-heated battery mat appropriate for the cabinet into which they will be installed.

F) Batteries shall indicate maximum recharge data and recharging cycles.

G) Battery harness:

1) Battery interconnect wiring shall be via a two-part modular harness.

2) Part I shall be equipped with red (+) and black (-) 30.48 cm (12") cabling that can be permanently connected to the positive and negative posts of each battery. Each red and black pair shall be terminated into an anderson style power pole connector or equivalent.

3) Part II shall be equipped with the mating power pole style connector for the batteries and a single, insulated power pole style connection to the inverter/charger unit. Harness shall be fully insulated and constructed to allow batteries to be quickly and easily connected in any order to ensure proper polarity and circuit configuration.

4) Power pole connectors may be either one-piece or two-piece. If a two-piece connector is used, a locking pin shall be used to prevent the connectors from separating.

5) All battery interconnect harness wiring shall be UL style 1015 CSA TEW or welding style cable or equivalent, all of proper gauge with respect to design current and with sufficient strand count for flexibility and ease of handling.

6) Battery terminals shall be covered and insulated with molded boots so as to prevent accidental shorting.

H) Each BBS system shall be supplied with an individual charge battery manager – Myers Power Products, Inc. Model #[illegible]930-48 with Myers part #CTSPBCK-37 battery string cable. The battery manager shall be provided to automatically balance the battery charge voltage on all batteries in the string to within ±100MV between any two batteries. The balancer shall allow for any single 12V battery within the battery string to be replaced at any time throughout the warranty period and not require the purchase of new batteries, to install the battery covered under the warranty.

10.7
The BBS enclosure shall be a NEMA 3R rated side-mount cabinet and installed on the left/right side of the traffic signal cabinet with a left/right hand door swing. The enclosure will house the batteries, UPS (BBS), (2) manual bypass switches, power transfer relay, generator connection compartment, on-battery light (external), other control panels and all wiring & harnesses. The cabinet must meet the requirements for NEMA 3R enclosure and **must be manufacture by Myers Power Products, model: BC100HZG-48LH-UPS, see Appendix "C", exhibit 3 for details**. . The housing must have the dimensions so that it may easily be attached the side of 'P' type signal cabinet. Dimensions of the enclosure shall not exceed 48"H x 22" W x 16.5" D. The BBS enclosure must not interfere with the opening of the signal cabinet door.

The complete enclosure and door must be made from .125" thick raw aluminum. All external seams must be continuously welded. The door opening must have a double flange for weather sealing purposes.

A. **DOOR:** The cabinet must have a door to provide access to the complete cabinet interior. The door must include a continuous piano hinge made of 14-gauge stainless steel and a .120" diameter stainless steel hinge pin. The hinge must be attached to the enclosure and the door with close end pop rivets. The door must have a three (3) point locking mechanism with rollers at the ends for the latch rods. The key lock must be a Corbin cylinder lock with two No. 2 keys provided for each cabinet. When the door is opened it must have stops at 90 and 130 degrees. A continuous neoprene gasket must be used to weatherproof the enclosure when the door is closed. **The door swing (hinge side) shall be as noted on plans.**

B. **VENTILATION FAN:** A fan must be mounted in the air baffle at the top of the cabinet with an air outlet built into the overhang. The fan must be thermostatically controlled. The bottom of the door must be louvered to allow airflow. A removable dust filter must be located behind the vent.

C. **FINISH:** The enclosure shall be painted finish to match controller cabinet (unless otherwise specified by the city).

D. **FEATURES:** An "On Battery" factory installed high impact red light option shall be installed on top of the BBS enclosure, and be a minimum of 2.5 inches in diameter. The "On Battery" LED shall operate from the DC voltage of the UPS to notify that the UPS is on battery power without opening the door. The light will be wired to and controlled by the UPS power module. The enclosure shall be designed to shelf mount the UPS and power transfer switch (PTS). When the UPS is mounted into the enclosure it must be mounted to accommodate straight-on horizontal viewing of the LCD screen

on the UPS. Two (2) battery shelves with rubber battery mats (non-heated) shall be provided.

E. **GENERATOR CONNECTION:** A factory-installed flush mount generator compartment with neoprene gaskets for weatherproofing shall be installed in the enclosure. The generator compartment shall include a locking 30 AMP plug, L5-30P, for connecting of a portable AC generator. A manual transfer switch shall be mounted within the BBS cabinet to allow for transferring from utility power to generator power. The generator door will provide a cable slot to allow for closing of the door when the generator is plugged in and to lock the cable inside of the compartment. The door shall include a Corbin Type 2 lock.

F. **MOUNTING:** The BBS cabinet will be mounted to the side of the traffic signal control cabinet with six (6) stainless steel hex head bolts, ¼" x 20". All holes will be field drilled by the contractor to accommodate the specific situation. A grommet must be supplied to protect the cable in a field drilled 1.5" to 2" hole for cable connection to the existing traffic controller. The BBS manufacturer shall supply all the mounting hardware, bolts, washers, nuts, gaskets, bushings, grommets, etc., necessary to install the BBS cabinet in a safe and weatherproof manner. The contractor shall supply the caulking.

G. WIRING AND PROGRAMMING

Contractor shall install a BBS terminal connection block in signal cabinet to provide direct connection from electrical service to BBS. The contractor shall be responsible to completely wire the battery backup system, <u>including contact wiring and programming as follows</u>:

1) Contact 1 (C1) – "On-Battery" (Signal Cabinet 'Alarm #2').
2) Contact 2 (c2) – "On-Battery Lamp".
3) Contact 3 (C3) – "Low Battery" (Signal Cabinet 'Maintenance Required' Alarm).
4) Contact 4 (C4) – "Low Battery" (Signal Cabinet 'Remote Flash' Activation').
5) Contact 5 (C5) – "BBS Faults" (Signal Cabinet 'Maintenance Required' Alarm).
6) Contact 6 (C6) – "BBS Alarms" (Signal Cabinet 'Maintenance Required' Alarm).

<u>IMPORTANT:</u> Existing traffic signal cabinets may be from different manufacturers. An approved method shall be determined by the contractor/BBS supplier for wiring between the BBS and signal cabinet for "Flash Activation" during the "Low Battery" period. The contractor shall be responsible for obtaining approval by the city, or its designated representative, once a method(s) is determined for the remote (automatic) flash activation in order to provide consistency in citywide installation.

TURN-ON:
Upon final installation at the project location, the contractor shall "Turn-On" and test the BBS system. The contractor shall arrange to have a knowledgeable technician from the BBS manufacturer present at the time of the BBS "Turn-On". The representative shall be fully-qualified to work on their respective BBS equipment and its connectivity to various types and manufacturers of traffic signal cabinets. The manufacturer's representative and city engineer shall be notified at least seven (7) working days prior to intersection "Turn-On".

Testing shall include BBS operation in the "On-Battery" mode (minimum run time of 5 minutes then check battery voltage and record), "Low Battery" mode (Flash), and verification that alarm and fault relay contacts are properly functioning.

Upon satisfactory "Turn-On" at the project location, the city engineer shall be notified within three (3) days, for city staff field-verification of all tests performed.

11. SERVICE AND WARRANTY

11.1
Manufacturer shall provide a two (2) year warranty. Under this warranty, the manufacturer will send out a replacement within two business days of the call notifying them of an issue. The replacement unit may be either a new unit or a re-manufactured unit that is up to the latest revision.

12. SPECIFICATIONS

INPUT SPECIFICATIONS

Nominal Input Voltage 120VAC, Single Phase
Input Voltage Range 120VAC +/- 25%
Input Frequency 60 Hz +/- 5%

OUTPUT SPECIFICATIONS

Nominal Output Voltage 120VAC, Single Phase
Power Rating 2000VA (1500 Watts)
Output Frequency 60 Hz (+/- 5%)
Voltage Wave Form Sine Wave, THD < 3%
Efficiency (Nominal) 95-97%

MECHANICAL SIZE

Inverter / Charger 17” Wide X 5.25” High (3u) X 10” Deep
Pts Assembly 17” Wide X 5.25” High (3u) X 7” Deep
Weight Under 50 Lbs

COMMUNICATIONS

SERIAL AND NETWORK COMMUNICATIONS INTERFACE

The BBS shall have serial and ethernet communications interfaces for user configuration and management. The user serial port shall be an EIA-232 (DB9-Female) connector. The ethernet port shall be an RJ45, EIA 568B pin out connector.

USER CONFIGURATION MENUS

All BBS configuration and system menus shall be accessible and programmable from the RS-232 port and from the ethernet port below. Additionally, all log files shall be available through these ports.

QUALITY ASSURANCE

QUALITY ASSURANCE

Each BBS shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two quality assurance procedures: (1) design QA (see below) and (2) production QA. The production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved.

QA PROCESS

QA process and test results documentation shall be kept on file for a minimum period of seven years.

QA APPROVAL

Battery backup system designs not satisfying design QA testing and production QA testing requirements shall not be labeled, advertised, or sold as conforming to this specification.

TESTING

For design qualification testing, as a minimum, the following will be tested for compliance to the specifications:

A. Minimum of two hours of run time while operating in backup mode, at full load.
B. Proper operations of all relay contacts.
C. Inverter output voltage, frequency, harmonic distortion, and efficiency, when in backup mode.

D. All power transfer voltage levels and all modes of operation.
E. Power transfer time from loss of utility line voltage to stabilized inverter line voltage from batteries.
F. Backfeed voltage to utility when in backup mode.
G. IEEE/ANSI C.62.41 compliance.
H. Battery charger operation.
I. Event counter and runtime meter accuracy.
J. User ability to control, monitor, get reports, and configure the system through the standard RS-232 and ethernet ports.
K. Complete physical inspection of the system for quality workmanship.

PRODUCTION QUALITY CONTROL TESTING

Production quality control tests shall consist of all of the above listed tests and shall be performed on each new system prior to shipment. Failure to meet requirements of any of these tests shall be cause for rejection. The manufacturer shall retain test results for seven years.

100-HOUR BURN-IN-PERIOD

Each BBS shall be given a minimum 100-hour burn-in period to eliminate any premature failures. The burn-in period can be a combination of running in backup mode with a full load and running in charger mode.

VISUAL INSPECTION

Each system shall be visually inspected for any exterior physical damage or assembly anomalies. Any defects shall be cause for rejection.

TRAFFIC SIGNAL FACES AND FITTINGS (SECTION 86-4)

Add the following:

All optical vehicle signal indication units shall utilize the Light Emitting Diode (LED) type signal modules. The led signal module units provided shall be manufactured by "Dialight Corporation" or approved equal and shall meet ITE specifications. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

All signal heads shall be supplied by the same manufacturer, and shall be made of metal with 12-in diameter Dialight or approved equal LED modules. Visors shall be full circle type.

In addition to Section 86-4.04, "Signal Mounting Assemblies," of the Caltrans Standard Specifications, the following special provisions shall apply whenever a terminal compartment is required:

The terminal block shall be mounted vertically and to the side of the cable inlet guide. Sufficient lateral spacing shall be provided to allow pulling and connecting of incoming

conductors without removal of the terminal block mounting screws. A minimum of one-inch (1") clearance shall be provided between the terminal block and all inside walls of the terminal compartment. The terminal compartment shall be provided with a captive hinged access door. With the door open, there shall be a minimum of ten-by-four-inch (10" x 4") access to the terminal compartment for the connection and inspection of the terminal block. The door shall be equipped with a neoprene gasket, permanently secured, to prevent water from entering the terminal compartment and captive screws for securing door. The mounting bolt spacing and cable guide location shall be as dimensioned on drawing ES-4D of the Caltrans Standard Plans.

METAL SIGNAL SECTIONS (SECTION 86-4.01A(1))

Add the following:

Metal signal faces shall be provided with metal backplates.

PEDESTRIAN SIGNAL FACES (SECTION 86-4.03)

Add the following:

All optical pedestrian signal units shall be of the Light Emitting Diode (LED) type. The LED module units provided shall be Dialight Corporation or approved equal and shall meet ITE specification. All certifications and warranties required under the Caltrans Specification for LED signal units shall be provided.

Pedestrian signals shall be type a with egg crate type screens and shall have a countdown timer function. The pedestrian head housing and door shall be green and made of metal with no plastic parts, and shall be 16 inches by 18 inches.

Pedestrian signal ground wires shall not have splices between the poles and the controller cabinet. All pedestrian signal ground wires shall be joined and grounded within the controller cabinet.

DETECTORS (SECTION 86-5)

Add the following:

Loop detector conductors shall be Type "2".

Loop detector lead-in cables shall be Type "B".

Circular detector loops shall be Type "E" per Caltrans Standard Plan, 6 feet in diameter. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of 3/4 inch.

Circular detector loops for bicycle and motorcycle detection shall be Modified Caltrans Standard Plan Type “E”, 6 feet in diamater with 1 diagonal wire cut inside the circle and set back 1 foot before the lead cross walk stripe or limit line. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 2 inches. Slot width shall be a maximum of ¾ inch.

All cuts shall be sealed with a sealant on the same day the slots are cut in accordance with the hot-melt rubberized asphalt sealant per Section 86-5.01A(5) of the Caltrans Standard Specifications. All loops shall have 2-1/8 inch clearance of sealer above loop wires.

Loop wires in home runs, beginning at each loop, shall be tightly twisted together with a minimum of five (5) turns per foot. Home runs shall be cut to a sufficient width to accommodate the twisted wire.

All loops shall be connected in series. Splices shall use butt-splice connectors and shall be soldered by the hot-iron. No open flame shall be used on soldered connections. All loop wires including loop conductors shall be installed on the same day the slots are cut.

Wires for each loop shall be marked with bands of colored tape to designate loop number, starting at the number 1 lane and proceeding to the number 2 lane, and so on.

PEDESTRIAN PUSH BUTTON ASSEMBLIES (SECTION 86-5.02)

Add the following:

Pedestrian push buttons shall be ADA compliant (2” Diameter), Type B, Polara Bulldog No. BLD3-Y (momentary, non-latching), with a stainless steel button, yellow body on a green color frame. Pedestrian push button signs shall conform to the details shown on the plans, except that the message and symbol shall conform to California sign specification sheet R10-3. Fasteners shall be stainless steel tamper-proof screws for pedestrians push-button assemblies. Pedestrian calls to the controller shall be independent, by phase, and not as concurrent thru-phase pairs.

LIGHTING (SECTION 86-6)

Replace with the following:

Luminaires shall be 120 V Cooper Lighting Navion LED Series Roadway Luminaires, part No. NVN-AE-02-E-U-T3-10K-U-AP or No. NVN-AE-03-E-U-T3-10K-U-AP as indicated on plans, or approved equal. Luminaires shall be 120 V, 107 W, and without photocell.

The luminaire shall provide true ninety-degree (90°) cutoff with no light emitted above the horizontal.

The luminaire optical assembly shall be sealed, water-tight, and filtered to prevent contamination from infiltration of gaseous and particulate matter. The LED's shall be factory preset to produce a full cutoff IES Type III light distribution.

INTERNALLY ILLUMINATED STREET NAME SIGNS (SECTION 86-6.09)

Add the following:

All IISNS and hardware shall be new. The materials and workmanship shall be of the best quality for the purpose.

All IISNS shall be "**National Edge Lit Led IISNS"**, or approved equal.

The contractor shall furnish and install **Led Edge Lit Internally Illuminated Street Name Signs** manufactured by national sign incorporated or approved equal. Model: **NAIM-72-LED EDGE LIT-D-DG3** with mounting hardware.

The visible message shall be displayed from both sides of the signs and be reflectorized. Signs shall have white legends, symbols, arrows, and 3/4 " border on green background. The legend shall be as shown on the plans.

The style and spacing of letters, figures, and arrows shall conform to the current standards established by the State of California, Department of Transportation. Side margins and spacing may be compressed when necessary to stay within sign length.

The full size IISNS layout shall be submitted to the city engineer for approval prior to fabrication. It shall be the responsibility of the contractor to keep the engineer informed of all operations requiring inspection or approval prior to proceeding with fabrication.

Affixed to one side of each panel shall be white 3M diamond grade reflective sheeting. Each panel shall be screened a "GREEN" color background as indicated on the plans. Manufacturing of panels shall conform to 3M specifications for installation of diamond grade reflective sheeting.

Photocell and receptacle shall be omitted.

All IISNS shall be 18" x 72" (unless otherwise identified as 18" x 96") double-sided and shall be mounted with hinged, adjustable or telescoping type brackets approved by the engineer.

IISNS must be guaranteed for a minimum of five (5) years.

OVERHEAD REFLECTORIZED STREET NAME SIGN

These specifications define requirements for overhead reflectorized street name signs:

I. GENERAL

A. WORKMANSHIP:

All items shall be new; the materials and workmanship shall be of the best quality for the purpose.

B. DRAWINGS:

All sign layouts shall be the contractor's responsibility and shall be in accordance to the State of California - sign specifications chart guidelines.

C. WARRANTY:

Any sign delivered under this contract which does not conform to these specifications shall be replaced by the contractor at no cost to the City.

II. DETAILED REQUIREMENTS

A. BASE METAL:

1. DESCRIPTION

The base metal substrate shall be new aluminum alloy 3003-H14 or 5052-H32.

The thickness of the aluminum shall be 1/20". The material shall be subject to inspection prior to degreasing and chromate conversion coating operations. Alloy and temper designations shall be verified by mill test certifications.

2. SHEARING:

All sign panel edges shall be shear-trimmed or roll-slit to produce neat edges and square corners. Sign panel edges shall be straight within 1/32" from the straight plane. Edge delimitation or incomplete coverage of the base metal substrate up to and coincident with the cut edge of the sign panel shall be sufficient basis for rejection of the entire sign panel.

3. PRETREATMENT:

All treatment tanks and/or spray-applied systems must be performed on the contractor premises, to ensure proper adhesion of reflective sheeting materials. All treatment tanks or spray applied systems shall be charged with fresh

chemicals at least once a year. If pretreatment is performed by immersion methods, the tanks must be sufficient size to accommodate the complete panel. Titration equipment shall be available for the inspectors to check the solutions strengths. The cleaned and coated base metal shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, the panels shall be protected at all times from contact or exposure to grease, oils, dust or other contaminates.

The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light tightly adherent chromate conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with Section 5, "Recommended Processing Methods" of ASTM designation B-449. The coating weight shall be (30-100 mg/sq.ft.), a Class 1 coating.

B. SIGN MESSAGE AND REFLECTORIZED MATERIAL:

1. Sign panels with identical legends shall be displayed on both sides of the sign frame unless otherwise indicated.

   Letter size, style, spacing, arrows, and figures shall conform to the current standards established by the State of California, Department of Transportation.

   a) The legends or street name shall be 8" upper case and 6" lower case. Series E shall be used.

   b) Message layout shall be per State of California-Sign Specifications, Code G7-1(CA). Side margins and spacing may be compressed when necessary to stay within sign length.

   c) 1” border

2. 3M diamond grade VIP reflective sheeting (wide-angle prismatic lens reflective sheeting) or equal, shall be on both fore and background. The standard color shall be white legends, letters, and borders, on a green background. No cut out legends, letters, or border shall be used.

C. SIGN FRAME AND PANEL CONSTRUCTION:

The size of the sign will be 18"x72" or 18"x96".

1. FRAMES:

The frame shall be aluminum channel extrusion, 1¼"x1¼"x1/8" wall thickness. Alloy 6063-T5. All joints of the aluminum channel shall be miter cut to form a 45-degree angle at each corner. The frame shall be welded with an inert gas shield-arc welding process using 4043 electrode filler wire in accordance with good shop practice. The width of the filler wire shall be equal to the wall thickness of the channel being welded.

The top of the frame will have two 2"x2"x¼" wall thickness channel members welded and fastened to the frame with stainless steel bolt, washer, nylon nuts and cotter pins. The adjustable swing assembly will be attached to these members.

2. ASSEMBLY:

A sign panel shall be fastened to both sides of the channel frame to make a double-faced unit. Each sign panel must be a continuous sheet, no vertical or horizontal splices to make up one panel.

The sign panels shall be affixed to the frame with 3/16" diameter blind pop rivets, alloy 5052, or a type approved by the engineer. They must be aluminum approved. The exposed face of the rivet shall be of similar shade and compatible with face color of the finished sign. The rivets shall be placed through the face of the sign with the wall of the channel placed against the back of the sign panel. Rivets shall be placed no closer than ½" from the edge of the sign panel and a maximum of 8" apart from one another. All rivets must penetrate the web of the channel frame for proper grip strength between sign panel and frame.

The swing hinge is attached to the 2"x2" channel member with a ¼" stainless steel bolt and bronze bushing. Then secured with a non-lock nut.

D. MOUNTING ASSEMBLIES:

1. SIGNAL MAST ARM MOUNTING:

The top of the sign frame shall have two free swinging mounting brackets. They shall be of all aluminum, bronze, and stainless steel parts. The 5" long stainless steel bolt for fine adjustments shall have nuts and lock washers, or self locking nuts and cotter key. The bracket assembly shall permit the sign to swing perpendicular to the support hardware.

The mounting bracket location shall be 18" from the outside edge for the 18"x72" sign, and 24" for the 18"x96" sign.

The mounting brackets shall be aluminum, connected to the mast arm by band straps.

When installation of the sign to the mast arm is complete, the sign should swing freely 70-90 degrees in both directions when moved by the installer.

2. VERTICAL POLE SHAFT MOUNTING:

The extruded aluminum sign support channel shall be made from Alloy-6061-T6. The top portion of the extrusion shall have a continuous inverted "T" slot. This section shall accommodate the positionable stainless steel fittings and clamps providing complete freedom of alignment within this slot forming an integral clamping system. The channel shall be compatible with the current system used to fasten the sign face to the channel support. The sign support system herein described shall conform to AASHTO's standard specifications for structural supports for highway signs, luminaires and traffic signals (latest revision) and be rated for specified wind velocities.

Universal channel clamps shall be fabricated from Type 304 stainless steel. Clamps shall be formed from 16 gauge stainless steel, formed by tapering uniformly from each end toward the center to a depth of ½" forming a modified "V" on the bottom of the clamp. This shall be referred as the "saddle". Locked within the "saddle" shall be a portion of the unit referred to as the insert plate which shall be fabricated from 14 gauge Type 304 stainless steel and form a shallow "U". The legs of the "U" shall be 1" high and 1&1/16" wide with an aperture designed to permit passage of a 3/4" stainless steel band or buckle strap. The opening shall be 3/4"x3/16" vertically on the one inch dimension and shall be in from the edge closest to the "U" of the "Saddle". The base of the "U" shall be ½" wide by 2½" long where it is designed to slide in the inverted "T" slotted section of the extruded aluminum sign support channel.

Band straps shall have a minimum thickness of 0.03" and be made of stainless steel.

3. STREET SIGN MASTARM MOUNTING:

Contractor shall provide and install a cantilever street sign mastarm and shall comply with section 86-2.04, "Standards, Steel Pedestals and Posts", of the standard specifications and these special provisions

The cantilever arm for the reflectorized street name sign shall connect to the signal standard with a clamp style arm connection manufactured by Valmont Industries or an approved equal. The arm shall be welded to the clamp connection and extend horizontally from the standard two (2) feet longer than the specified sign size. The free end of the arm shall be capped and welded. The reflectorized sign shall be centered about the arm. The arm shall have a 3&7/8" O.D. and a thickness of 0.1196 inch.

Sign shall be mounted to the street sign mastarm as described in item #1 above, "Signal Mastarm Mounting".

E. FINISH:

The finished sign shall be flat within a ratio of 0.40inch per linear foot when measured across the plane of each panel from opposite corners or at any location on the panel. All finished signs shall have a smooth flat surface without defects or objectionable marks of any kind on either the front or the back faces. All letters and designs shall be clearly cut and sharply defined.

The appearance of the sign face shall be uniform throughout and shall be free of wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles or blemishes that may impair the serviceability, detract of the sign when viewed from a distance of twenty-five (25) feet.

The finished sign shall be clean and free from all burrs, sharp edges, loose rivets and aluminum marks.

Signs with any defects or damage that affect their appearance and quality workmanlike manner with all sign surfaces and edges free of defects. No repairs shall be made to the face sheet without the approval of the engineer.

City of Mission Viejo Standard Specifications

General Conditions and Special Provisions

CITY OF MISSION VIEJO

GENERAL SPECIFICATIONS
OLYMPIAD ROAD – FELIPE ROAD
TRAFFIC SIGNAL INFRASTRUCTURE CONSTRUCTION PROJECT
CIP No. 18236

SCOPE OF WORK

The Work to be done consists of furnishing all permits, licenses, testing, materials, equipment, tools, labor and incidentals as required by the Contract Documents to construct the above-stated project, as well as any other duties or obligations of Contractor under the Contract Documents.

The traffic signal improvements include, but are not limited to, site mobilization, installation of ADA pedestrian pushbutton systems, furnishing and installing CCTV camera and cabling, installation of UPS systems and cabinets, installation of traffic signal cabinets and all appurtenant Work.

LOCATION OF WORK

The general locations and limits of the Work are as follows: sixteen (16) traffic signals along Olympiad Road-Felipe Road from Marguerite Parkway to Marguerite Parkway, and two (2) traffic signals at Aruza/Mirasol @ Oso Parkway and San Rafael @ Oso Pkwy in the city of Mission Viejo.

TIME OF COMPLETION

The Contractor shall Complete all Work in every detail within **50 working days** (as defined in the Greenbook Standard Specifications; see below) after the date of the Notice to Proceed, exclusive of maintenance periods.

PERFORMANCE OF AT LEAST 50% OF THE WORK

Per Standard Specifications Section 2-3.2, the Contractor must perform at least 50% of the Work itself.

UTILITY REQUIREMENTS

The Contractor is advised of the existence of the utility notification service provided by UNDERGROUND SERVICE ALERT (USA). USA member utilities will provide the Contractor with the precise locations of their substructures in the construction area when the Contractor gives at least 48 hours' notice to the Underground Service Alert by calling 811.

The Contractor shall notify the following agencies at least 48 hours in advance of excavating around any of their structures. The utility companies listed below can be contacted as indicated.

AT&T California
1265 North Van Buren, Room 180
Anaheim, California 92807
Valentina Gipson 714-618-9132
vk3921@att.com

Cox Communications
29947 Avenida de las Banderas
Rancho Santa Margarita, California 92688
Sina Muckenfuss 949-546-2485
sina.muckenfuss@cox.com

El Toro Water District
24251 Los Alisos
Lake Forest, California 92630
Brian Miller 949-837-7050 x224
bmiller@etwd.com

Moulton-Niguel Water District
27500 La Paz Road
Laguna Niguel, California 92656
Steve Merk 949-425-3538
smerk@mnwd.com

Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, California 92688
Jeff MacDonnell 949-459-6504
jeffm@smwd.com

Metropolitan Water District
P.O. Box 54153
Los Angeles, California 90054-0153
213-217-6000

San Diego Gas & Electric
662 Camino De Los Mares, SD1421
San Clemente 92673
Patti Good 949-361-8047
pgood@semprautilities.com

Southern California Edison
14155 Bake Parkway
Irvine, California 92619
Todd Tate 949-458-4419
todd.tate@sce.com

Southern California Gas Company
1919 South State College
Anaheim, California 92803
Ed Hale 714-634-3118
ehale@semprautilities.com

City of Mission Viejo
Public Services Department
27204 East La Paz Road
Mission Viejo, California 92692
949-470-3064

The California Public Utilities Commission mandates that, in the interest of public safety, mainline gas valves be maintained in a manner to be readily accessible and in good operating condition. The Contractor shall notify the Southern California Gas Company's Headquarters Planning Office at 714-369-0680, at least two (2) working days prior to the start of construction.

The Contractor shall exercise extreme care to protect all existing utilities in place whether shown on the plans or not, and shall assume full responsibility for all damage resulting from its operations. The Contractor shall coordinate with each utility company as to the requirements and methods for protection of their facilities during the construction period and shall be responsible for preparation and processing of any required plans or permits. The Contractor shall assume full responsibility to maintain uninterrupted service for all utilities.

By submitting a bid, the Contractor acknowledges the above-referenced utility work to be done in conjunction with this project. The Contractor shall schedule its work and conduct its operations so as to permit access and time for the required utility work to be accomplished during the progress of the work.

The Contractor shall coordinate with each utility company as to the extent of required work and the time required to do so. The Contractor shall include this time in its schedule. Payment for the above, if any, shall be deemed as included in the items of work as shown on the proposal bid sheet and no additional compensation will be allowed.

FLOW AND ACCEPTANCE OF WATER

It is anticipated that storm, surface, or other waters will be encountered at various times during the work herein contemplated. The Contractor, by submitting a bid, acknowledges that he has investigated the risk arising from such waters and has prepared his bid accordingly; and Contractor submitting a bid assumes all said risk.

The Contractor shall conduct his operations in such a manner that storm or other existing waters may proceed uninterrupted along their existing street or drainage courses. Diversions of water for short reaches to protect construction in progress will be permitted if public and/or private properties, in the opinion of the Engineer, are not subject to probability of damage. The Contractor shall obtain written permission from the applicable public agency or property owner before any diversion of water outside of public right-of-way will be permitted.

REMOVAL OF WATER

The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and properly dispose of all water entering the excavations or other parts of the work. No concrete footing or floor shall be laid in water, nor shall water be allowed to rise over them until the concrete or mortar has set. Dewatering for the structures and pipelines shall commence when ground water is first encountered and shall be continuous until such time as water can be allowed to rise in accordance with the above paragraph. Dewatering shall be accomplished by well points or some other method which will insure a dry hole and preservation of final lines and grade of the bottoms of excavation, all subject to the approval of the Engineer.

Disposal of water from dewatering operations shall be the sole responsibility of the Contractor. Disposal methods shall conform to the Porter-Cologne Water Quality Control Act of 1974, the Federal Water Pollution Control Act Amendments of 1972, and the California Administrative Code, Title 23, Chapter 3.

Full compensation of dewatering shall be considered as included in the contract prices paid for the related items of work, and no additional compensation will be allowed therefore.

TRENCH SAFETY AND SHORING EXCAVATION

In accordance with Section 6500 of the Labor Code, the Contractor is required to obtain a permit from the Division of Industrial Safety for any trench or excavation which is five feet (5') or more in depth and into which a person is required to descend.

The Contractor shall furnish all labor, equipment, and materials required to design, construct, and remove all sheeting, shoring, and bracing or other equivalent method of support of this project.

Excavation for any trench five feet (5') or more in depth shall not begin until the Contractor has received approval from the Engineer of the Contractor's detailed plan for worker protection from hazards of caving ground. Such plan shall be submitted at least five (5) days before the Contractor intends to begin excavation and shall show the details of the design of shoring, bracing, sloping, or other provisions to be made for worker protection during excavation. No such plan shall allow the use of shoring, sloping, or a protective system less effective than required by Construction Safety Orders of the Division of Industrial Safety; and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by the Engineer who is registered as a Civil or Structural Engineer in the State of California.

Prior to beginning of excavations requiring shoring, the Contractor shall designate in writing to the Engineer someone whose responsibility it is to supervise the project safety measures and someone whose responsibility it is to supervise the installation and removal of sheeting, shoring and bracing.

In addition to shoring the excavations in accordance with the minimum requirements of Industrial Safety Orders, it shall be the Contractor's responsibility to provide any and all additional shoring required to support the sides of the excavation against the effects of load which may exceed those desired by using the criteria set forth in the Industrial Safety Orders. The Contractor shall be solely responsible for any damages which may result from his failure to provide adequate shoring of the excavation under any and all of the conditions of loading which may exist or which may arise during construction of the project.

The Contractor shall include in his bid all costs for the above requirements. Full compensation for sheeting, shoring, bracing, and all other things necessary shall be considered as included in the appropriate bid items of work, and no additional allowance will be made therefore.

CONSTRUCTION FENCING

The Contractor shall furnish and install temporary six-foot-high (6') construction fencing enclosing all construction areas protecting the public from potential harm. This temporary fencing shall not block sidewalks or access roads unless approved in writing by the City. The fencing location shall be approved by the City and shall remain in place through the maintenance period, unless the City directs otherwise. Fencing shell includes privacy shade cloth.

STANDARD SPECIFICATIONS

The Standard Specifications of the City are contained in the most recent edition of the *Standard Specifications for Public Works Construction*, Latest Edition, including all supplements as written and promulgated by the Joint Cooperative Committee of the Southern California District of the Associated General Contractors of California. Copies of these Standard Specifications (the “Greenbook”) are available from the publisher:

Building News, Incorporated
1612 South Clementine Street, Suite A
Anaheim, California 92802
714-517-0970

The section numbers of the City’s General Provisions and Special Provisions coincide with those of the *Standard Specifications for Public Works Construction*. Only those sections requiring amendment or elaboration, or specifying options, are called out.

Where the plans or specifications describe portions of the work in general terms, but not in complete detail, it is understood that the item is to be furnished and installed complete and in place and that only the best general practice is to be used. Unless otherwise specified, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals, and perform all the work, involved in executing the contract.

WAGE RATES AND LABOR CODE REQUIREMENTS

Wage Rates

The Contractor and all Subcontractors shall be required to adhere to the general prevailing rate of per diem wages as determined and published by the State Director of the Department of Industrial Relations, pursuant to Sections 1770, 1773, and 1773.2 of the California Labor Code. Copies of these rates and the latest revisions thereto are on file in the Office of the Secretary of the Board of Directors and are available for review upon request.

Attention is directed to the provisions of Sections 1774, 1775, 1776, 1777.5 and 1777.6 of the State Labor Code. Sections 1774 and 1775 require the Contractor and all Subcontractors to pay not less than the prevailing wage rates to all workmen employed in the execution of the contract and specify forfeitures and penalties for failure to do so. The minimum wages to be paid are those determined by the State Director of the Department of Industrial Relations. Section 1776 requires the Contractor and all Subcontractors to keep accurate payroll records, specifies the contents thereof, their inspection and duplication procedures and certain notices required of the Contractor pertaining to their location.

Apprentices

Section 1777.5 requires the Contractor or Subcontractor employing tradesmen in any apprentice-able occupation to apply to the Joint Apprenticeship Committee nearest the site of the public works project which administers the apprenticeship program in that trade for a certificate of approval. The certificate will also fix the ratio of apprentices to journeymen to be used in the performance of the contract.

The Contractor is required to make contributions to funds established for the administration of apprenticeship programs if he employs registered apprentices or journeymen in any apprentice-able trade and if other Contractors on the public work site are making such contributions.

Information relative to apprenticeship standards, contributions, wage schedules, and other requirements may be obtained from the State Director of Industrial Relations or from the Division of Apprenticeship Standards.

CLAYTON ACT AND CARTWRIGHT ACT

Section 4551 of the State Government Code specifies that in executing a public works contract with the City to supply goods, services, or materials, the Contractor or Subcontractors offer and agree to assign to the City all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (l5 USC Section l5) or under the Cartwright Act (Chapter 2 commencing with Section 16700) of Part 2 of Division 7 of the Business and Professional Code arising from purchase of goods, services, or materials pursuant to the contract or subcontract. This assignment shall become effective when the City tenders final payment to the Contractor without further acknowledgment by the parties.

SUBSTITUTION OF SECURITIES

In conformance with the State of California Government Code Chapter 13, Section 4590, the Contractor may substitute securities for any moneys withheld by the City to ensure performance under the contract.

At the request and expense of the Contractor, securities equivalent to the amount withheld shall be deposited with the City or with a State- or Federally-chartered bank as the escrow agent who shall pay such moneys to the Contractor upon notification by City of Contractor's satisfactory completion of the contract. The form for this escrow agreement, as required by Public Contract Code Section 22300, may be obtained from the City Attorney's office.

The type of securities deposited and the method of release shall be approved by the City Attorney's office.

WATER POLLUTION CONTROL (NPDES COMPLIANCE)

The City of Mission Viejo in conformance with the City's National Pollutant Discharge Elimination System (NPDES) Permit, is dedicated to the elimination/reduction of water pollution as a result of construction projects. The Contractor shall comply with the items described in this section and construct those facilities as specified by these Contract Documents, as required by law, or as directed by the Engineer, as necessary to eliminate/reduce water pollution. Said items are intended to provide prevention, control, and abatement of water pollution into storm drain systems, streams, oceans, and other bodies of water as a result of the Contractor's operations. These items are supplemental

to those required of the Contractor in Section 7-8 “Project Site Maintenance” of the Standard Specifications for Public Works Construction.

1. Concrete and Mortar Products:

The Contractor shall prevent or reduce the discharge of pollutants into stormwater or stormwater systems from concrete waste by conducting washouts at appropriate off-site locations, performing on-site washouts in a designated area, and providing appropriate training for employees and subcontractors.

The Contractor shall store and mix dry and wet materials either off-site or under cover, away from drainage areas.

For washout of concrete trucks, the Contractor shall provide appropriate off-site locations or designated contained areas at least fifty feet (50') away from storm drains, open ditches, streets, or streams.

The Contractor shall prevent run-off from designated washout areas by constructing a temporary pit or bermed area large enough to handle all produced liquid and solid waste. When concrete sets, break up and dispose of concrete in construction fills per direction of the soils engineer or dispose of it as solid waste and/or recycle.

The Contractor shall inform concrete suppliers and subcontractors of the designated washout locations and disposal sites for concrete and mortar products and shall be responsible for ensuring that all workers use it appropriately.

2. Construction Water:

The Contractor shall reduce or eliminate excessive construction water that may cause erosion and carry pollutants from the site. In addition, the Contractor shall:

1. Store construction water in leak-proof tanks located away from drainage systems.
2. Use construction water conservatively.
3. Whenever possible, dispose of excess water on-site, by allowing it to soak into the ground.

3. Saw-cutting Water Runoff:

Saw-cutting water runoff contains pollutants that must be contained and disposed of properly. The Contractor shall:

1. Prevent saw-cut water runoff from entering catch basins, manholes, and storm drains.
2. Direct water into a temporary pit and dispose of the water by vacuuming the water into a truck and removing the water from the site.
3. Place drip pans or absorbent materials under saw-cutting equipment when not in use.
4. Clean up spills with absorbent materials rather than burying. Dispose of absorbent material properly.

4. Housekeeping/Cleanup

The Contractor shall prevent pollution of stormwater from cleanup and disposal operations by using good housekeeping methods. When fluids or dry materials spill, cleanup should be immediate, thorough, and routine. The Contractor shall never attempt to “wash them away” with water, or bury them. The Contractor shall report significant spills to the appropriate spill response agencies immediately. The Contractor shall recognize that different types of materials have different disposal requirements and follow appropriate practices. The Contractor shall confine non-hazardous debris to dumpsters, covered at night or during wet weather, and take the debris to a landfill for recycling or disposal. The Contractor shall handle hazardous debris in accordance with specific laws and regulations and dispose of them properly. A separate permit may be required. Common hazardous debris found on construction sites are: Liquid residues from paints, thinners, solvents, glues, and cleaning fluids, leaching agents from lumber such as formaldehyde, arsenic, copper, creosote and chromium, motor oil, gear oil, antifreeze fluids, brake fluids, etc., and unused pesticides.

5. Sanitary Waste Management:

The Contractor shall prevent the discharge of sanitary waste into stormwater systems by providing convenient, properly located, well-maintained facilities. The Contractor shall hire a licensed portable sanitary facility leasing company, which will clean the facilities regularly and keep them in good working order. The Contractor shall make sure that portable sanitary facilities are located on relatively level ground away from traffic areas, drainage courses, and storm drain courses and storm drain inlets. The Contractor shall regularly inspect the facilities for any leaks, and have defective units replaced.

6. Vehicle and Equipment Management:

The Contractor shall use and maintain construction vehicles and equipment in a manner that prevents leaks and spills of fluids, contains wash waters, and controls off-site tracking. The Contractor shall not allow leaking vehicles and equipment on-site and shall inspect equipment and vehicles frequently for leaks and repair them immediately. The Contractor shall clean up spills and leaks promptly with absorbent materials, and shall not flush said spills with water.

The Contractor shall fuel, maintain, and repair vehicles and equipment off-site whenever possible and on-site only in designated areas. The Contractor shall prevent run-on and run-off from designated areas and provide cover as well as containment devices as necessary.

The Contractor shall wash vehicles and equipment on-site in designated, contained areas, allowing wash waters to infiltrate into the ground. The Contractor shall use phosphate-free, biodegradable soaps, and limit steam cleaning to confined areas only.

When not in use, the Contractor shall store equipment and vehicles in designated, contained areas and place drip pans and absorbent material under stored equipment that is prone to leaking and dripping (e.g., paving equipment).

If the Contractor must drain and replace motor oil, radiator coolant, or other fluids on-site, use drip pans or drop cloths to catch drips and spills. The Contractor shall collect all spent fluids, store in separate containers, and recycle whenever possible. Note: For recycling purposes, such liquids must not be mixed with other fluids. Non-recycled fluids generally must be disposed of as hazardous waste.

Except as otherwise provided for in the Standard Specifications or elsewhere in these Special Provisions, full compensation for conforming to the requirements of this section including furnishing all labor, tools, equipment, and materials necessary for doing the work, shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefore.

NOTE: The City of Mission Viejo is a co-permittee with the County of Orange for the water discharge from the San Diego Regional Water Quality Control Board. The Contractor will be held accountable and should make himself aware of all municipal activities procedures as part of the NPDES permit and program.

CITY OF MISSION VIEJO

SPECIAL PROVISIONS (EXCERPTS)
MARGUERITE PARKWAY TRAFFIC SIGNAL SYNCHRONIZATION PROJECT
CIP NO. 17230

PART II SPECIAL PROVISIONS

1.0 Mobilization

Mobilization shall include all preparatory work and operations including those necessary for the movement of personnel, equipment, facilities, materials and incidentals to the project site necessary for work on the project. It shall also include other work and operations which must be performed or costs incurred including bonds, insurance, permits, permit fees, and financing prior to beginning work on the various contract items on the project site. Other items included shall be the initial moving into the join and setup and maintenance of the Contractor staging area, supervisory time on the job by the Contractor's personnel to keep the construction site in safe condition, shop drawings, potholing, preparation of project schedule, project phasing, supervision, coordination of concurrent work with other Contractors, meetings, utility agency work, ""as-built" plans, moving off the job (de-mobilization) and all the preparatory work and operations for which no separate bid item is provided in the proposal and all other related work as required at all times and for all non-working days during construction period.

Measurement and Payment

The Contract Lump Sum price paid for Mobilization shall include full compensation for furnishing all labor, materials, tools, equipment, tools, and incidentals and for doing all the work complete and accepted in place as shown on the drawings and as specified in these Special Provisions.

The lump sum price listed in Section 9-3.2, "Partial and Final Payment," of the Standard Specifications will be paid with the first monthly progress payment. The amount in excess of the maximum value for progress payment purposes listed above will be included for payment in the first made after acceptance of the Contract.

2.0 Traffic Control

Traffic control shall conform to the requirements in Subsection 7-10, "Public Convenience and Safety," of the Standard Specifications and these Special Provisions. All work to maintain and control traffic shall conform to the provisions of the vehicle code, the current California Manual on Uniform Traffic Control Devices (CA MUTCD), and the City's Traffic Engineer.

Construction area signs shall be furnished, installed maintained and removed when no longer required in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Caltrans Standard Specifications and these Special Provisions. The Contractor shall provide and maintain all other signs, barricades, pedestals, flashers, delineators, flashing arrow signs, and other necessary facilities for the protection of the public within the limits of the construction area.

Portable delineators shall be placed as necessary for proper delineation of the travel way. The spacing between delineators shall not exceed 25 feet on tangent or 20 feet on curves except when used for lane closure, unless otherwise required by the City's Traffic Engineer or shown on the Plans.

When used for lane closures, the fluorescent traffic cones or portable delineators shall be placed at intervals not to exceed the following:

Taper:	Equals to the speed limit in feet and shall not exceed 50 feet
Edge of Closed Lane	Tangents 25 feet Curves 20 feet

If the traffic cones or portable delineators are damaged, displaced or not in an upright position, from any cause, said cones or portable delineators shall immediately be replaced or restored to their original location, in an upright position, by the Contractor.

The Contractor shall furnish such flaggers as are necessary to give adequate warning to traffic or to the public of any dangerous conditions to be encountered. Flaggers, while on duty, are assigned to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in accordance with the current "Instructions to Flagmen" of the Department of Transportation. The equipment shall be furnished and kept clean and in good repair by the Contractor, at the Contractor's expense. Flagger shall be available until such time the construction area has been returned to safe conditions.

Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures as provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor at the Contractor's expense. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.

All existing stop signs, street name signs, regulatory signs and hospital signs shall be maintained in visible locations during construction and permanently relocated or removed as shown on the Plans or directed by the Engineer. Signs that need not be maintained during construction or permanently relocated shall be removed or salvaged as determined by the Engineer. When closing lane(s) on an arterial highway, the Contractor shall use mobile flasher arrow boards.

All Type II and Type III barricades shall have flashing beacons for visibility at night. Where lane closures are opened at the end of a working day, advance warning signs shall be removed, turned around or bagged each day.

Measurement and Payment

The Contract Lump Sum price paid for Traffic Control shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for doing all the work complete and accepted in place as shown on the drawings and as specified in these special provisions.

3.0 Traffic Signal Communications Upgrade—Olympiad Road

3.01 Traffic Signal Communication System

The work to be performed under this section shall consist of, but not be limited to, the project elements listed below, as shown on the construction plan drawings set (Plans), as specified in these Special Provisions, and as directed by the Engineer:

1. Contractor shall furnish and install pull boxes at locations as shown on the Plans.
2. Contractor shall furnish and install conduit at the locations as shown on the Plans.
3. Contractor shall furnish and install new Two Hundred Eighty-Eight (288) Single-Mode Fiber Optic Distribution Cables (288-SMFO), installed in existing and new conduit, at Olympiad Road locations and complete termination of Distribution Cable, at the locations as shown on the Plans.
4. Contractor shall furnish and install new Six-Strand Single-Mode Fiber Optic Drop Cable (6-SMFO) in existing and new conduit, at Olympiad Road locations and complete termination of Drop Cable, at the locations as shown on the Plans.
5. Contractor shall furnish and install fiber optic communication equipment and accessories, including fiber optic splice enclosures, fiber optic patch panel (FPP) at Olympiad Road locations and complete termination of Drop Cable and fiber optic jumpers, at the locations as shown on the Plans.
6. Contractor shall be responsible for testing of the fiber optic communication system including OTDR testing, and shall provide accurate documentation, as specified in these Special Provisions.

3.02 Conduit

Conduit shall conform to the provisions in Section 86-1.02, "Conduit and Accessories," of the Caltrans Revised Standard Specifications and these Special Provisions. Conduit to be installed underground shall be Type 3 unless otherwise specified. The conduit in a foundation and between a foundation and the nearest pull box shall be Type 3. When Type 3 conduit is placed in a trench (not in pavement or under Portland cement concrete sidewalk), after the bedding material is placed and the conduit is installed, the trench shall be backfilled to not less than four inches (4") above the conduit with minor concrete conforming to the provisions in Section 90-2, "Minor Concrete," of the Caltrans Standard Specifications, except the concrete shall contain not less than 421 pounds of cementitious material per cubic yard.

The remaining trench shall be backfilled to finished grade with backfill material. Conduit runs shown on the Plans to be located behind curbs may be installed in the street, within three feet (3') of, and parallel with the face of the curb, by the trenching in pavement method in conformance with the provisions in Section 87-1.03B, “Conduit installation,” of the Caltrans Revised Standard Specifications. Pull boxes shall be located behind the curb or at the locations shown on the Plans.

At locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed five (5) minutes, conduit may be installed by the "Trenching in Pavement Method." At the option of the Contractor, the final two feet (2') of conduit entering a pull box in a reinforced concrete structure may be Type 4. Insulated bonding bushings will be required on all conduit.

Conduit runs are shown in schematic form only. Actual installation shall be done in the most direct manner.

Conduit shall have 45-degree elbow sweeps into No. 6 pull boxes or vaults.

3.02 Pull Boxes

Pull boxes shall conform to the provisions of Section 86-1.01C(2), "Pull Boxes," of the Caltrans Revised Standard Specifications and these Special Provisions.

In unimproved areas, install pull box markers and marker posts. Pull boxes, covers and extensions shall be concrete. The Contractor shall install, at a maximum of 500 feet, No. 6E pull boxes for fiber optic cable.

3.03 Fiber Splice Closures

Any fiber optic splices exposed to the elements (Interconnect Splice Cabinet - ISC) shall be contained in a waterproof, rodent proof, re-enterable fiber optic splice closure designed for use on optical fiber cables in a cable vault environment where total and continuous submersion in water may be expected.

Fiber splice closures shall be complete with outer and inner closures, splice organizer trays, brackets, plugs, clips, cable ties, seals and sealant, and a dry encapsulate and shall conform to the following Special Provisions.

1. The fiber optic splice closure shall conform to the following specifications or match existing 3M 2178-S splice closures.

2. Splice closures shall be designed for a temperature range of -40° C to +70° C.

3. The fiber splice closure shall be suitable for either a direct burial or pull box/vault application.

4. The size of the closure shall allow all the fibers of the largest fiber optic cable to be spliced to a second cable of the same size. The closure shall be not more than twenty-eight inches (28") in length and not more than six inches (6") in diameter. The closures shall be designed for both horizontal and butt splicing.

5. All materials in the closures shall be non-reactive and shall not support galvanic cell action. The outer-closure shall be compatible with the other closure components, the inner closure, splice trays, and cables.

6. The outer-closure shall protect the splices from mechanical damage; shall provide strain relief for the cable, and shall be resistant to salt corrosion. The outer-closure shall be waterproof, and re-enterable. The outer-closure shall be flash-tested at 100 kPa.

7. The inner-closure shall be of metallic construction. The inner-closure shall be compatible with the outer closure and the splice trays and shall allow access to and removal of individual splice trays.

8. The splice trays shall be compatible with the inner-closure and shall be constructed of rigid plastic or metal.

9. Acceptable fiber splice closures, encapsulant, trays, and reseal kits shall be from 3M, Corning Cable Systems, OFS, or approved equal.

Installation

1. Adequate splice trays shall be provided to splice all fibers of the communication cable with the greatest fiber count entering the closure.

2. Upon completion of the splices, the splice trays shall be secured to the inner closure. The Contractor shall verify the quality of each splice prior to sealing the fiber splice closure.

3. The closure shall be sealed using a procedure recommended by the manufacturer that will provide a waterproof environment for the splices.

4. Care shall be taken at the cable entry points to ensure a tight salt-resistant and waterproof seal is made which will not leak upon aging. It is acceptable to have multiple service drop cables enter the fiber optic fiber splice closure through one hole as long as all spaces between the cables are adequately sealed.

5. The fiber splice closure shall be mounted horizontally in a manner that allows the cables to enter at the end of the closure without exceeding any minimum bending radius specification.

6. All fiber optic cable splicing performed on this project shall be of the fusion type. All fiber optic cable splices shall be of the fusion type and shall not exceed 0.1 dB loss per splice.

7. The field splices shall connect the fibers of the two (2) fiber optic cable lengths together. The termination splices shall connect the fiber optic cable span ends with pig tails. The field splices shall be placed in a splice tray, then the splice tray with splice shall be placed in a fiber splice closure.

8. The termination splices shall be placed in a splice tray and the splice tray with splice shall then be placed in a fiber distribution unit or field cabinet as required. All splices shall be protected with a thermal shrink sleeve.

9. The fiber optic field splices shall be enclosed in fiber splice closures, which shall be waterproof, rodent proof, and re-enterable, and shall accommodate all the fibers in a single cable.

The Contractor shall furnish and install fiber optic splice closures capable of accommodating a minimum of eight (8) splice trays and a maximum of 96 splices. The fiber splice closure shall also include the required encapsulant. The fiber splice closure shall be able to accommodate up to four (4) cable entries. If all four cable entry holes are not required, the remaining unused entry holes will be closed such that moisture does not enter the fiber splice closure and affect the operation of the fiber optic cable. The fiber splice closure shall have sleeves to size the cable entry to the appropriate cable diameter. Each fiber splice closure shall come equipped with the required number of single mode splice trays.

Included within the fiber splice closure, the Contractor shall also supply and install splice trays. Each splice tray shall be appropriately sized to fit inside the fiber splice closure. The splice trays shall be of injection molded plastic type with a clear plastic cover so allow visibility of fibers without opening the tray. Each splice tray shall handle up to twelve (12) single-mode fusion splices.

A minimum of three (3) unopened kits required for the resealing of the fiber splice closure shall be supplied with this contract and considered as part of the necessary equipment.

3.04 Fiber Optic Cable

This item shall govern to furnish and install fiber optic cable in designated locations as shown on the Plans and as detailed in accordance with these Special Provisions.

Requirements

Fiber optic cables shall be supplied in the configurations shown on the Plans and specified in these Special Provisions.

There shall be one (1) principal cable type as well as incidental cabling procured under this specification. They are identified using a naming convention of “distribution cable” and “drop cable”. Distribution cable shall contain two hundred eighty-eight (288) single-mode optical fibers. Drop cable shall contain six (6) single-mode optical fibers. The fiber optic cable shall be suitable for underground duct placement.

Additionally, there will be ancillary connecting (patching) optical fiber cables procured under this Contract and these Special Provisions, which are more precisely described elsewhere in this document or as shown on the Plans.

All single-mode fiber optic cable shall be loose tube fiber optic cable for installation in conduit.

All materials furnished, assembled, fabricated or installed under this item shall be new, corrosion resistant and in strict accordance with the details shown on the Plans and in these Special Provisions. All fibers in the cables shall be usable fibers and free of surface imperfections and occlusions, in order to meet or exceed all of the optical, mechanical, and environmental requirements contained in these Special Provisions.

All cables shall be free of material or manufacturing defects and dimensional non-uniformity that would:

- Interfere with the cable installation employing accepted cable installation practices.
- Degrade the transmission performance and environmental resistance after installation.
- Inhibit proper connection to interfacing elements.
- Otherwise yield an inferior product.
- Each fiber optic outside plant cable for this project shall be all-dielectric, dry water-blocking material, duct type, with loose buffer tubes, and shall conform to these Special Provisions.

The Contractor shall furnish, install, splice and test all the required fiber optic cable. All splicing kits, fiber optic cable caps, moisture/water sealants, terminators, splice trays, patch cords, connectors, pig tails and accessories to complete the fiber optic network shall be provided as incidentals. All equipment for installation, splicing and testing shall be provided by the Contractor.

All fiber optic cable on this project shall be from the same manufacturer who is regularly engaged in the production of optical fiber material.

The cable shall be qualified as compliant with Chapter XVII, of Title 7, Part 1755.900 of the Code of Federal Regulations, “REA Specification for Filled Fiber Optic Cables.”

Packaging

1. The completed cable shall be packaged for shipment on non-returnable wooden reels. Required cable lengths shall be stated in the purchase order.
2. Top and bottom ends of the cable shall be available for testing.
3. Both ends of the cable shall be sealed to prevent the ingress of moisture.
4. Each reel shall have a weather-resistant reel tag attached identifying the reel and cable.

Cable Marking

1. The optical fiber cable outer jacket shall be marked with manufacturer's name, the month and year of manufacture, the words "Optical Cable," telecommunications handset symbol as required by Section 350G of the National Electrical Safety Code (NESC®), fiber count, fiber type, and sequential meter marks.
2. The markings shall be repeated every two feet (2').
3. The actual length of the cable shall be within -0/+1% of the length marking.
4. The marking shall be in a contrasting color to the cable jacket.
5. The marking shall be approximately ±1% of the actual length of the cable in height and must be permanent and weatherproof.

Quality Control

The manufacturer(s) of supplied optical cable, optical cable assemblies, and hardware shall be TL 9000 and/or ISO 9001 registered. All cabled optical fibers shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

MATERIAL

General Considerations–Loose Tube Fiber Optic Cable

The fiber optic cable shall consist of, but not be limited to, the following components:

- Single-mode optical fiber
- Buffer tubes
- Central member
- Filler rods (as needed per cable type)
- Stranding
- Dry-filled water-blocking tape and water-blocking yarn
- Tensile strength member
- Ripcord
- Outer jacket
- Loose tube fiber optic cable shall be by Corning, OFS or approved equal. Any other cable meeting the above specifications shall also be considered per approval by Engineer.

Optical fiber cable shall comply with all other aspects of the specifications as set forth in the Special Provisions for optical fiber cable. The drop cable shall have sufficient length to extend from the fiber splice location to the optical interface of the associated communications equipment, allowing for routing and securing with nylon ties plus fifteen feet (15') of slack at each end, unless otherwise specified in the Plans or these Special Provisions or directed by the Engineer.

The drop cable shall be sufficiently de-sheathed within the traffic control cabinet to allow adequate slack fiber to afford ease of routing of the active fiber to the communications equipment. The Contractor shall provide a thermal shrink sleeve dam or other appropriate wrapping at the beginning of the de-sheathed cable area so as to prevent loss of any aqueous gel filling from the remainder of the service drop cable.

Color Coding

Optical fibers shall be distinguishable from others in the same buffer tube by means of color-coding. The color coding shall be the following:

1.	Blue	BL	7.	Red	RD
2.	Orange	OR	8.	Black	BL
3.	Green	GR	9.	Yellow	YL
4.	Brown	BR	10.	Violet	VL
5.	Slate	SL	11.	Rose	RS
6.	White	WT	12.	Aqua	AQ

The colors shall be targeted in accordance with the Munsell color shades and shall meet TIA/EIA-598B "Color Coding of Fiber Optic Cables" and RUS 7 CFR 1755.900.

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound and be heat stable. It shall not fade or smear or be susceptible to migration; it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Fiber Characteristics

One hundred percent (100%) of the optical fibers shall meet or exceed the requirements contained in this specification.

The cable shall be tested in accordance with TIA/EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." The average change in attenuation at extreme operational temperatures (-40° C to +70° C) will not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual fiber will not be greater than 0.15 dB/km at 1550 nm. This figure includes an allowance of up to 0.05 dB/km for measurement repeatability.

All fibers within the finished cable shall be composed primarily of silica and shall have a matched clad index of refraction profile.

Fiber Optic Patch Cords

The fiber optic cable patch cords, assemblies and components shall be compatible components, designed for the purpose intended, and manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies shall be best quality, non-corroding, with a design life of at least twenty (20) years. All patch cords, components or assemblies of the same type shall be from the same manufacturer.

The Contractor shall furnish and install patch cords which are fiber optic cables with connectors on both ends. Patch cords are used to connect fiber optic transmission equipment to connector panel modules. The patch panel shall interface to patch cords with ST, ST compatible or approved equivalent connectors. All connectors shall be pre-manufactured.

Patch cords shall have 900JAm single-fiber single-mode cable with SC, SC compatible Super PC or approved equivalent connectors. The patch cords shall be sized according to the installation requirements allowing for ample strain relief and interconnect length between termination extremes. Length shall be pre sized in the factory to the required lengths. The attenuation of the cable shall be between 1.0 and .75 dB. All patch cords shall be installed without exceeding the manufacturer specified bending radius.

Acceptable equipment shall be from OFS, Corning Cable System, or approved equal.

Fiber Optic Fan-Out Kits

Fan-out kits are not envisioned for this Contract. This section is provided for reference only.

Fan-out kit connects the fiber optic jumper cable to the fiber optic transmission equipment (Fiber Distribution Units - FDUs) located in the cabinet. The fan-out shall be equipped to terminate 250µm fiber (loose tube cable) and shall provide protection for the bare fibers. The fan-out kit shall have two (2) 6-fiber or one (1) 12-fiber fan-out insert and 2-meter lengths of fan-out tubing with twelve (12) single-mode fibers manufacturer-assembled SC connectors. The fan-out cable kit shall also meet the following specifications.

Housing	
Length	132 mm (5.2 in)
Diameter	31 mm (1.22 in)
Fan Out Tubing	
Length	2 m (78.8 in)
Diameter	2.9 mm (0.11 in)
Environmental	-40° C to 70° C

The fan-out kit, when installed in the existing traffic cabinets, shall be securely anchored to the side wall of the cabinet by suitable ties. Acceptable Fan-Out Kit shall be from OFS, Corning Cable System, or approved equal.

Fiber Optic Connectors

Fiber optic jumpers and fan out kits shall include manufacturer assembled fiber optic connectors that are single mode Super PC reflectance SC compatible type that meet the following specifications.

Interconnection Compatibility	The Connectors shall be compliant with EIA/TIA and JIS specifications for SC-compatible connectors.
Insertion Loss	0.4 dB (typical)
Reflectance	≤ -40 dB between a temperature range of -70° C to 74° C
Durability	≤0.3 dB change, 200 re-matings
Tensile Strength	≤ 0.2 dB change, 10 lb
Temperature Cycling	≤0.3 dB change, -20° C to 74° C
Nominal Fiber OD	125µm
Materials	Ferrule: Ceramic Housing: Composite

Accepted equipment shall be SC-Compatible Single-Mode UniCam Connector with Super PC polish and rotating cam, as required, from OFS, Corning, or approved equal.

Fiber Optic Cable Installation

Fiber optic cables shall be installed in continuous lengths without intermediate splices throughout the project, except at the location(s) specified in the Plans.

When ordering fiber optic cable, the Contractor shall exercise extreme caution so as to ensure that no additional splicing, beyond that indicated in the Plans shall be required. Should the Contractor believe additional splices are required, this matter shall be immediately brought to the attention of the Engineer for resolution.

The Contractor shall install the fiber optic cable in strict adherence to the manufacturer's recommended procedures. Care shall be taken to avoid cable damage during handling and placing. Fiber optic cable is sensitive to excessive pulling, bending and crush forces. The minimum bending and maximum tension requirements for installing the fiber optic cables shall be according to the manufacturer's specifications. The Contractor shall submit the manufacturer's recommended procedures for blowing or pushing central core fiber optic cable and for pulling the loose tube fiber optic cable to the Engineer for review and approval at least twenty (20) working days prior to installing cables.

Cable installation personnel shall be familiar with the cable manufacturer's recommended procedures including, but not limited to, the following:

- Proper attachment to the cable for blowing or pushing during installation.
- Proper attachment to the cable strength elements for pulling during installation.
- Cable tensile limitations and tension monitoring procedures.
- Cable bending radius limitations.

To accommodate long, continuous installation lengths, bi-directional installation of the optical fiber cable is permissible and shall generally be implemented as follows:

1. From the midpoint of a pull station, blow/push (central core fiber) or pull (loose tube fiber) the optical fiber cable into the conduit from the shipping reel in accordance with the manufacturer's specifications.

2. When this portion of the blow/push (central core fiber) or pull (loose tube fiber) is complete, the remainder of the cable should be removed from the reel to make the inside end available for blowing/pulling in the opposite direction.

3. This is accomplished by hand pulling the cable from the reel and laying it into large "figure eight" loops on the ground. The purpose of the figure eight pattern is to avoid cable tangling and kinking.

4. The figure eight loops shall be laid carefully one upon the other (to prevent subsequent tangling) and shall be in a protected area.

5. The inside reel end of the cable should be available for testing.

6. Should it be necessary to set up a winch at an intermediate pull box, the required length of cable shall be pulled to that point and brought out of the pull box and coiled into a figure eight.

7. The figure eight is then turned over to gain access to the free cable end. This can then be reinserted into the conduit system for installation into the next section.

Mechanical aids may be used to assist cable installation. The pulling eye/sheath termination or cable grip hardware on the optical fiber cables shall not be pulled over any sheave blocks. Field-installed pulling grips with a rotating type swivel shall be used to pull the fiber optic cable. A Corning Cable System GRP series or equivalent woven wire type of grip is recommended.

No power pulling of fiber optic cable shall be allowed.

The pulling tension and bending radii limitation for optical fiber cables shall not be exceeded under any circumstances. A tension measuring device or break-away swivel shall be placed between the pull line and the end of the cable to ensure that the tension does not exceed 80 percent of recommended tension or 2225 N, whichever is less. A ball

bearing swivel shall be utilized between the pull line and the end of the cable to prevent the cable from twisting during installation.

Large diameter wheels, pulling sheaves, and cable guides shall be used to maintain the appropriate bending radius. During cable installation, the bend radius shall be maintained at a minimum of twenty (20) times the outside diameter of the cable. The cable shall not be stressed beyond the minimum bend radius at any time during installation. Tension monitoring shall be provided at all times during the pulling operation and shall be accomplished using commercial dynamometers or load-cell instruments.

Fiber optic cable shall be installed using a cable pulling lubricant recommended by both the fiber optic cable and the conduit manufacturer and a non-abrasive pull rope/tape conforming to the provisions described under "Conduit" elsewhere in these Special Provisions. Cable lubricant shall be compatible with the fiber optic cable outer sheath and existing cable where fiber cable is installed in a conduit with other existing cable. Lubricant shall be applied according to the manufacturer's recommendations.

Where the fiber optic cable is installed in existing conduct or utility ducts, at locations shown on Plans, the Contractor shall remove all existing cables and install all cables in same pull to minimize risk of damage to cables. The Contractor shall be responsible for replacing any cables damaged during removal and reinstallation at the cost of the Contractor and not the City.

Cable slack shall be provided for each cable at each pull box, splice vault, or fiber optic splice location, as shown on the Plans and as specified in these Special Provisions. A minimum of fifteen feet (15') of drop cable shall be installed in each pull box and cabinet as slack cable. Cable slack shall be divided equally on each side of a fiber splice closure. Sufficient slack shall also be provided at all pull boxes to facilitate placing the optical fiber cable against the side of the pull box.

At all pull boxes and cable vaults, cable slack, as shown on the Plans, shall be left by the Contractor for all unspliced cable. Cable slack shall be installed in pull boxes and shall be coiled and secured with tie wraps, coiled in pull boxes, and secured to the racking hardware in splice vaults. The Contractor shall ensure that the minimum bending radius of the optical fiber cable is not compromised when preparing this stored cable slack.

Following the installation of cables in conduit, all duct entrances in cabinets, pull boxes and vaults shall be sealed with mechanical plugs; or at the discretion of the Engineer, duct sealing compound, to prevent the ingress of moisture, foreign materials and rodents.

Splicing

Fiber optic cable shall be installed without splices except where specifically allowed on the Plans or described in these Special Provisions. When splicing into a distribution cable, only those fiber strands associated with a specific communication equipment shall be severed. All other fibers shall remain intact. The Engineer may allow additional splices between these specified locations.

Splicing

Optical fibers shall be spliced using the fusion splice method and the insertion loss shall not exceed 0.07 dB of loss per splice.

Field splicing is permitted for the following:

- Connection of cable reel sections as approved in advance by Engineer.
- Connection of a distribution cable to a drop cable or a breakout cable.
- Connection of drop cable or breakout cable to an optical fiber pigtail at communication equipment locations, or the patch panels in a hub equipment cabinet, or at the TMC.

The Contractor shall not exceed the maximum number of field splices permitted as shown on the Plans. Completed splices shall be placed in a splice tray. The splice tray shall then be placed in a watertight fiber splice closure. Field splices shall be conducted only at locations as shown on the Plans as an approved splice location.

All splicing equipment shall be in good working order, properly calibrated, and meeting all industry standards and safety regulations. Cable preparation, closure installation, and splicing shall be accomplished in accordance with accepted and approved industry standards.

Using a mid-span splicing method, a drop cable shall be joined to the fibers in the fiber optic cable span. The termination splices shall be placed in a splice tray and the splice tray(s) shall then be placed in a watertight fiber splice closure.

At equipment cabinets, single-mode optical fiber factory-fabricated connectorized pigtails shall terminate at the rack-mounted fiber termination unit in each equipment cabinet and be connected to the optical interface to the Ethernet switch/fiber communication equipment with a suitable patch cord. All connected and stored cables shall be routed in each equipment cabinet in a manner that prevents damage during regular operation and maintenance functions. All exposed cable shall be secured every 300 mm to 450 mm to the equipment frame with nylon ties.

Equipment cabinets shall be equipped with splice trays suitable for storage and protection of each single-mode optical fiber pigtail and the splice connection to cable fibers. Equipment cabinets shall be equipped with a suitable means for routing and securing of cables, fibers, and pigtails to prevent damage to fibers during all regular operation and maintenance functions

All splices shall be protected with a thermal shrink sleeve. Upon completion of the splicing operation, all waste material shall be deposited in suitable containers, removed from the job site, and disposed of in an environmentally acceptable manner.

Fiber Optic Cable Assemblies

Cable assemblies (consisting of various necessary connectors, pigtails and jumpers) shall be products of the same manufacturer. The cable used for cable assemblies shall be made of fiber meeting the performance requirements of these Special Provisions for the fiber optic cable being connected, except that the operating temperature shall be modified to -20° C. to +70° C.

Manufacturer's attenuation test results shall be provided for all cable assemblies.

The outer jacket of jumpers shall be yellow.

Optical Fiber Connectors

All optical fiber termination components shall meet or exceed the applicable provisions of TIA/EIA-455-B, Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components.

All optical fiber connectors shall be of industry standard SC, Ultra-PC, type for single-mode optical fiber and shall meet or exceed the applicable provisions of TIA/EIA-455-2C (FOTP-2), Impact Test Measurements for Fiber Optic Devices, TIA/EIA-455-5B (FOTP-5), Humidity Test Procedure for Fiber Optic Components, and TIA/EIA-455-34A (FOTP-34), Interconnection Device Insertion Loss Test. When tested in accordance with FOTP–2, the connector assembly will be subjected to ten (10) impact cycles by being dropped from a height of 1.5 m. The maximum insertion loss measured before and after the impacts should be < 0.50 dB. The mean insertion loss of the before and after impacts should be < 0.30 dB.

The insertion loss increase measured before and after the impacts should be < 0.30 dB. The maximum reflectance measured before and after the impacts should be < 40 dB. When tested in accordance with FOTP–5, the connector assembly will be subjected to test conditions of 75 °C and 95% relative humidity for seven (7) days. Measurements of loss and reflectance will be made at the beginning of the test, at a minimum of six-hour intervals during the test, and at the end of the test. The maximum insertion loss measured before, during, or after the test should be < 0.50 dB. The mean insertion loss of the before, during, or after the test should be < 0.30 dB. The insertion loss increase measured before, during, or after the test should be < 0.30 dB. The maximum reflectance measured before, during, or after the test should be < 40 dB.

Optical fiber connectors shall satisfy all of the interface parameters of equipment components as may be defined by the transmission equipment specifications. All optical fiber connector assemblies shall be machine polished for low back-reflection and low insertion losses at both 1310 nm and 1550 nm operating wavelengths.

Single-mode pigtails shall be provided with factory pre-connectorized single-mode connectors of the "SC Ultra-PC" type. Connectors shall have maximum insertion loss of 0.27 dB or better. Connectors shall have a stainless-steel barrel (coupling nut) with a bayonet connection design, ceramic (zirconia) ferrule. Each connector shall be capable of 200 repeated matings with a total maximum additional increase in insertion loss after 200 matings limited to 0.30 dB.

Each connector shall have a return loss (back reflection) equal to or better than 55 dB.

All connectors shall be factory-assembled and tested. There shall be no fabrication of connectors in the field.

All unmated connectors shall have protective caps installed.

Couplers

Couplers shall be made of nickel-plated zinc or a glass-reinforced polymer that is consistent with the material forming the associated SC connector body. The design mechanism for mounting the coupler to the connector panel may be flanged or threaded but shall coincide with the connector panel punch-outs. All coupler sleeves shall be ceramic of the split clamshell or clover leaf design. The temperature operating range for couplers shall be the same as that specified for the SC connectors.

Pigtails

Pigtails shall be of simplex (one-fiber) construction, in 900 µm tight-buffer form, surrounded by aramid for strength, with a connector on one end. The outer jacket shall be yellow PVC with a nominal diameter of 3 mm, marked with the manufacturer's identification information. All pigtails shall be of adequate length for the intended connection purpose, but not less than one meter in length. Pigtails installed in conduit shall follow the installation procedures outlined for fiber optic cables, except that the pulling tension shall not exceed 500 N (110 lbf).

Jumpers

Jumpers shall be simplex. All jumpers shall be at least two (2) meters in length, sufficient to avoid stress, and allow orderly routing. Jumpers shall have appropriate connectors on both ends.

Fiber Labeling

All fiber optic cable jackets shall be properly labeled. All labels shall be permanent, waterproof vinyl markers with machine-produced text. Each label shall include strand count and fiber origin/destination, at a minimum.

Fiber Assignment

The fiber optic assignment tables, included in the Plans, show the protocol to be followed when placing and splicing the fiber optic cables.

Fiber Optic Cable Link Testing

The installed optical fiber cable shall be tested for compliance with the transmission requirements of this specification, the cable and hardware manufacturer's specifications, and prescribed industry standards and practices. The Contractor shall provide all personnel, equipment, instrumentation, and materials necessary to perform all testing herein.

Multiple tests shall be required prior to shipment as well as before and after installation of the cable. The results of these tests shall be logged and posted in the cabinet and in a conspicuous location for future comparisons. Documentation of all test results shall be provided to the Engineer within two working days after the field tests are performed. The documentation shall also be made part of and submitted as part of the Operations & Maintenance Manual.

The types of acceptance tests required by the City of fiber optic cable system certification are:

- Documentation of compliance with the fiber specifications, as specified in these Technical Provisions, shall be supplied by the fiber manufacturer. Before shipment, but while on the shipping reel, 100% of all fibers shall be tested for attenuation. Copies of the results shall be:
  - Maintained on file by the fiber manufacturer, with a file ID number for a period of five (5) years.
  - Attached to each fiber cable shipping reel in a waterproof pouch.
  - Submitted to both Contractor and Engineer and shall be made part of the Operations and Maintenance Manual.

Continuity Testing (Before Installation)

The fiber cable shall be physically inspected on delivery and the attenuation shall be measured for 100% of the fibers. In addition, the continuity test procedure shall be used on short links (less than 300 feet) of the cable system during construction to validate continuity of fiber elements.

Failure of any single fiber within the cable to comply with these Technical Provisions shall be cause for rejection of the entire reel. Test results shall be recorded, dated, compared and filed with the copy accompanying the shipping reel in a waterproof pouch. Attenuation deviations of greater than 5% from the shipping records shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If test results are unsatisfactory, the reel(s) of fiber optic cable shall be rejected. The rejected reel(s) of cable shall be replaced with new reel(s) of cable at the Contractor's expense. The new reel(s) of cable shall be tested upon delivery as described herein.

Cable continuity shall be verified using a visual light source, typically a 635 nm laser diode. For cables with insertion loss of less than 3 dB, the light source shall be the Corning Cable System OS 1 OOD test set, a RIFOCS 263A visual fault finder, or equivalent.

The continuity test procedure shall also be used to verify continuity on all fibers prior to measuring pre installation attenuation using an Engineer-approved Optical Time Domain Reflectometer (OTDR). This insures that the fibers are completely continuous from end to end, since single-ended OTDR tests cannot reveal fiber discontinuities close to the cable endpoints.

Continuity Testing (After Installation)

These tests shall occur after the termination process has been completed. Each point-to-point link shall be tested for optical power loss with an OTDR in both directions. For example, the optical power loss shall be tested from each fiber patch panel in the Field Element cabinet to the communication hub and from the communication hub to the TMC. The connectors shall be identified by numbered colored tape, where each tape color shall be consistent throughout the project.

The Contractor shall use OTDR testing to insure that each fiber is one continuous length (contains no splices within the cable structure) and meets the attenuation specifications of the manufacturer and cognizant industry standards. OTDR measurements made before the cable installation provide baseline data for comparison to post installation OTDR tests. The OTDR test also provides useful measurements and documentation for the installed system. Therefore, OTDR traces shall be generated into a hard copy and software file on a CD-ROM for the purpose of developing historical as built documentation regarding the cable's condition before and after it was installed. The hard copy and CD-ROM documentation shall be provided to the Engineer. The recordings shall also be made part of and submitted as part of the Operations & Maintenance Manual.

If specialized software (i.e., other than Microsoft Office Products) is needed to access and read OTDR electronic test results, the Contractor shall obtain and provide licensed software to the City at no additional cost to the project.

Prior to conducting OTDR tests, the Contractor shall provide the City with information regarding the test equipment to be utilized (manufacturer and model number) plus the equipment calibration procedures that will be utilized by the Contractor.

Quality tests shall consider both attenuation and localized loss discontinuities. The OTDR shall be equipped with a switchable, dual wavelength module with 1310 nm and 1550 nm light sources, and be compatible with single mode test fibers. The OTDR shall be either capable of writing to a floppy disk or configured with a plotter to provide a hard copy record of each test measurement. The OTDR shall be equipped with sufficient internal masking to allow the entire cable section to be tested. This may be achieved by using an optical fiber pigtail of sufficient length to display the required cable section, or by using an OTDR with sufficient normalization to display the required cable section. A hard copy XY plot shall be provided to the City for all fiber optic tests.

All traces shall display the entire length of cable under test, highlighting any localized loss discontinuities. The trace shall display fiber length (in kilo feet), fiber loss (dB), and average fiber attenuation (in dB/mile) as measured between two markers placed as near to the opposite ends of the fiber under test as is possible while still allowing an accurate reading. Time averaging shall be used to improve the display signal to noise ratio.

If connectors exist in the cable under test, then two traces shall be recorded. One trace shall record the fiber loss (dB) and average attenuation (dB/mile) of the entire cable link, including connectors. The second trace shall display a

magnified view of the connector regions, revealing the connector losses (dB). All connector losses shall be measured using the Least Squares Approximation (LSA) or 5 point splice loss measurement technique.

The OTDR trace shall also include the following information:

- The date and time of the test
- The Cable ID number
- The fiber color or ID number
- The optical wavelength used for the test
- The refractive index setting of the OTDR
- The pulse width setting of the OTDR
- The averaging interval of the test

Each connector shall be tested for optical loss using an OTDR. Measure each connector in both directions, at 1310 nm and 1550 nm, for single mode connectors. An XY plot, from the OTDR, shall be provided for each connector measurement. Connector loss shall meet or exceed the requirements of the connector specifications. The OTDR shall be calibrated for correct index of refraction to provide proper length measurement for the known length of reference fiber.

Insertion Loss Testing (After Installation)

Insertion loss testing is performed after the cable has been installed, terminated with connectors, and connected to the patch panels. It is used to closely emulate the losses incurred in a fully assembled optical data link. It measures actual losses through connector panels and fiber cable. A light source from an insertion loss test set directly replaces the data transmitter at the output launch point and an optical power meter replaces the data receiver at the data receiver input port.

The Contractor shall conduct insertion loss testing on all installed and terminated optical fiber elements. Insertion loss test measurements for each fiber on each cable shall be documented by the Contractor and the results provided to the City. Testing shall be conducted at 1310 nm and 1550 nm for all single-mode fiber strands. Total end to end loss for each fiber in each cable shall be within the fiber optic modem manufacturer's allowable loss budget specifications. If it is not, the Contractor shall take corrective measures to bring the cable link's insertion loss into compliance with the manufacturer's specifications, such as remating and retermination of the connectors, and/or replacement of the cable.

The Contractor shall provide the City with information regarding what type of test equipment will be utilized (manufacturer and model number) plus the equipment calibration procedures that will be utilized by the Contractor prior to conducting this test routine.

The test recordings for all fiber cables shall be provided on documentation sheets in a form to be determined by the City and submitted to the City within two (2) weeks after termination of the fiber elements. The recordings shall also be made part of and submitted as part of the Operations & Maintenance Manual, discussed elsewhere in these Special Provisions.

Insertion Loss Test Equipment (Fiber Optic Cable)

1. Testing Light Source: An LED laser light source with a wavelength equal to the operational system wavelength shall be used. The LED shall be stable within 0.1 dB in output power over a time period sufficiently long to perform the measurement.

2. Launch Reference Cable: It shall provide for attachment to the light source. The launch reference cable shall be of the same fiber size and type as the fiber under test. To eliminate cladding modes, a self-mode stripping cable or a low loss (0.5 dB) mandrel wrap-mode filter shall be used.

3. Power Meter: The detector in the power meter shall have an effective numerical aperture (NA) and active area that is larger than the fiber under test. The power meter shall have a sufficient measurement range to measure the insertion loss of the cable and connectors in the link. The power meter must be linear over the range of losses to be measured in the system and have sufficient resolution for the proposed measurements (0.05 dB). The power meter must be able to measure both absolute power in units of dBm and relative loss in units of dB. The power meter must also be able to change its calibration wavelength to match the system (1310 nm, or 1550 nm) operation wavelength. The meter shall be capable of measuring to -70 dBm.

Insertion Loss Test Procedures and Execution

The Contractor shall provide all personnel, equipment, instrumentation and supplies as necessary to perform all testing.

- Zero Reference Cable: Connect the launch reference cable between the test light source and the power meter detector. Illuminate the reference cable and record the optical power as Ref. Power 1 in dBm.

- System Insertion Loss: The system to be tested shall be inserted between the launch reference cable and the power meter, completing the optical path from the LED to the power meter. Record the optical power shown on power meter as Test Power 1 in dBm. System Insertion Loss 1 is then calculated by the following equation: NOTE: Record insertion loss as a positive value.

  System Insertion Loss 1 (dB) = Ref. Power 1 (dBm) Test Power 1 (dBm)

  The system under test shall then be tested from the other end in a similar fashion as above. Here, record the output of the launch reference cable as Ref. Power 2 and the output of the system link as Test Power 2. System Insertion Loss 2 is calculated identically:

  System Insertion Loss 2 (dB) = Ref. Power 2 (dBm) Test Power 2 (dBm)

The results of the insertion loss testing shall be recorded along with the test date, name of person performing the test, and the brand name, model number and serial number of the equipment used during the test. All results shall be made part of and submitted as part of the Operations & Maintenance Manual, discussed elsewhere in these Special Provisions.

Fiber Optic Cable Route Records

The Contractor shall provide the City with a cable route diagram indicating the actual cable route and foot marks, for all intersections, directional change points in the cable routing, and all termination points. The Contractor shall record these points during cable installation. Cable system as-built drawings showing the exact cable route shall be provided by the Contractor to the City. Information such as the location of slack cable and its quantity shall also be recorded in the cable route diagram. This information shall be included as part of the Operations & Maintenance Manual. Each of the fiber connectors and patch panel connectors shall be tagged with its fiber number and associated field element location. Each tag shall be permanently attached by a nylon tie-lock to the cable or connectors.

Measurement and Payment

The Contract Lump Sum price paid for Communication Upgrades—Olympiad Road shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for doing all the work complete and accepted in place as shown on the drawings and as specified in these Special Provisions.

CABLE VERIFICATION WORKSHEET
Link Loss Budget Worksheet

Contract No. _____

Contractor: _____

Approved by City: _____

Date: _____ Operator: _____

Link Number: _____ Fiber Color: _____

Buffer Color: _____ Cable No.: _____

Test Wavelength *(Circle One)* 1310 1550

Expected Location of Fiber Ends: End 1: _____ End 2: _____

OTDR Test Results

Forward Loss:	_____	dB	1A
Reverse Loss:	_____	dB	1B
Average Loss:	_____	dB	1C

Power Meter and Light Source Test Results:

Forward Loss:	_____	dB	2A
Reverse Loss:	_____	dB	2B
Average Loss [(2A + 2B)/2]:	_____	dB	2C

Calculated Fiber Loss:

Length of the Link (from OTDR):	_____	km	3A
Allowed Loss per km of Fiber:	_____	dB/km	3B
Total Allowed Loss due to the Fiber (3A * 3B):	_____	dB	3C

Calculated Splice Loss:

Number of Splices in the Link:	_____		4A
Allowed Link Loss per Splice:	_____	dB	4B
Total Allowed Loss due to Splices (4A * 4 B):	_____	dB	4C

Calculated Link Loss:

Connector Loss:	_____	dB	5A
Total Link Loss (5A + 3C + 4C):	_____	dB	5B

Cable Verification:

Compare Power Meter Average Loss to Calculated Link
Loss (2C - 5B): _____ dB 6A

If the value of 6A is greater than zero, the link has failed the Test.
See Test Failures elsewhere in these Special Provisions.

To Be Completed by City: Completed by City:

Resident Engineer's Signature: _____

Cable Link Accepted: _____

System Integration Test

Unless specified otherwise in the Plans, the Contractor shall accompany the Engineer and the City while conducting system integration tests on the complete functional system as shown on the Plans and as defined in these Special Provisions for system components specified in this project. The system components shall include at least the following:

1. Fiber optic cable

The Contractor shall provide all the necessary testing equipment including test modems in order to verify that the system will be fully operational.

This test shall demonstrate that all system components can be functioned and operated as a complete system. The test shall be conducted in accordance with the approved test plan. The Engineer shall be notified a minimum of ten (10) working days before tests are to be conducted. The Engineer and/or his/her representative (s) reserve(s) the right to witness all tests.

If Field Work equipment fails the system integration test, the equipment shall be corrected and no substitutions will be allowed without repeating the entire testing procedure on the substituted unit and the complete systems integration test repeated until successfully completed. Discrepancies noted in testing of the unit shall be documented and forwarded to the Engineer. Minor discrepancies noted in testing of the item shall be corrected with a maximum of thirty (30) days of written notice to the Engineer. Major discrepancies that in the opinion of the Engineer will substantially delay receipt and acceptance of the unit will be cause for rejection of the unit.

Test Procedures

The Contractor shall provide all test procedures and blank data forms for each test of the Field Work elements required on this project. The test procedures shall include the sequence in which the tests will be conducted. Unless otherwise specified in the Plans, the Contractor shall provide three (3) copies of all documents for the Engineer's approval. The test procedures and forms shall be submitted to the Engineer prior to the day tests are to begin, as required by these Special Provisions. The test procedures shall have the Engineer's approval prior to submission of equipment for test.

The Contractor shall furnish data forms containing all of the data taken, as well as quantitative results for all tests. The data forms shall be signed by an authorized representative (company official) of the equipment manufacturer. One copy of the completed and signed data forms shall be submitted to the Engineer and shall become the basis of acceptance or rejection of the test and/or unit being tested.

Documentation of all test results shall be provided within two (2) weeks to the Engineer for review and approval. System documentation shall incorporate test results, ongoing maintenance, and performance measurements.

The Contractor shall provide the Engineer with a copy of the manufacturer's test procedures and quality assurance procedures for information. If the Engineer determines that the procedures are not adequate, the Engineer may require that additional tests be conducted by the Contractor prior to installation.

All test procedures and equipment required for the Field Work elements under this testing shall be furnished and maintained by the Contractor.

SFP Module

One (1) GB SFP Module Cisco GLC-LX-SM-RGD in existing Cisco IE 3000 Fiber Switch

4.0 Signal Upgrades—Marguerite Parkway (To be provided in next submittal)

4.01 Equipment List and Drawings

Equipment list and drawings of electrical equipment and material shall conform to the provisions in Section 86-1.04, "Equipment List and Drawings," of the Caltrans Standard Specifications and these Special Provisions.

The controller cabinet schematic wiring diagram and intersection sketch shall be combined into one drawing so that when the cabinet door is fully open, the drawing is oriented with the intersection. In addition to the five (5) sets of cabinet schematic diagrams, one (1) Mylar copy shall be furnished. No other type of reproducible material shall be allowed in place of Mylar.

The Contractor shall furnish a maintenance manual for all controller units, auxiliary equipment and vehicle detector sensor units, emergency vehicle pre-emption system, control units and amplifiers. The maintenance manual and operation manual may be combined into one manual. The maintenance manual or combined maintenance and operation manual shall be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, previous to purchase. The maintenance manual shall include, but need not be limited to, the following items:

a. Specifications
b. Design characteristics
c. General operation theory
d. Function of all controls
e. Detailed circuit analysis
f. Troubleshooting procedure (diagnostic routine)
g. Voltage charts with waveforms
h. Block circuit diagram
i. Geographical layout of components
j. Schematic diagrams
k. List of replaceable component parts with stock numbers

The Contractor shall also furnish cabinet inventory sheets. These sheets shall include serial and model numbers of all equipment contained in the cabinet.

4.02 "As-Built" Drawings

The Contractor is required to submit to the City Inspector "as-built" prints, prior to the City's accepting the installations. The prints shall indicate in red all deviations from the Contract Plans such as location of poles, pull boxes and runs, depths of conduit, number of conductors, and other appurtenant work for future references.

4.03 Contractor-Furnished Materials

The Contractor shall furnish all materials and equipment as shown on the Plans and necessary to complete the project.

4.04 Schedule of Work

The Contractor shall notify the City Engineer **in writing** within ten (10) days of the notice to proceed of the date that all electrical materials and equipment will be received. Said notice shall include a schedule subject to the approval of the City Engineer for the coordination of the sub-surface signal work consisting of the installation of conduit, foundations, and detectors with the commencement of the above-ground signal work. The goal is to minimize the duration of the construction but complete the project per the specified completion date. Work shall proceed per the approve schedule.

No materials or equipment shall be stored at the job sites until receipt of said notification by the Engineer. The job sites shall be maintained in neat and orderly condition at all times.

4.05 Maintaining Existing and Temporary Electrical Systems

Traffic signal system shutdowns shall be limited to periods between the hours of 9:00 a.m. and 3:30 p.m.

4.06 Maintaining Existing Traffic Management System Elements During Construction

Traffic Management System (TMS) elements include, but are not limited to, traffic signal system, closed circuit television (CCTV) camera system, and fiber optic communication.

Existing TMS elements, including detection systems, identified on the plans and located within the project limits shall remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or offline, and if temporary or portable TMS elements are not shown on the plans, the Contractor shall provide for temporary or portable TMS elements. The Contractor shall receive the Engineer's approval on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer and the Contractor shall jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements that are not shown on the plans and elements that may not be impacted by the Contractor's activities. The City's Traffic Operations Electrical representatives will certify the TMS elements' location

and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor shall obtain written approval from the Engineer at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or offline. The Contractor shall notify the Engineer at least 72 hours before starting excavation activities.

If existing TMS elements shown on the plans or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer shall be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, shall be repaired or replaced at the Contractor's expense within 24 hours. For structure-related elements, the Contractor shall install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may approve temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor shall install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized in writing by the Engineer. Fiber optic cable shall be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices shall be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor shall demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment or as directed by the Engineer. If the Contractor fails to perform required repairs or replacement work, as determined by the Engineer, the City may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element shall be considered nonoperational or offline for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor shall provide provisions for replacing existing TMS elements within the project limits, including detection systems that were not identified on the plans or during the preconstruction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the City's representatives shall jointly conduct a post-construction operational status check of all existing TMS elements and each element's communication status with the TMC. The City's representative will certify the traffic signal and communication elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. Traffic signal and communication elements that cease to be functional between pre- and post-construction status checks shall be repaired at the Contractor's expense and as directed by the Engineer.

The Engineer will approve, in writing, the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements shall be new and of equal or better quality than the existing TMS elements.

Payment

The Contract **Lump Sum** price paid for **Maintaining Existing Traffic Management System Elements During Construction** shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in maintaining existing traffic management system elements as shown on the Plans, specified in the Caltrans Standard Specifications and these Special Provisions, and as directed by the Engineer.

Furnishing and installing temporary or portable TMS elements that are not shown on the plans, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown on the plans nor identified during the pre-construction operational status check and were damaged by construction activities will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, the provisions will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

4.07 Conductors and Cables

Conductors and Cable shall conform to the provisions in Section 86-1.02F, "Conductors and Cables," and Section 87-1.03F, "Conductors and Cables Installations," of the Caltrans Revised Standard Specifications and these Special Provisions.

Splices shall be insulated by "Method B" or, at the Contractor's option, splices of conductors shall be insulated with heat-shrink tubing of the appropriate size after thoroughly painting the spliced conductors with electrical insulating coating.

Conductors shall be wrapped around projecting end of conduit in pull boxes, as shown on the plans. Cables shall be secured to the projecting end of conduit in pull boxes to prevent pulling of cables without removing the securing device.

4.08 Splice Insulation

Splice insulation shall conform to the provisions in Section 87-1.03H(2), "Splice Insulation Methods," of the Caltrans Revised Standard Specifications and these Special Provisions.

Conductors No. 10 AWG or larger shall be spliced by the use of "C"-shaped compression connectors. Splices shall be insulated by Method "B."

4.09 Bonding and Grounding

Bonding and grounding shall conform to the provisions in Section 86-1.02F(1)(c)(ii), "Bonding Jumpers and Equipment Grounding Conductors," of the Caltrans Standard Specifications and these Special Provisions.

Grounding jumper shall be attached by a $^{3}/_{16}$-inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

4.10 Salvaged Equipment

All salvaged equipment shall be delivered to the City's designated yard. Cost of delivery of salvaged equipment shall be included in the Contract Lump Sum price paid for the item requiring the material to be salvaged.

4.11 Emergency Vehicle Preemption System

A complete, functioning 3M Opticom (TM) emergency vehicle preemption system shall be furnished and installed by the Contractor. Emergency vehicle preemption equipment shall conform to the Caltrans Standard Specifications and these Special Provisions, and as shown on the Plans.

Emergency vehicle preemption equipment shall include:

1. 3M models 711 optical detectors for each approach, as shown on the Plans.
2. 3M model 762 rack-mounted dual priority phase selector sufficient for phase operation as shown on the plans.
3. 3M model 138 detector cable.

The optical detector shall be a light-weight, weatherproof, adjustable optical detector assembly. Internal circuitry shall transform optical energy from the optical emitter assembly into electrical signals for delivery via optical detector cable to the phase selection equipment.

The optical detector shall be mounted on the indicated signal mast arm by an approved mast arm clamp or chase nipple. The detector shall not be mounted on the signal head.

The phase selector shall be installed in the traffic signal controller cabinet, and shall interface with the signal controller and provide the following functions while not compromising the control equipment fail-safe provisions:

1. Sufficient power to all optical detectors required for the intersection.

2. Sensitivity to the optical detector signal via adjustable range potentiometer.

3. Differentiation of signals by optical detectors from one or more emitters on a first-come, first-served basis.

4. Outputs to signal the controller to cause selection of the desired phase green display for the approaching vehicle.

5. Smooth transition to not-priority operation upon passage of the vehicle through the intersection.

The optical detector cable shall be a durable, shielded, 3-conductor cable with a drain wire and the necessary electrical characteristics to carry power to the optical detector from the phase selector, and to carry the optical detector signal to the phase sector. The cable shall conform to the requirements of the manufacturer of the phase selector and optical detector. The Contractor shall label each Opticom cable to indicate the direction of traffic served by that cable.

The system shall be designed to prevent simultaneous preemption by two or more emergency vehicles on separate approaches to the intersection.

Emergency vehicle preemption shall conform to the following sequence of operation:

1. A yellow change interval and any required red clearance interval shall be provided for any signal phase that is green or yellow when preemption is initiated and which will be red during the preemption interval.

2. An all-red intersection preemption display shall not be used.

3. The traffic signal shall return to normal operation upon termination of the demand for preemption or the termination of the assured green interval.

Emergency vehicle preemption sequence of operation shall be approved by the Engineer prior to timing and turn-on of traffic signal.

The Contractor shall arrange for a manufacturer's representative of the emergency vehicle preemption equipment to be present for the first day of the traffic signal and lighting function test to insure proper installation and functioning of the equipment. Detection range shall be programmed for 1,200 feet in each direction, unless limited otherwise.

The emergency preemption equipment shall be furnished and installed in a complete, operative manner, as intended by the manufacturer, and these Special Provisions. The Contractor shall arrange for, and pay the costs of, the services of the controller manufacturer to perform any controller modifications required for the installation or operation of the emergency vehicle preemption equipment.

Guaranty/Warranty

The manufacturer shall warrant that, provided the priority control system has been properly installed, operated, and maintained, any component parts of a system that are defective in workmanship and/or material during the standard warranty period from date of shipment from manufacturer shall be covered in a documented system protection plan.

In addition, upon request, the manufacturer shall provide documentation proving ability to financially support the provision period of the warranty.

The protection plan shall warrant that component parts of a system that are defective in workmanship and/or material during the first five (5) years from date of shipment from manufacturer will be repaired at no charge and that extended coverage with a fixed repair deductible will be available for an additional five (5) years.

In total, the warranty coverage must assure 10-year operational reliability and interface compatibility with future components designed for the system.

A copy of the manufacturer's warranty outlining the conditions stated above shall be supplied with the equipment.

Certificate of Insurance

The manufacturer shall provide a certificate of insurance protection for $5,000,000. This certificate assures the priority control user that the manufacturer is insured against civil damages if proven to be at fault for an accident due to equipment failure within the system of priority control components. This certificate, however, need not and is not meant to provide liability insurance protection to the priority control system user.

Certification

The manufacturer of the priority control system shall certify that all component products are designed, manufactured and tested as a system of components and will meet or exceed the requirements of these Special Provisions.

Full compensation for furnishing and installing the emergency vehicle preemption equipment shall be considered as included in the Contract Lump Sum price paid for **Traffic Signal Modification—Marguerite Parkway Traffic Signal Synchronization Project** and no additional compensation shall be allowed therefore.

CITY OF MISSION VIEJO

SPECIAL PROVISIONS (EXCERPTS)
OLYMPIAD ROAD – FELIPE ROAD
TRAFFIC SIGNAL INFRASTRUCTURE CONSTRUCTION PROJECT
CIP No. 18236

PART II SPECIAL PROVISIONS

1.0 Mobilization

Mobilization shall include all preparatory work and operations including those necessary for the movement of personnel, equipment, facilities, materials and incidentals to the project site necessary for work on the project. It shall also include other work and operations which must be performed or costs incurred including bonds, insurance, permits, permit fees, and financing prior to beginning work on the various contract items on the project site. Other items included shall be the initial moving into the join and setup and maintenance of the Contractor staging area, supervisory time on the job by the Contractor's personnel to keep the construction site in safe condition, shop drawings, potholing, preparation of project schedule, project phasing, supervision, coordination of concurrent work with other Contractors, meetings, utility agency work, ""as-built" plans, moving off the job (de-mobilization) and all the preparatory work and operations for which no separate bid item is provided in the proposal and all other related work as required at all times and for all non- working days during construction period.

Measurement and Payment

The Contract Lump Sum price paid for Mobilization shall include full compensation for furnishing all labor, materials, tools, equipment, tools, and incidentals and for doing all the work complete and accepted in place as shown on the drawings and as specified in these Special Provisions.

The lump sum price listed in Section 9-3.2, "Partial and Final Payment," of the Standard Specifications will be paid with the first monthly progress payment. The amount in excess of the maximum value for progress payment purposes listed above will be included for payment in the first made after acceptance of the Contract.

2.0 Traffic Control

Traffic control shall conform to the requirements in Subsection 7-10, "Public Convenience and Safety," of the Standard Specifications and these Special Provisions. All work to maintain and control traffic shall conform to the provisions of the vehicle code, the current California Manual on Uniform Traffic Control Devices (CA MUTCD), and the City's Traffic Engineer.

Construction area signs shall be furnished, installed maintained and removed when no longer required in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Caltrans Standard Specifications and these Special Provisions. The Contractor shall provide and maintain all other signs, barricades, pedestals, flashers, delineators, flashing arrow signs, and other necessary facilities for the protection of the public within the limits of the construction area.

Portable delineators shall be placed as necessary for proper delineation of the travel way. The spacing between delineators shall not exceed 25 feet on tangent or 20 feet on curves except when used for lane closure, unless otherwise required by the City's Traffic Engineer or shown on the Plans.

When used for lane closures, the fluorescent traffic cones or portable delineators shall be placed at intervals not to exceed the following:

Taper:	Equals to the speed limit in feet and shall not exceed 50 feet
Edge of Closed Lane	Tangents 25 feet Curves 20 feet

If the traffic cones or portable delineators are damaged, displaced or not in an upright position, from any cause, said cones or portable delineators shall immediately be replaced or restored to their original location, in an upright position, by the Contractor.

The Contractor shall furnish such flaggers as are necessary to give adequate warning to traffic or to the public of any dangerous conditions to be encountered. Flaggers, while on duty, are assigned to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in accordance with the current "Instructions to Flagmen" of the Department of Transportation. The equipment shall be furnished and kept clean and in good repair by the Contractor, at the Contractor's expense. Flagger shall be available until such time the construction area has been returned to safe conditions.

Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures as provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor at the Contractor's expense. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.

All existing stop signs, street name signs, regulatory signs and hospital signs shall be maintained in visible locations during construction and permanently relocated or removed as shown on the Plans or directed by the Engineer. Signs that need not be maintained during construction or permanently relocated shall be removed or salvaged as determined by the Engineer. When closing lane(s) on an arterial highway, the Contractor shall use mobile flasher arrow boards.

All Type II and Type III barricades shall have flashing beacons for visibility at night. Where lane closures are opened at the end of a working day, advance warning signs shall be removed, turned around or bagged each day.

Measurement and Payment

The Contract Lump Sum price paid for Traffic Control shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for doing all the work complete and accepted in place as shown on the drawings and as specified in these special provisions.

3.0 Signal Upgrades

3.01 Equipment List and Drawings

Equipment list and drawings of electrical equipment and material shall conform to the provisions in Section 86-1.04, "Equipment List and Drawings," of the Caltrans Standard Specifications and these Special Provisions.

The controller cabinet schematic wiring diagram and intersection sketch shall be combined into one drawing so that when the cabinet door is fully open, the drawing is oriented with the intersection. In addition to the five (5) sets of cabinet schematic diagrams, one (1) Mylar copy shall be furnished. No other type of reproducible material shall be allowed in place of Mylar.

The Contractor shall furnish a maintenance manual for all controller units, auxiliary equipment and vehicle detector sensor units, emergency vehicle pre-emption system, control units and amplifiers. The maintenance manual and operation manual may be combined into one manual. The maintenance manual or combined maintenance and operation manual shall be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, previous to purchase. The maintenance manual shall include, but need not be limited to, the following items:

a. Specifications
b. Design characteristics
c. General operation theory
d. Function of all controls
e. Detailed circuit analysis
f. Troubleshooting procedure (diagnostic routine)
g. Voltage charts with waveforms
h. Block circuit diagram
i. Geographical layout of components
j. Schematic diagrams
k. List of replaceable component parts with stock numbers

The Contractor shall also furnish cabinet inventory sheets. These sheets shall include serial and model numbers of all equipment contained in the cabinet.

3.02 "As-Built" Drawings

The Contractor is required to submit to the City Inspector "as-built" prints, prior to the City's accepting the installations. The prints shall indicate in red all deviations from the Contract Plans such as location of poles, pull boxes and runs, depths of conduit, number of conductors, and other appurtenant work for future references.

3.03 Contractor-Furnished Materials

The Contractor shall furnish all materials and equipment as shown on the Plans and necessary to complete the project.

3.04 Schedule of Work

The Contractor shall notify the City Engineer **in writing** within ten (10) days of the notice to proceed of the date that all electrical materials and equipment will be received. Said notice shall include a schedule subject to the approval of the City Engineer for the coordination of the sub-surface signal work consisting of the installation of conduit, foundations, and detectors with the commencement of the above-ground signal work. The goal is to minimize the duration of the construction but complete the project per the specified completion date. Work shall proceed per the approve schedule.

No materials or equipment shall be stored at the job sites until receipt of said notification by the Engineer. The job sites shall be maintained in neat and orderly condition at all times.

3.05 Maintaining Existing and Temporary Electrical Systems

Traffic signal system shutdowns shall be limited to periods between the hours of 9:00 a.m. and 3:30 p.m.

3.06 Maintaining Existing Traffic Management System Elements During Construction

Traffic Management System (TMS) elements include, but are not limited to, traffic signal system, closed circuit television (CCTV) camera system, and fiber optic communication.

Existing TMS elements, including detection systems, identified on the plans and located within the project limits shall remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or offline, and if temporary or portable TMS elements are not shown on the plans, the Contractor shall provide for temporary or portable TMS elements. The Contractor shall receive the Engineer's approval on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer and the Contractor shall jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements that are not shown on the plans and elements that may not be impacted by the Contractor's activities. The City’s Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor shall obtain written approval from the Engineer at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or offline. The Contractor shall notify the Engineer at least 72 hours before starting excavation activities.

If existing TMS elements shown on the plans or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer shall be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, shall be repaired or replaced at the Contractor's expense within 24 hours. For structure-related elements, the Contractor shall install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may approve temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor shall install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized in writing by the Engineer. Fiber optic cable shall be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices shall be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor shall demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment or as directed by the Engineer. If the Contractor fails to perform required repairs or replacement work, as determined by the Engineer, the City may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element shall be considered nonoperational or offline for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor shall provide provisions for replacing existing TMS elements within the project limits, including detection systems that were not identified on the plans or during the preconstruction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the City's representatives shall jointly conduct a post-construction operational status check of all existing TMS elements and each element's communication status with the TMC. The City's representative will certify the traffic signal and communication elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. Traffic signal and communication elements that cease to be functional between pre- and post-construction status checks shall be repaired at the Contractor's expense and as directed by the Engineer.

The Engineer will approve, in writing, the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements shall be new and of equal or better quality than the existing TMS elements.

Payment

The Contract **Lump Sum** price paid for **Maintaining Existing Traffic Management System Elements During Construction** shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in maintaining existing traffic management system elements as shown on the Plans, specified in the Caltrans Standard Specifications and these Special Provisions, and as directed by the Engineer.

Furnishing and installing temporary or portable TMS elements that are not shown on the plans, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown on the plans nor identified during the pre-construction operational status check and were damaged by construction activities will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, the provisions will be paid for as extra work under Section 3-3, "Extra Work," of the Standard Specifications.

3.07 Conductors and Cables

Conductors and Cable shall conform to the provisions in Section 86-1.02F, "Conductors and Cables," and Section 87-1.03F, "Conductors and Cables Installations," of the Caltrans Revised Standard Specifications and these Special Provisions.

Splices shall be insulated by "Method B" or, at the Contractor's option, splices of conductors shall be insulated with heat-shrink tubing of the appropriate size after thoroughly painting the spliced conductors with electrical insulating coating.

Conductors shall be wrapped around projecting end of conduit in pull boxes, as shown on the plans. Cables shall be secured to the projecting end of conduit in pull boxes to prevent pulling of cables without removing the securing device.

3.08 Splice Insulation

Splice insulation shall conform to the provisions in Section 87-1.03H(2), "Splice Insulation Methods," of the Caltrans Revised Standard Specifications and these Special Provisions.

Conductors No. 10 AWG or larger shall be spliced by the use of "C"-shaped compression connectors. Splices shall be insulated by Method "B."

3.09 Bonding and Grounding

Bonding and grounding shall conform to the provisions in Section 86-1.02F(1)(c)(ii), "Bonding Jumpers and Equipment Grounding Conductors," of the Caltrans Standard Specifications and these Special Provisions.

Grounding jumper shall be attached by a $^{3}/_{16}$-inch or larger brass bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box.

Grounding jumper shall be visible after cap has been poured on foundation.

3.10 Salvaged Equipment

All salvaged equipment shall be delivered to the City's designated yard. Cost of delivery of salvaged equipment shall be included in the Contract Lump Sum price paid for the item requiring the material to be salvaged.

3.11 Accessible Pedestrian Push Button Assembly

General

Furnish and install **Polara Audible Pedestrian Push Button–Model iN2-5 BB 1 B** or approved equal at all pedestrian crosswalk for the following intersections:

1.

Definitions

APS	As defined in the California MUTCD.
Accessible walk indication	Activated audible and vibrotactile action during the walk interval.
Ambient sound	Background sound level in dB at a given location.
Ambient sound sensing microphone	Microphone that measures the ambient sound level in dB and automatically adjusts the APS speaker's volume, accordingly.
APS pedestrian push button (APS PPB) assembly	Assembly that connects a pedestrian push button to an APS electronic device to actuate the components of the APS.
Audible speech walk message	Audible prerecorded message that communicates to pedestrians which street has the walk interval.
Programming mechanism	Device to program the APS operation.
Push button information message	Audible prerecorded message actuated when the push button is pressed and the walk interval is not timing.
Push button locator tone	As defined in the California MUTCD.
Vibrotactile pedestrian device	As defined in the California MUTCD.

Submittals

Submit the APS wiring diagram and product data.

Submit 3 APS user and operator manuals for each signalized location. Manuals must include a master item index that describes the purpose of each manual and brief description to the directory. The index must include an overall description of the APS and its associated equipment and cables with illustrative block diagrams, manufacturer contact information, technical data specification, parts list, part descriptions, and settings. The manuals must include fault diagnostic and repair procedures and procedures for preventative maintenance in order to maintain APS performance parameters.

Before shipping APSs to the job site, submit APSs and the following to the Transportation Laboratory:

1. Delivery form including contract number and contact information
2. List containing all APS serial numbers
3. Manufacturer's name, trademark, model number, lot number, and month and year of manufacture
4. Programming mechanism if not integral to the APS

Submit a record of completed field tests, APS final configuration, audible sound levels and threshold, and a list of all parameter settings.

Quality Control and Assurance

The APS must be compatible with the Econolite ASC/3 controller assembly.

Power to the APS must come through the standard pedestrian push button wires from the cabinet.

Functional Testing

Field tests must be completed twice, when traffic is noisy (e.g., peak traffic hours) and when traffic is quiet (e.g., off peak hours). Notify the Engineer fifteen (15) days before testing the APS.

Warranty

Provide a 2-year manufacturer replacement warranty for the APS effective from the date of installation against any defects or failures. All warranty documentation must be submitted to the Engineer before installation.

Replacement parts must be provided within ten (10) days after receipt of the failed part at no cost to the City and must be delivered to Mission Viejo City Hall, Department of Public Works, 200 Civic Center, Mission Viejo, California 92691, Phone No. 949-470-8422.

Materials

The APS PPB assembly must include:

1. PPB actuator with a minimum diameter of two inches (2"). The PPB must be rainproof and shockproof in any weather condition. If a mechanical switch is used, the switch must have:

    a. Operating force of 3.5 lbs
    b. Maximum pretravel of 5 64 inch
    c. Minimum overtravel of 1 32 inch
    d. Differential travel from 0.002 to 0.04 inches

2. Vibrotactile device on the push button or on the APS. The device may be a vibrotactile arrow or other vibrating surface approved by the Engineer.

3. Enclosure with an ambient sound-level-sensing microphone and weatherproof speaker. A Type B PPB assembly may be substituted with an APS PPB assembly enclosure, but must be less than 7 pounds, be less than 16" x 6" x 5, and fit the standard. Maximum diameter of the hole for passage of wiring must not exceed 1.125". Attachment to the pole must be with two (2) screws of diameter from ¼- to ⅜-inch suitable for use in tapped holes. Clear space between any two (2) holes in the post must be at least twice the diameter of the larger hole.

4. 5" x 7" R10-3b sign above each PPB.
5. Braille on Face Plate

6. Custom Audio Message Option
7. Black button cover color

The APS speakers and electronic equipment must be installed inside the APS PPB assembly enclosure. Speakers must not interfere with the PPB or its mounting hardware. Speaker grills must be located on the APS PPB assembly enclosure.

Electronic switches, a potentiometer, or a handheld device must be used to control and program the volume level and the messaging for the APS. Programming mechanism must be submitted to the Engineer upon successful APS installation.

The APS must:

1. Include a provision to enable and disable the APS operation.

2. Have a failsafe operation. In the event of APS failure, the pedestrian push buttons system puts in a constant call.

3. Provide information using:

   a. Audible speech walk message plays when the PPB is pressed. The message must include the name of the street to be crossed associated with that push button. An example of the message is "*Peachtree, 'walk' sign is 'on' to cross Peachtree*." The message must be repeated for the duration of the "walk" interval. The APS must include at least five (5) sound options to be played during the "walk" interval. The Engineer may field select the "walk" sound option. The message must be activated for use from the beginning of the "walk" interval. The message must have a percussive tone consisting of multiple frequencies with a dominant component of 880 Hz. If the tone is selected as the "message," it must repeat 8 to 10 ticks per second.

   b. Push button information message provides the name of the street to be crossed associated with that push button. The message must play when the PPB is pressed. An example of the message is "*Wait to cross Howard at Grand. Wait.*"

   c. Push button locator tone that clicks or beeps. The locator tone must come from the PPB and repeat at one (1) tone per second interval. Each tone has a maximum duration of 0.15 second. The locator tone volume must adjust in response to ambient sound and be audible up to twelve feet (12') from the push button or to the building line, whichever is less.

4. Bluetooth-enable device capable of communicating with Apple iOS app and Microsoft PC app.

5. Must be able to connect via Ethernet port on existing CISCO switches and adjust settings remotely via free web-based Polara Software.

6. Shelf-mount Central Control Unit (iCCU-S) features full BIU capability. Must have SDLC port. Must support up to eight (8) phase/channels.

Construction

Arrange, at Contractor's expense, to have a manufacturer's representative qualified to work on APS present whenever the equipment is installed, modified, connected, and reconnected.

The APS must not interfere with the controller assembly, the signal installation on signal standards, the pedestrian signal heads, or the terminal compartment blocks. The APS electronic control equipment must reside inside the APS PPB assembly and the controller cabinet.

Contractor is responsible for the compatibility of the components and for making the necessary calibration adjustment to deliver the performance specified. Contractor shall provide the equipment and hardware required to install, set up, calibrate, and verify the performance of the APS.

Upon successful completion of the APS installation, disable the APS operation.

Training

Provide a minimum of four (4) hours of training by a certified manufacturer's representative for up to two (2) City employees selected by the Engineer. The content of the training must include instruction on how to install, program, adjust, calibrate, and maintain the APS.

Provide materials and equipment for the training. Notify the Engineer fifteen (15) days before the training. The time and location of the training must be agreed upon by the manufacturer or the Contractor and the Engineer. If no agreement can be reached, the Engineer will determine the time and location.

Payment

The Contract unit price paid per **Pedestrian Push Button Assembly and System** shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for all the work complete and accepted in place as specified in these provisions.

3.12 Traffic Signal Controller Cabinet

Cabinet Assemblies

For the new cabinet assemblies, Contractor shall furnish and install Type "P-44" unpainted aluminum cabinet assembly as indicated that includes the following items:

1. One (1) fully wired eight (8) phase NEMA TS2 Type 2 "P-44" unpainted aluminum cabinet.
2. One (1) Malfunction Management Unit with LCD display (programmed for the intersection).
3. Two (2) position TS2 detector racks with eight (8) two-channel detection as indicated on plan and one (1) Bus Interface Unit, per rack.
4. Sixteen (16) position load bay.
5. Twelve (12) load switches.
6. One (1) controller cabinet power supply.

Contractor shall salvage existing Econolite ASC/3-2100 TS2 Type 2 Controller unit with data key, Ethernet port and FSK module from existing cabinet and install in new Type "P-44" unpainted aluminum cabinet assembly as indicated.

Cabinet Construction

A complete NEMA TS2 Type 2 "P-44" cabinet shall be supplied. Cabinet shall meet, at a minimum, all applicable sections of the NEMA Standard Publication. Where differences occur, this specification shall govern. The cabinet shall meet the following criteria:

1. Material shall be aluminum sheet, 5052-H32, with a minimum thickness of 0.125 inch.
2. The cabinet exterior shall be aluminum finish painted rustic brown aluminum with a white interior.
3. The door hinge shall be of the continuous type with a stainless steel hinge pin.
4. The door handle shall be cast aluminum.
5. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet.
6. Cabinet lock shall be of the Corbin No. 2 type.
7. The cabinet shall have four (4) sets of cabinet wiring diagrams.
8. The cabinet shall have one (1) set of equipment manuals (Controller, MMU, etc.).

Shelves

Two (2) aluminum shelves extending completely across the back of the cabinet in the top cabinet area.

1. The first aluminum shelf extending completely across the back of the cabinet shall be provided to support the detector rack(s) and power supply.

2. The second aluminum shelf extending completely across the back of the cabinet shall be provided to support the controller and master (if required) and the MMU. The second aluminum shelf shall also have an Econolite 34448G2 pull-out drawer or City-approved equivalent installed.

Equipment Accessibility

All mounted panels and equipment shall have a minimum tool access clearance of six inches (6").

Ventilating Fan

The cabinet shall be provided with one (1) thermostatically-controlled ventilation fan, adjustable between 80° to 150° F and shall be installed in the top of the cabinet plenum.

Air Filter Assembly

The cabinet air filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite Part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

Cabinet Light Assembly

The cabinet shall be equipped with an LED lighting fixture mounted on the inside of the cabinet near the front edge. The LED light shall be activated by an On/Off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

Lightning Suppression

The cabinet shall be equipped with an EDCO Model SHP-300-10 surge arrester, or City-approved equivalent.

Power Panel

The Power Panel shall house the following equipment:

1. One (1) 40-Amp main breaker to supply power to the main panel, controller, MMU, and cabinet power supply.

2. One (1) 15-Amp auxiliary breaker to supply power to the fan, light, and GFCI outlet.

3. One (1) 50-Amp, 125-VAC radio interference line filter.

4. One (1) normally-open, 60-Amp, Crydom Model #HA8475 solid-state relay, or City-approved equivalent.

Convenience Outlet

Two (2) duplex outlets shall be supplied, as per the following:

1. The first is for short-term equipment use, 120-volt AC, 15-Amp NEMA 5-15 GFCI duplex outlet, and shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within six inches (6") of the front edge of the opening of the door.

2. The second is for long-term equipment use, 120-volt AC, 15-Amp NEMA duplex outlet, and shall be mounted in the upper right corner of the cabinet facing the inside of the cabinet. Power shall be supplied from un-switched filtered power.

Inside Auxiliary Control Panel Switches

The inside door panel shall contain three (3) switches: Auto/Flash, Auto/Off/On Stop- Time, and Power On/Off. Auxiliary door panel switches shall be hard wired; printed circuit boards shall not be used.

1. Auto/Flash Switch (2-Position). In the Auto position, the intersection shall operate normally. In the Flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

2. Auto/Off/On Stop-Time Switch (3-Position). In the Auto position, the controller shall be stop timed when the police door Auto/Flash Switch is in the Flash position or MMU flash. In the Off position, the switch shall release all stop time from controller. In the On position, the switch shall maintain a continuous stop time to the controller.

3. Controller Power On/Off Switch (2-Position). This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

Police Panel Switches

The Police Panel shall contain two (2) switches: Signals On/Off and Auto/Flash. All police panel switches shall be hard wired; printed circuit boards shall not be used.

1. Signals On/Off Switch (2-Position). In the On position, the field displays shall show either normal operation or flash. In the Off position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. In the Off position, the MMU shall not conflict or require reset.

2. Auto/Flash Switch (2-Position). In the Auto position, the intersection shall operate normally based on all other switches. In the Flash position, power shall not be removed from the controller and stop time shall be applied based on the Stop-Time switch.

Cabinet Wiring

Cables

All Controller and MMU cables shall have sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length.

All cabinet wiring shall be color coded as follows:

Purple	=	Flash Color programming
Brown	=	Green Signal wiring
Yellow	=	Yellow Signal wiring
Red	=	Red Signal wiring
Blue	=	Controller wiring
Gray	=	DC ground return, logic ground
Black	=	AC positive
White	=	AC negative
Green	=	Chassis

Main Panel and Wire Terminations

All wires terminated behind the main panel and other panels shall be soldered. No pressure or solder-less connectors shall be used. Printed circuit boards shall not be used on main panels.

Flashing Operation

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash Red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

Detector Rack and Interface

TS-2 Vehicle Loop detector racks with field termination panel, TS-2 power supply, and SDLC cable shall be provided. Each individual rack shall support up to sixteen (16) channels of loop detection, four (4) channels of emergency vehicle pre-emption (EVP) detection and one (1) BIU. The number of racks installed shall be determined by the number of detection channels required on the signal plans.

Main Panel Configuration

The main panel shall be fully wired in the following configuration:

1. Sixteen (16) load sockets.
2. Six (6) flash transfer relay sockets.
3. One (1) flasher socket.
4. Wiring for both Type 1 and Type 2 Controllers.
5. Wiring for one Type 16 MMU.

Field Terminal Locations

Field terminals shall be located at the bottom of the main panel and angled forward for easy viewing and wiring. The order shall be from left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

Cabinet Equipment

Detectors

New cabinets shall be equipped with the proper number of detectors, as required.

Controller Unit

New cabinets shall be equipped with salvaged one (1) ASC/3-2100 Econolite TS2-Type 2 controller.

Malfunction Management Unit (MMU)

New cabinets shall be equipped with a NEMA TS2 Type 16 MMU with the latest current released software. MMU jumper cards shall be programmed to specific intersection's requirements.

Bus Interface Unit (BIU)

BIUs shall meet all TS2-1992, Section 8 requirements. In addition, all BIUs shall provide three (3) separate front panel indicators: Power, Valid Data, and Transmit.

Cabinet Power Supply

The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator LED for each of the four (4) power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

Interconnect Termination

New cabinets shall be supplied with interconnect termination and sub-base assembly.

Flasher Unit

All flasher units shall meet NEMA TS-2, Section 6 requirements and shall be EDI Model 810, or City-approved equivalent.

Intersection Diagram

For the new cabinets, an intersection diagram prepared in AutoCAD shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the Auxiliary Panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and north arrow. The top of the diagram will be north, and the diagram shall be pre-approved by the City Engineer.

Cabinet Wiring Diagram

New cabinet wiring diagrams shall be arranged on three (3) separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second sheet everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the City Engineer

Payment

The Contract unit price paid per **Type P Signal Cabinet** shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for all the work complete and accepted in place as specified in these provisions.

3.13 UPS System

1. GENERAL

Provide a complete Uninterruptible Power Supply, including engineering, components, installation and commissioning at locations specified on plans.

2. PRODUCTS

General

All equipment and materials incorporated shall be standard components that are regularly manufactured and used in the manufacturer's product line.

All systems and components shall have been thoroughly tested and in actual use.

Clary SP1250LX-R/N (72 Volts)

Overview

The Clary *SP1250LX-R/N (72)* Traffic UPS System is a turnkey, true on-line, solid-state, microprocessor-controlled Power Conditioner and Uninterruptible Power System (UPS). The Clary *SP1250LX-R/N (72)* features programmability via the operator control panel. The *SP1250LX-R/N (72)* system is unique in that it continuously regenerates and conditions the AC sine wave, where 100% of the power to the load, whether on utility or batteries, is generated by the on-board inverter. The Clary *SP1250LX-R/N (72)* is capable of operating, up to its rated power level, in extreme environments with existing equipment on the street today including any and all signal heads (i.e., incandescent, LED, neon, etc.). Additionally, the *SP1250LX-R/N (72)* features a *72*Vdc battery system for application where battery storage is an issue. When configuring this device, it is important to correctly identify the appropriate model [i.e., SP1250LX-R (*72*) identifies a Rack-Mounted unit with rear power connection, while an SP1250LX-N (*72*) would indicate front power connection and is a typical unit installed in NEMA cabinets]. Where shown on plans, the *SP1250LX-R/N (72)* Traffic UPS shall be furnished and installed in conformance with the following specification.

Operation

A. Unit shall be capable of on-site programming without the use of attached computers.

B. On-line technology shall be supported, and 100% of the load shall flow through the inverter 100% of the time to isolate and protect the attached equipment.

C. Power connection shall be made to the front or back of the UPS chassis to support NEMA or Rack-Mounted cabinetry.

D. The unit shall support the traffic system during power outages in the full online mode.

E. The traffic UPS shall be capable of providing continuous, fully conditioned and regulated sinusoidal (AC) power to selected devices such as signal controllers, modems, communication hubs, NTCIP adapters and video equipment.

F. Up to the maximum rating, the Traffic UPS shall be capable of supporting all cabinet systems, regardless of power factor rating, without overdriving the poorer power factor LED heads which may cause early degradation, low luminosity or early signal failure.

G. Upon loss of utility power, the Traffic UPS shall insert battery power into the system.

H. In case of UPS failure and/or battery depletion, the UPS will drop out and, upon return of utility power, the traffic control system will default to normal operating mode.

I. The bypass switch shall enable removal and replacement of the Traffic UPS without shutting down the traffic control system (i.e., “hot swap” capability). Connectors shall be equipped with a “safety interlock” feature.

J. The UPS shall support generator input without going to batteries.

K. The UPS traffic control system shall be capable of “cold starting”, starting when no utility AC is available (i.e., starting while on batteries).

L. For 170 or “California” style cabinets, when operating in the standby flash mode, upon loss of power the Traffic UPS shall actuate the existing Bus Relay to force the traffic control system into Flash Mode operation.

M. Existing cabinet Flasher Modules and Flash Transfer Relays shall be utilized.

N. To facilitate emergency crews and police activities, the Traffic UPS shall be compatible with the police panel functions.

O. The Traffic UPS shall not duplicate or assume flash operation or flash transfer relay functions.

P. The UPS shall deliver 120 VAC out +/- 3% with an AC input between 75 and 155 VAC without discharging the batteries while operating in the true Online Mode.

Q. The SP1250LX-R/N (*72*) shall support load increases to 1400 watts for ten (10) seconds through the full NEMA temperature range of - 40° to + 74° C while on continuous battery operation.

Description

The Traffic UPS shall consist of three (3) major components: the Electronics Module, the Bypass Switch, and the Battery System.

The Electronics Module shall consist of the following:

A. True sine wave, micro-processor-controlled high-frequency inverter utilizing IGBT technology.

B. 3-stage, temperature-compensated, battery charger.

C. Local and remote control of UPS functions.

D. Local and remote communications capabilities.

E. Support capability to accept an NTCIP-ready adapter or to connect a Spread.

F, Spectrum Radio modem.

G. Utility Bypass Switch for bypassing the UPS for repair or removal.

Mounting/Configuration

NEMA Style: mounting method shall be shelf-mount or wall-mount.

170 Style: mounting method shall be 19" rack-mount. Shelf angles or rails are available as optional accessories.
External: A separate, stand-alone, pad-mounted or piggy back (type 2), outdoor (NEMA 3R) enclosure shall be available should there be inadequate room in the signal cabinet or should the consulting/traffic engineer prefer independent, external mounting.

Battery System

The battery shall be comprised of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/Valve Regulated Lead Acid) batteries that have been field proven and tested by the U.S. military.

The battery system shall consist of one or more strings (four batteries per string) of extreme temperature deep cycle, 12V, 41/51Ahr, AGM/VRLA (Absorbed Glass Mat/Valve Regulated Lead Acid) batteries such as Clary OutpostTM batteries or equivalent.

Batteries shall be certified to operate at extreme temperatures from -40° C to +74° C.

The batteries shall be provided with appropriate interconnect wiring and corrosion-resistant mounting trays and/or brackets appropriate for the cabinet into which they will be installed.

The interconnect cables shall be protected with abrasion-resistant nylon sheathing.

The interconnect cables shall connect to the base module via a quick-release connector.

For purposes of safety and proper operation, the battery connector shall have interlocking pins to prevent turn-on if batteries are not connected, and to shut off the UPS should the batteries be disconnected.

Battery construction shall include heavy-duty, inter-cell connections for low-impedance between cells, and heavy-duty plates to withstand shock and vibration.

The top cover shall use tongue and groove construction and shall be epoxied to the battery case for maximum strength and durability.

Electrical Specifications

1.	**Input Specification**	
	Nominal Input Voltage	120 VAC, Single Phase
	Input Voltage Range	75 VAC to 155 VAC (before drawing power from the batteries)
	Input Frequency	50 or 60 Hz (+/- 5%)
	Input Configuration	3 Wire (Hot, Neutral & Ground)
	Input Current (Max. draw) SP1250LX-R/N (*72*)	 10.4 amps, Power factor corrected
	Input Protection	Input Fuse (20 amps)
2.	**Output Specification**	
	Nominal Output Voltage	120 VAC, Single Phase
	Power Rating SP1250LX-R/N (*72*)	 1.25KVA/875W
	Dynamic Response	+/- 4% for 100% step load change 0.5ms Recovery Time
	Output Frequency	50 or 60 Hz (+/- 5%)

Output Configuration	Keyed, connectors and duplex receptacle
Output Wave Form	True Sinewave
Overload capability: SP1250LX-R/N (*72*)	110% for 10 minutes, 200% for 50MS
Fault clearing	Current limit and automatic shutdown
Short circuit protection	Current limit and automatic shutdown
Efficiency	85% at full load
Load Power Factor	.99 lagging through unity to .99 leading

Physical Specifications, UPS Electronics Module

1. Dimensions	
SP1250LX-R/N (*72*)	Width = 19” Depth = 10.12” Height = 3.5”
2. Weight	
SP1250LX-R/N (*72*)	UPS: 27 lbs Shipping weight: 33 lbs.

Environmental Specifications

The UPS shall meet or exceed NEMA temperature standards from –40° C to +74° C.

Battery Specifications

Ampere-Hour Ratings: (see Table 1).

Hydrogen Gas Emissions: must meet Mil-Spec, MIL-B-8565J.

Weight and Dimensions: (see Table 1).

Table 1

Four Battery, *72* Volt Sets	**Single String 41 Ah Batteries**	**Estimated Runtime** (Assumes 77° F/25° C to 1.75 volts per cell) Full Charge				**Unit Weight**	**Overall Dimensions Per Battery** Inches		
Clary Model	**Volts/ Ah**	**300 Watts**	**500 Watts**	**700 Watts**	**875 Watts**	**Lbs. (Kg.)**	**Length L**	**Width W**	**Height H**
OP48C*	12 VDC/ 41 Ah	4.3 Hrs	2.5 Hrs	1.5 Hrs	1.1 Hr	29	7.72	4.96	8.05

Communications, Controls & Diagnostics

Alarm Function Monitoring: The traffic UPS shall come standard with a DB-9F connector with open collectors (40 V @ 20 MA) indicating: loss of utility power, inverter failure, or low battery condition and USB connectivity for system up/down loads.

An RS232 Interface shall be provided via a DB-9F connector allowing full, interactive, remote computer monitoring and control of the UPS functions.

Front Panel Controls: Power ON, Cold Start, Alarm Silence, Battery Test, Bypass Breaker, and DC/Battery Breaker, Battery Test Points, Auxiliary Temperature Connector, and Programmable Keys.

Reliability

Calculated MTBF is 100,000 hours based on component ratings.

When Bypass Switch is included, system MTBF increases to 150,000 hours.

Options

SP1250LX-R/N (*72*) – OP48C, *72*Vdc Battery Systems (four each OPB-1241batteries)

BTR-346 Battery Tray is designed to hold four (4) OPB-1241 batteries and up to three (3) OPB-1251 batteries. Tray is 19" wide for use in 170-type cabinets and mounts on standard RETMA rails.

SBB-346 Swing-out Battery Box: mounts on right rail inside back door of 170-type cabinets. Swing-out Box is designed to hold four (4) OPB-1241 batteries and up to three (3) OPB1251 batteries.

Adjustable Delay-timer to provide up to ten (10) hours of full cycling while on battery before switching to flash mode (only available where 100% low-power/LED signals and PED heads are used). Batteries must be sized properly to fully utilize this feature.

Service pedestal-mounting option.

One-shot ground pulse to trigger External Start upon return of AC power.

External dial-out modem for wireless or landline communication.

Internal SNMP option providing TCP/IP capability to internet.

Enhanced battery charger provides accelerated charging capacity (contact factory for details).

SNMP Internal/External Adapter

Overview

The optional SNMP/HTTP card functions as an SNMP agent and includes an embedded HTTP server (web server). This means that one industry standard management tool can be used to monitor and control all City's UPS systems from one central location, and power management can now be integrated into City's existing traffic network management strategy. Alarms ('traps') can be configured to ensure automatic notification of events such as low battery, power outage or UPS overload. MIBs are included with the product for integration into City's third-party traffic management system software.

Control and management functions are also available through any standard web browser (e.g., Internet Explorer, Netscape or Fire Fox). Simply point your browser to the network address assigned to the card and the embedded web server returns web pages providing access to monitor or control all system parameters. The easy-to-use browser interface with online help means that minimum training is required to enable staff to effectively manage the UPS and protected intersections. A sophisticated Java applet provides full system monitoring in real time, along with comprehensive event and history logs.

Additional SNMP Features

1. Configurable from serial port or web browser.
2. Management from SNMP manager or web browser.
3. Supports most standard network management systems via MIB definitions.
4. Firmware upgrades by TFTP via serial port.
5. Full-featured GUI runs in web browser.
6. Accessible from any workstation on the network using SNMP/HTTP, regardless of OS via standard browser.
7. UPS warning broadcast capability.

8. Real-time monitoring of all functions.

9. Full history logs.

10. Scheduling functions.

11. Supports: Optional, Environmental Monitoring Device (EMD) that provides temperature and humidity sensing. Additional detection or sensing of motion, smoke, security devices, water sensor or vibration sensors is also supported.

12. Certifications: CE, FCC Class B

SNMP Technical Specifications

1. CPU 16-bit micro controller

2. Ram 1Mbits x 16

3. Flash ROM 1Mbits x 16

4. LAN Interface Auto-sensing 10/100Mbps Fast Ethernet

5. Serial Port Two asynchronous serial ports for UPS communication

6. SNMP MIB RFC1213, RFC1268, USHA MIB

7. Network Protocol TCP/IP, UDP, SNMP, Telnet, SNTP, HTTP, SMTP

8. LED Power, Status, LAN 10/100 Link

9. Power Input DC CT-09G: 8 volts – 15 volts DC

10. Power Input DC CT-09H: 12 volts unregulated (External)

11. Power Consumption 3 Watts maximum

12. Environment Temperature: -40° C to +74° C

13. Miscellaneous Real-Time-Clock, Reset button

14. Firmware upgrading Network Upgrade and Serial Upgrade

15. System Security IP-based filtering and password protection

16. Approvals CE, FCC Class B

17. Warranty Two Years

SNMP Extended Device Support–CT-16F, EMD Module

The CT-16F (Environmental Monitoring Device) is a connectivity device that allows City to remotely monitor the temperature, humidity and status of two connected devices. The connection to the USHA Card enables monitoring or notification of alarms via a standard Web browser or Remote View, USHA icon-based UPS management software.

SNMP Operating Systems Supported

1. Microsoft Windows 2000, ME, XP, XP/2003, Windows 7
2. Novell 4.x thru 6.x
3. Solaris (x86 version) 2.6/2.7/2.8
4. Solaris (Sparc version) 7/8/9/10

5. SCO UNIX 5.x
6. SCO UnixWare 7.x
7. HP_UX 10.2/11i
8. IBM_AIX 4.3/5.3
9. Free BSD 4.3/5.1/6
10. Other Linux-derivatives OS (Kernel 2.x or later)

Warranty

Two years for parts and labor F.O.B. factory.

Manufacturer

The manufacturer of CT-09G and CT-09H is:

Clary Corporation
150 East Huntington Drive
Monrovia, California 91016
(800) 44-CLARY
sales@clary.com
www.clary.com

Serviceability & Maintainability

MTTR (Mean-Time-To-Replace):

Electronics: 15 minutes or less
Battery System: 15 minutes or less

Warranty

Standard warranty terms cover entire Traffic UPS electronics; terms are two years parts and labor F.O.B. factory. No provision of this warranty shall cover batteries. However, battery manufacturer's warranties will be passed through to the customer whenever applicable—please consult Factory Service for more details.

Manufacturer

The manufacturer of the *SP1250LX-R/N (48)* Traffic UPS Systems shall be:

Clary Corporation
150 East Huntington Drive
Monrovia, California 91016
(800) 44-CLARY
sales@clary.com
www.clary.com

SPD-302C Bypass Switch

Overview

The SPD-302C Bypass Switch provides the basic bypass capability for the SP-PD Series and the SP1250LX or SP2000LX products. Additionally adding the generator plug, cable and the GFI duplex plug and circuit breaker.

Generator Dongle for SPD-302A and SPD-302C Bypass Switch. Cable is included in the aforementioned model numbers.

SPD-09A2 SNMP/HTTP Adapter

Overview

The optional SNMP/HTTP card functions as an SNMP agent and includes an embedded HTTP server (web server). This means that one industry standard management tool can be used to monitor and control all City UPS systems from one central location, and power management can now be integrated into City's existing network or building management strategy. Alarms ('traps') can be configured to ensure automatic notification of events such as low battery, power outage or overload. MIBs are included with the product for integration into City's system management software.

Control and management functions are also available through any standard web browser (e.g., Internet Explorer, Netscape or Opera). Simply point City's browser to the network address assigned to the card, and the embedded web server returns web pages providing access to monitor or control all system parameters. The easy-to-use browser interface with online help means that minimum training is required to enable staff to effectively manage the UPS and protected devices. A sophisticated Java applet provides full system monitoring in real time, along with comprehensive event and history logs.

Features

1. Configurable from serial port or web browser
2. Management from SNMP manager or web browser
3. Supports standard UPS MIB
4. Firmware upgrades by TFTP via serial port
5. Full-featured GUI runs in web browser
6. Accessible from any workstation on the network using SNMP/HTTP, regardless of OS via standard browser
7. UPS Shutdown warning broadcast capability
8. Real-time monitoring of all functions
9. Full history logs
10. Scheduling functions
11. Supports: Linux, Novell, SCO Unix 5.x, SCO
12. Unixware 7.x, Solaris (x86) and Windows 2000, Me, XP, HP-UX, IBM-AIX, FreeBSD and other Linux derived Operating Systems
13. Supports Environmental Monitoring Device (EMD) that provides temperature and humidity sensing
14. Additional detection or sensing of motion, smoke, security devices, water sensor or vibration sensors is also supported
15. Certifications: CE, FCC Class B

Specifications

Power Input: DC 8V USHA internal 15V USHA external, DC power Module

Power Consumption: 3 watts

Operating Environment: 10 to 80% Humidity Non-condensing

Temperature: 0° C to 40° C

Regulatory Approval: FCC Class B, CE Class B

Warranty: 2 Years

Functional Information

Network Interface: One RJ-45 connector for 10Mb BASE-T Ethernet connection.

HTTP/HTTPs: Supports HTTP Protocol. Remotely monitor or manage UPS through Windows Internet Explorer or Netscape browsers.

SNMP: Supports SNMP Protocol. Centralized monitoring and management of the UPS can be accomplished by a Network Management System such as HP Openview.

Java Applet: Provides "Real Time" UPS status and data graphical format. Can be activated through selected browser for Real-time UPS status monitoring with graphical data.

TELNET: Provides alternative method for configuration of the UPS including automatic log-out function for additional security.

E-mail Notification: E-mail can be sent to the administrator or to pre-defined designated users based on mail configuration parameters.

Mobile Phone: With WAP support, administrator can either browse the UPS information or receive the UPS event short message (SMS) notification on users Cellular Phone.

PDA: Users can also browse UPS status and receive event status.

Language: Supports both English and simplified traditional Chinese.

Firmware Upgrades: Under the Windows environment, utilizing proprietary utility software, users can upgrade SNMP adapters internal firmware.

UPS Status Information

SNMP: Notify multiple hosts and pre-define the recipients for any warning messages. Java applet: Notify the administrator when there is a power event via pop-up dialog box at specified user terminals.

Shutdown Daemon: Notifies of power event to those servers or workstations (maximum of 72 stations) of the power event and starts the shutdown procedure to those systems that have the appropriate shutdown software installed.

Intelligent Shutdown Services

Schedule: UPS can be shut down on a pre-defined weekly schedule.

Special Day Schedule: UPS can be shut down on a pre-defined date and time.

Manual: UPS can be set to "Sleep" mode or to "Turn off" the UPS.

Unattended: When there is a utility power event, warnings/shutdown messages can be immediately sent to pre-defined users.

Outpost OP72C Batteries

Overview

Wide Temperature Applications. Deep Cycle. Field Tested and Used for Years by the US Military. 41 and 51 Ampere-Hour (AH) Ratings. 41AH – Standard. 51AH – Optional. Sealed, Maintenance Free - No Need to Add Water. Absorbed Glass Mat (AGM) Construction. Microporous Spun Glass Separators. Non-Spillable, Immobilized Electrolyte. Recombinant Gas Technology. Copolymer Polypropylene Case and Cover. Developed for Use on Military Jet Fighters.

Features

1. Pressure relief safety valves
2. Epoxy and heat sealed
3. Absorbed glass mat separator
4. Thick positive plates
5. Polyethylene envelope

Charging Requirements

- Initial Charge or Recharge: 2.37 to 2.40 volts per cell at 25° C (77° F).
- Float Charge: 2.23 volts per cell at 25° C (77° F).
- Equalize Charge: 2.40 volts per cell at 25° C (77° F).
- Temperature Compensation: ±3.75 mV per cell per degree Celsius referenced to 25° C (77° F). This is for battery temperature (not ambient temperature) and is useful for battery temperatures from -40° C to +74° C. No current limiting is required.
- Charge Retention: Clary Outpost™ Batteries retain charge five to ten times better than flooded or vented type batteries.

Recyclability

The Outpost™ AGM-VRLA batteries may be recycled at any smelter that processes lead acid automobile batteries. Due to the cadmium content used in their manufacturing process, some of the VRLA batteries are limited as to where they can be recycled.

Shipping

Outpost™ AGM-VRLA batteries have been tested by an independent laboratory to meet DOT shipping requirements for hazardous materials, 49CFR A Section 173.159. The testing requirements of 173.159 permit the batteries to be shipped as a non-spillable, wet electric storage battery and is exempt from the hazardous materials category.

Payment

The Contract unit price paid per **UPS System** shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for all the work complete and accepted in place as specified in these provisions.

3.14 CCTV Camera System

1. General

Provide a complete Dome Positioning system, including engineering, components, installation and commissioning Ath the intersection of Felipe Rd/La Mancha and Marquerite Parkway.

References

A. Reference Standards: Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this section:

1. Electronic Industry Association (EIA)
2. Federal Communications Commission (FCC)
3. National Television Systems Committee (NTSC)
4. Underwriters Laboratories Inc. (UL)
5. Institute for Electrical and Electronics Engineers (IEEE)
6. Open Network Video Interface Forum (ONVIF)

System Description

The remote dome positioning system shall have full HD 1080p30 image resolution with integral 30x optical zoom lens. The positioning system shall include true day-night with variable speed pan and tilt technology with a minimum sensitivity of 0.00025 fc @ 35 IRE. The remote Dome Positioning device shall provide up to five (5) or more independent output video streams configurable for H.264 and MJPEG and analog video output.

Submittals

A. Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use, including instruction manuals.

B. Shop Drawings: Submit complete shop drawings including connection diagrams for interfacing equipment, list of connected equipment, and locations for major equipment components.

C. Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings not later than Substantial Completion of the project.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the system installed. Include system and operator manuals.

E. Field Tests: Submit results of field testing of every device including date, testing personnel, retesting date if applicable, and confirmation that every device passed field testing.

F. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a one-year period for Owner's review. Maintenance shall include, but not be limited to, labor and materials to repair the system, provide test and adjustments, and regular inspections.

Quality Assurance

Manufacturer: Minimum ten years' experience in manufacturing and maintaining networked Dome Positioning system IP video recording systems. Manufacturer shall provide technical assistance and support.

Delivery, Storage, and Handling

Deliver materials in manufacturer's labeled packages. Store and handle in accordance with manufacturer's requirements, in a facility with environmental conditions within recommended limits.

Warranty

Manufacturer's Warranty: The warranty period shall be thirty-six (36) months from the delivery date of the system under normal use and service.

2. Products

General

All equipment and materials incorporated shall be standard components that are regularly manufactured and used in the manufacturer's product line.
All systems and components shall have been thoroughly tested and in actual use.

The specified product shall be manufactured by a firm whose quality system is in compliance with the I.S. EN ISO 9001:2008, QUALITY SYSTEM.

System Capabilities

The system specified herein shall provide an integrated network HD Dome Positioning System providing 1080p30 video with 30x auto focus zoom optics and 12x digital zoom capability.

The HD Dome Positioner shall incorporate H.264 and MJPEG compression and encoding technology for providing low bandwidth, low latency and high-quality video images transported over standard Ethernet infrastructures.

The HD Dome Positioner encoding system shall support dynamic video profile creation, allowing user flexibility in defining the quantity and properties of each video profile. This capability shall only be bounded by the encoder's pixels/sec processing budget. Use of this technology shall allow the following possible video stream configurations; H.264 Streams: (1) 1920x1080 @ 30fps, (1) 1280x720 @ 30 fps, (1) 720x480 @ 15 fps, (1) 720x480 @ 10 fps. MJPEG Streams: (1) 1920x1080 @ 10 fps, (1) 1280x720 @ 20 fps along with (1) analog video output signal.

The HD Dome Positioner shall provide hybrid capability delivering both Ethernet and analog composite video and RS422 serial connections for external system connections and control.

The HD Dome Positioning System positioning drive system shall provide wide dynamic range speed capability of 0.1 to 45 degrees per second, with a minimum of 0.1 degree repeatability, 360 degree continuous pan rotation, and +5 to –90 degree tilt range.

The HD Dome Positioner shall have sufficient holding torque to maintain operation with TS-2 vibration conditions for each pan and tilt function.

The HD Dome Positioning System shall include a web server allowing password-protected administration/configuration capabilities along with full camera and positioning system control and viewing functions.

The HD Dome Positioning System camera manufacturer shall provide a software development kit (SDK) for allowing third-party developers all necessary tools for integrating the HD Dome Positioning System into the City's control system environment.

The HD Dome Positioning System shall include an advanced OSD generation capability for indications of viewing direction, compass setting, azimuth/elevation position, location descriptors, time/date and City-defined image/logo.

The HD Dome Positioner shall provide an operating temperature range of +75° C to -40° C compliant with NEMA TS2 temperature profile.

The HD Dome Positioning System shall be designed for use in rugged and harsh operational environments conforming to NEMA TS2 requirements for power and shock and vibration.

The HD Dome Positioning System shall support ONVIF Profile S and NTCIP 1205 over IP interface for providing a standardized interoperability of third-party system equipment.

The HD Dome Positioning System units shall be fully assembled, purged, pressurized and tested at the original manufacturing facility and shipped as a complete unit, ready for installation and commissioning.

Performance Specifications

CAMERA IMAGING SYSTEM:

1. Image Sensor: Progressive Scan CMOS.

2. Image Size: Diagonal 6mm (⅓" type).

3. Image Resolution: 1920 horizontal x 1080 vertical pixels.

4. Picture Elements: (total) 1920 (H) x 1440 (V).

5. Sensitivity: Scene Illumination; F1.4 @ 50% Video.

   a. 0.4 Lux (0.04 fc) @ $^{1}/_{30}$ shutter, color mode.
   b. 0.0025 Lux (0.00025 fc) @ ½ shutter, mono mode.

6. Day/Night Operation: Adjustable (Auto, Color and Mono Modes) via removable IR cut filter.

7. Optical Zoom Range: 30x, 4.4mm to 132mm minimum.

8. Optical Zoom Speed: Three speeds, from approximately 3.5 seconds to 14 seconds full range.

9. Maximum Lens Aperture: f/1.4 (wide) to f/4.6 (tele).

10. Horizontal Angle of View: Optical: 63.4° to 2.1°.

11. Digital Zoom: 1x to 12x in 1x increments. The camera system shall support digital zoom limit setting.

12. Minimum Focus Distance: 1.0m.

13. Auto Focus, Selectable Auto/Manual: Minimum Scene Illumination for Reliable Auto Focus shall be no more than 50% video output. Auto Focus Function shall provide 3 sensitivity levels selectable by user.

    a. Low: Slower auto focus reaction provides more stability when viewing scenes with minimal changes.
    b. Normal (default): Auto focus reacts more conventionally to scene changes.
    c. High: Auto focus reacts faster and more often to scene changes.

14. Manual Shutter: Selectable shutter speeds shall be from ½ to $^{1}/_{30,000}$.

15. Auto Iris, Selectable Auto/Manual: Iris shall automatically adjust to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications.

16. Image Defog/Haze Analytics: Shall support Auto/Manual/Off Modes.

    a. Manual mode shall support 3 levels of defog/haze enhancement.
    b. Auto mode shall provide user configuration settings for strength level and color level. The auto defog/haze analytics shall apply the enhancement to maintain strength and color levels.

17. Electronic Image Stabilization (EIS): Shall support On/Off mode. EIS function shall automatically pause while PTZ functions are occurring and restore when no PTZ is occurring.

18. Wide Dynamic Range (WDR): 90db. Shall support On/Off mode. WDR On mode shall support user selectable settings of Normal, Combination, and Contrast.

19. Backlight Compensation (BLC): Shall support On/Off mode.

20. White Balance (WB): Shall support Auto/Manual Mode. Auto mode shall provide user selection of Normal, Sodium or Mercury lighting conditions.

21. Sharpness: Shall provide user control of increases or decreases in image sharpness through 4 user selectable settings of soft, normal, sharp and sharpest.
22. Noise Reduction (NR): Shall provide 4 user selectable levels.

    a. Normal: Automatically reduces frame noise without impact on overall image quality and sharpness.
    b. Medium: Reduces frame noise with minimal impact on overall image quality and sharpness.
    c. Strong: Reduces frame noise as much as possible while sacrificing image quality and sharpness.
    d. Fixed: User adjustable frame noise reduction from Low to High setting.

23. Enhanced Intensity: Shall enhance darker areas of the image. Shall support Off/Enhanced/Whiteout Reduction modes with user adjustable level from Low to High.

H.264/MJPEG Encoding Engine

The video encoding and profile management system shall utilize a dynamic architecture based on its encoding power for determining the video streams available. Use of this technology shall allow the following possible video stream configurations:

1. H.264 Streams: (1) 1920x1080 @ 30fps, (1) 1280x720 @ 30 fps, (1) 720x480 @ 15 fps, (1) 720x480 @ 10 fps.

2. MJPEG Streams: 1920x1080 @ 10 fps, 1280x720 @ 20 fps.

3. Analog Video Output: (1).

Each video encoder channel shall provide the following configurable properties:

Codec

1. H.264 Base Profile

2. H.264 Main Profile

3. H.264 High Profile

4. MJPEG

Resolution

1. HD 1920 x 1080, 1280 x 720

2. SD 720 x 480, 640 x 480

3. CIF 352 x 240, 320 x 240

4. QCIF 160 x 120

Frame Rate

1. Video frame shall be adjustable from 30 fps to 1 fps in increments of 1 fps.

Bite Rate Control

1. Variable Bit Rate

2. Constant Bit Rate

Bit Rate

1. Selectable from 256 Kbs to 8 Mbs

GOV Length

1. Selectable from 1 to 600 in increments of 1

Video Streaming Protocols; the camera system shall support the following streaming protocols:

1. RTSP/RTP: The RTSP communication shall occur over a TCP socket. RTP video packets shall be sent over UDP. This mode shall be available at all times for H264 and MJPEG encoded streams.

2. RTSP Interleaved: RTSP commands and the RTP video packets shall be transmitted over a single TCP connection. This mode shall be available at all times for H264 and MJPEG encoded streams.

3. HTTP Tunneling: this mode shall use two separate TCP connections for sending and the other for received data from the client over port 80. This mode shall be available at all times for H264 and MJPEG encoded streams.

4. RTP Multicast: this mode shall send RTP video packets to the user assigned multicast destination. This mode shall be required to be enabled or disabled. This mode shall be available for both H264 and MJPEG encoded streams.

Connection Types: Uni-cast, multi-unicast or multi-cast

Camera Video Latency: <135ms (4 frames maximum)

Network Protocol Layers: TCP, UDP, IPv4, IGMP, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, HTTPS, ARP, and ONVIF Profile S as a minimum

Positioning Drive

1. Pan Movement: 360 degrees continuous rotation

2. Pan Speed: Variable from 0.1 to 45 degrees/second using up to a minimum of 64 distinct speeds.

3. Pan Repeatability: +/- 0.1 degree precision

4. Pan Preset Speed: 180 degree movement 2 < Seconds

5. Tilt Movement: Minimum of +5 to –90 degrees

6. Tilt Speed: Variable from 0.1 to 45 degrees/second

7. Tilt Repeatability: +/- 0.1 degree precision

8. Tilt Preset Speed: 180 degree movement < 2 Seconds

9. Proportional Zoom Control: Positioning control shall allow variable pan/tilt speeds based on zoom position. This shall scale the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.

10. Holding Torque: The Positioner shall have sufficient holding torque to maintain operation under the following conditions:

    a. Capable of holding mechanical position and maintaining operation under TS-2 vibration for each pan and tilt function

11. Home Position: Shall be a user defined point where pan and tilt position is reported to be 0. This can be different from the mechanical home position.

    a. Home position commands include “get”, “set” and “go to”

12. The HD Dome Positioning System shall provide an internal heater blanket to prevent ice accumulation on the viewing area.

Operational Requirements

Required camera control functions shall include the following features and capabilities as a minimum; these functions shall be exposed as part of the HD Dome Positioning System web server.

1. Day/Night Mode: shall allow user control of Color, Mono and Auto modes of operation.

2. Shutter Speed: shall allow user control of shutter speed mode from ½ to $^{1}/_{30,000}$ setting.

3 White Balance: shall allow user control of auto or manual mode. If in manual mode, user shall be capable of adjusting red and blue color levels.

4. Maximum AGC Level: shall allow user selection of maximum AGC level of 1 dB up to 48db

5. Wide Dynamic Range: shall allow user control of setting mode to on or off.

6. Backlight Compensation: shall allow user control of setting mode to on or off.

7. Properties: Allows user to save and recall a specific user defined configuration camera property settings or return to factory default configuration.

8. Lens Properties: allow user control of the following features:

   a. Focus, Auto or Manual Mode: If in manual mode, user shall be capable of adjusting focus near/far settings
   b. Iris, Auto or Manual Mode. If in manual mode, user shall be capable of adjusting iris open/close settings
   c. Speed: Allow user control of normal or fast zoom lens speed.

9. Zoom Lens Control: provide three types of control functions for the zoom lens as follows:

   a. Continuous: Allows user to zoom in or out as necessary on a continuous basis.
   b. Absolute: Allows user to select an explicit zoom level the lens should be set at.
   c. Digital: Provide client side capability to digitally zoom up to 12x of the displayed image.

Required positioning control functions shall include the following features and capabilities as a minimum:

1. Pan/Tilt Positioning

   a. Movements: The HD Dome Positioning System positioning system shall allow continuous 360 degree azimuth (pan) rotation and +5 to - 90 degree elevation (tilt) movement.
   b. Variable Speed: The HD Dome Positioning System shall provide variable speed azimuth and elevation capability using a minimum of up to 64 distinct speed settings ranging from 0.1 to 45 degrees/second.
   c. Vector Positioning: The HD Dome Positioning System shall be capable of simultaneous pan and tilt movements.
   d. Scalable Zoom: Variable speed pan/tilt ranges based off of zoom position. This adds the capability of limiting the maximum pan/tilt speed, while maintaining variable speed capability, throughout the zoom range of the camera.

2. Presets: Minimum of 512, with each preset consisting of a pan, tilt, zoom and focus, preset ID label and image freeze state. When a preset position is recalled the corresponding preset ID shall be displayed. The preset ID shall remain displayed until a pan, tilt, zoom or another preset command is received.

3. Preset Tours: Minimum 512 tours required, each tour shall consist of up to 512 pre-programmed presets, with individual dwell time and preset speed property per preset per tour.

    a. Each Tour shall include direction (forward/backward) and recurrence (continuous, cycles or duration) properties for customizing tour operation.
    b. Tours shall stop upon receipt of any pan/tilt positioning command.
    c. Tour data shall be stored in non-volatile memory and shall not be lost if a power failure occurs.

4. Auto-Park Mode: Shall allow user to set a park [home] position, where the camera system will return to upon the following conditions:

    a. Park properties shall consist of pan, tilt, zoom, and focus coordinates, timer value [1-999 seconds], and enable/disable mode.
    b. An auto- park event shall occur when enabled using the following triggers.
    c. Power recycles.
    d. Timer expiration. Timer resets upon each user command.

Privacy Masks; shall support Privacy Masks to conceal user-defined rectangular areas

1. Up to 16 Individual Masks can be programmed

2. Any or all of the 16 Privacy Masks can be placed within the cameras field of view

3. Privacy Masks can overlap adjacent Privacy Masks

4. The Privacy Mask(s) scale in size relative to the cameras zoom position

5. The Privacy Mask(s) move relative to the camera system pan and tilt position

6. Each Mask shall be able to be enabled or disabled

7. All Privacy Masks share the following properties: Color Selection, Transparency or Mosaic setting

Updates: The HD Dome Positioning System shall allow updates of firmware for new features via the Ethernet network communication channel. An internal HD Dome Positioning System web server shall be provided for performing this task.

The HD Dome Positioning System shall return to previous position and state of operation upon power loss and restoration.

Communication Protocols and Formats

The HD Dome Positioning System shall include integrated video camera system communication drivers for flexibility and system interoperability. The HD Dome Positioning System camera system shall support both serial RS422 and Ethernet communication channels at a minimum, allowing field selection of the following protocol drivers as required:

1. Ethernet Channel (IP)

    a. NTCIP 1205
    b. ONVIF Profile S
    c. CohuToken

2. Serial RS422 Channel

    a. Cohu Serial
    b. Pelco D

On-Screen Display (OSD)

The HD Dome Positioning System shall provide OSD capabilities on both digital video and analog video outputs as defined below. The camera system shall support a minimum of 8 OSD elements for inclusion in each video stream. The available OSD elements shall include at a minimum:

1. Camera Title/Location Description
2. Date/Time
3. PTZ Position
4. Compass Position
5. Sector Zone Title
6. Preset Title
7. Event Title
8. Maintenance Display
9. Logo Display

The displayed OSD element shall include the following configurable properties.

1. OSD Position: Top left, top right, bottom left, bottom right or customized [x, y coordinate].
2. OSD Size: The displayed OSD size shall scale based on the video stream resolution and the OSD size property. The size properties shall include small [4% of Image Resolution], Medium [5% of Image Resolution] or Large [6% of Image Resolution].
3. Logo: The camera system shall support multiple image files in .bmp format to be uploaded, allowing users to select a specific image file for displaying on video streams.

Maintenance Functions

The camera system shall support maintenance features as defined below:

1. The camera system shall support querying of camera parameters via the Ethernet connection. The camera parameters shall consist of the following items
    a. Serial number
    b. Software revision
    c. Assembly date
    d. Camera Model Number
2. Internal Temperature Monitoring and Reporting
3. Remote Software Upload/Updates via Ethernet
4. Camera Device Auto Discovery of IP address
5. Camera System Reset
6. Save and Restore camera system start-up configuration

IP/Network Management

1. The HD Dome Positioning System shall provide at minimum the following network configuration properties:

   a. IP Configuration: DHCP or Static IP address entry
   b. Net mask address entry

2. Gateway address entry

3. Domain name entry

4. DNS server entry

Power Input

1. The HD Dome Positioning System shall fully comply with Nema TS-2 standards and include independent laboratory test results confirming compliance with the following electrical operating conditions:

   a. Power: <60 Watts @ maximum load
   b. Operating Voltage: The camera system shall provide flexible power input options as required by the installation to include:

      1) Power over Ethernet, LTPoE++™ @ 60W
      2) Optional 24Vac, +/- 10%

2. Earth Ground: Continuity shall be provided through the shield of the CAT5e Ethernet/PoE++ cable, and the shield of the multi-conductor cable, to chassis ground of the Base Enclosure. Connecting either, or both, of these shields to earth ground at the control side shall apply earth ground to chassis ground of the Base enclosure.

Mechanical Specifications

1. Connectors; 18 Pin MS style PT06E-14-18S(SR) weatherproof non-corrosion type or equal.

2. Weight: Maximum 14lbs (6.3kg).

3. Dimensions: Housing shall be 11.05” outer diameter x 11.66” Height. Dome acrylic shall be less than 7.00” diameter.

4. Construction: Powder Coated 6061 T6 aluminum; all internal and external parts corrosion protected, stainless steel fasteners, and shall use only optically corrected acrylic for dome bubble.

5. Camera Mount: 1.5” NPT.

Environmental Requirements

1. The HD Dome Positioning System shall fully comply with and include test results confirming compliance with the following environmental operating conditions:

   a. IP67 Ingress Protection; The camera system shall have no moisture ingress and shall operate correctly after testing to MIL-STD-810G, Method 512.4 at a depth 1.0m for a minimum duration of 30 minutes.

2. Temperature: The system shall operate correctly in the temperature range of -40° C (-40° F) through +75° C (+167° F), tested across low and high voltage ranges per NEMA TS2, para. 2.2.7.3 - 2.2.7.7, Profile 2-1.

3. Vibration: The camera PTZ functions shall operate nominally during and after vibration Per Nema-TS2 paragraphs 2.1.9, 2.2.3, 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.

4. Shock: Per Nema-TS2 paragraphs 2.1.10, 2.2.4, 10g applied in each of 3 mutually perpendicular planes.

Certifications

1. FCC Class A
2. IEC/CE CISPR 22 24
3. RoHs

Warranty Information

Manufacturer's Warranty: The warranty period shall be thirty six (36) months from the delivery date of the system under normal use and service.

3. EXECUTION

Examination

Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

Do not begin installation until unacceptable conditions are corrected.

Preparation

Protect devices from damage during construction.

Installation

1. Install devices in accordance with manufacturer's instruction at locations indicated on the floor drawings plans.
2. Perform installation with qualified service personnel.
3. Install devices in accordance with the National Electrical Code or applicable local codes.
4. Ensure selected location is secure and offers protection from accidental damage.
5. Location must provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.

Field Quality Control

1. Test snugness of mounting screws of all installed equipment.
2. Test proper operation of all video system devices.
3. Determine and report all problems to the manufacturer's customer service department.

Adjusting

Make proper adjustment to video system devices for correct operation in accordance with manufacturer's instructions.

Make any adjustment of camera settings to comply with specific customer's need.

Demonstration

Demonstrate at final inspection that video management system and devices functions properly.

Payment

The Contract unit price paid per **CCTV camera system** shall include full compensation for furnishing all labor, materials, equipment, tools and incidentals and for all the work complete and accepted in place as specified in these provisions.

City of Mission Viejo Specifications

Cabinet Specifications

CITY OF MISSION VIEJO

Standard Plans

Standard plans referred to on the traffic signal plans and the Special Provisions shall conform to the latest edition of the State of California Department of Transportation Standard Plans (Caltrans Standard Plans).

Standard Specifications

All work shall conform to the latest edition of the State of California Department of Transportation Standard Specifications (Caltrans Standard Specifications) and the following Special Provisions.

Equipment List and Drawings

One (1) set of Mylar copy, five (5) sets of bond copy, and one (1) set of electronic copy on CD of cabinet schematic diagrams shall be furnished for each applicable traffic signal location. No other type of reproducible material shall be allowed in place of Mylar copy.

The controller cabinet schematic wiring diagrams shall be provided on 24” x 36” sheets. One schematic wiring diagram shall be provided for left wall, back wall, right wall, and door. The intersection sketch shall be provided on cover sheet with north up.

Contractor shall furnish two (2) maintenance and operation manuals for all controller units, conflict monitors, auxiliary control equipment, vehicle detector sensor units, and amplifiers. The manuals shall be submitted at the time the equipment is delivered for testing. The manuals shall include, but not limited to, the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Detailed circuit analysis
6. Troubleshooting procedure (diagnostic routine)
7. Voltage charts with wave forms
8. Geographical layout of components
9. Schematic diagrams
10. List of replaceable component parts with stock numbers

All manuals and documents furnished by the Contractor shall be placed inside a heavy duty, clear plastic envelope. The envelope shall be attached to the inside of the controller cabinet door.

Testing

The testing of traffic signal equipment, including controller units, fully-wired signal cabinets and auxiliary equipment as specified in Section 86-3, "Controller Assemblies", shall be performed by a testing facility designated by the City.

CONTROLLER ASSEMBLIES (Section 86-3)

Add the following:

1. Controller/Cabinet Assemblies

New complete Controller/Cabinet Assemblies including controller, completely wired cabinet and appurtenances shall be supplied by Econolite Control Products.

Solid-state traffic actuated controller units, cabinets and auxiliary equipment shall conform to the provisions in Section 86-3, ”Controller Assemblies”, these Special Provisions, and NEMA TS-2 standards.

Contractor shall furnish and install Econolite ASC/3-2100 TS2 Type 2 Controller unit in new signal cabinets as indicated on the plans.

Contractor shall provide miscellaneous items as necessary to produce a fully-operational system in accordance with the specifications and Caltrans Standard Plans and Standard Specifications. Power distribution panel, inside auxiliary control panel, police panel and all detector termination panels shall be hard wired.

2. Cabinet Assembly

For the new cabinet assemblies, Contractor shall furnish and install Type “P-44” unpainted aluminum cabinet assembly as indicated that includes the following items:

i. One (1) - Fully wired eight (8) phase NEMA TS2 Type 2 “P-44” unpainted aluminum cabinet.

ii. One (1) - Econolite ASC/3-2100 TS2 Type 2 Controller unit with data key, ~~and~~ Ethernet port and FSK module.

iii. One (1) - Malfunction Management Unit with LCD display (programmed for the intersection).

iv. Up to ~~T~~two (8) position TS2 detector racks with (8) two-channel detection as indicated on plan and one (1) Bus Interface Unit, per rack.

v. Sixteen (16) position load bay.

vi. Twelve (12) load switches.

vii. One (1) - Controller cabinet power supply.

3. Cabinet Construction

A complete NEMA TS2 Type 2 "P-44" cabinet shall be supplied. Cabinet shall meet, as a minimum, all applicable sections of the NEMA Standard Publication. Where differences occur, this specification shall govern. The cabinet shall meet the following criteria:

i. Material shall be aluminum sheet, 5052-H32, with a minimum thickness of 0.125-inch.

ii. The cabinet exterior shall be aluminum finish painted rustic brown aluminum with a white interior.

iii. The door hinge shall be of the continuous type with a stainless steel hinge pin.

iv. The door handle shall be cast aluminum.

v. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet.

vi. Cabinet lock shall be of the Corbin No. 2 type.

vii. The cabinet shall have four (4) sets of cabinet wiring diagrams.

viii. The cabinet shall have one (1) set of equipment manuals (Controller, MMU, etc.).

Shelves

Two (2) aluminum shelves extending completely across the back of the cabinet in the top cabinet area.

1. The first aluminum shelf extending completely across the back of the cabinet shall be provided to support the detector rack(s) and power supply.

2. The second aluminum shelf extending completely across the back of the cabinet shall be provided to support the controller and master (if required) and the MMU. The second aluminum shelf shall also have an Econolite 34448G2 pull out drawer or City approved equivalent installed.

Equipment Accessibility

All mounted panels and equipment shall have a minimum tool access clearance of 6".

Ventilating Fan

The cabinet shall be provided with one (1) thermostatically-controlled ventilation fan, adjustable between 80 to 150 degree F and shall be installed in the top of the cabinet plenum.

Air Filter Assembly

The cabinet Air Filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite Part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

Cabinet Light Assembly

The cabinet shall be equipped with an LED lighting fixture mounted on the inside of the cabinet near the front edge. The LED light shall be activated by an On/Off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

~~The cabinet shall have a gooseneck type lighting fixture that shall be mounted on the inside of the door near the hinge. The gooseneck light shall be activated by an On/Off switch that is turned on when the cabinet door is opened and turned off when the door is closed.~~

Lightning Suppression

The cabinet shall be equipped with an EDCO Model SHP-300-10 surge arrester, or City approved equivalent.

Power Panel

The Power Panel shall house the following equipment:

1. One (1) 40 Amp main breaker to supply power to the main panel, controller, MMU, and cabinet power supply.

2. One (1) 15 Amp auxiliary breaker to supply power to the fan, light, and GFCI outlet.

3. One (1) 50 Amp, 125 VAC radio interference line filter.

4. One (1) normally-open, 60 Amp, Crydom Model #HA8475 solid state relay, or City approved equivalent.

Convenience Outlet

Two (2) duplex outlets shall be supplied, as per the following:

1. The first is for short-term equipment use, 120 volt AC, 15 Amp NEMA 5-15 GFCI duplex outlet, and shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

2. The second is for long-term equipment use, 120 volt AC, 15 Amp NEMA duplex outlet, and shall be mounted in the upper right corner of the cabinet facing the inside of the cabinet. Power shall be supplied from un-switched filtered power.

Inside Auxiliary Control Panel Switches

The inside door panel shall contain three (3) switches: Auto/Flash, Auto/Off/On Stop-Time, and Power On/Off. Auxiliary door panel switches shall be hard wired; printed circuit boards shall not be used.

1. Auto/Flash Switch (2-Position) In the Auto position, the intersection shall operate normally. In the Flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

2. Auto/Off/On Stop-Time Switch (3-Position) In the Auto position, the controller shall be stop timed when the police door Auto/Flash Switch is in the Flash position or MMU flash. In the Off position, the switch shall release all stop time from controller. In the On position, the switch shall maintain a continuous stop time to the controller.

3. Controller Power On/Off Switch (2-Position) This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

Police Panel Switches

The Police Panel shall contain two (2) switches: Signals On/Off and Auto/Flash. All police panel switches shall be hard wired; printed circuit boards shall not be used.

1. Signals On/Off Switch (2-Position) In the On position, the field displays shall show either normal operation or flash. In the Off position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. In the Off position, the MMU shall not conflict or require reset.

2. Auto/Flash Switch (2-Position) In the Auto position, the intersection shall operate normally based on all other switches. In the Flash position, power shall not be

removed from the controller and stop time shall be applied based on the Stop-Time switch.

Cabinet Wiring

Cables
All Controller and MMU cables shall have sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length.

All cabinet wiring shall be color coded as follows:

Purple	=	Flash Color programming
Brown	=	Green Signal wiring
Yellow	=	Yellow Signal wiring
Red	=	Red Signal wiring
Blue	=	Controller wiring
Gray	=	DC ground return, logic ground
Black	=	AC positive
White	=	AC negative
Green	=	Chassis

Main-Panel and Wire Terminations

All wires terminated behind the main-panel and other panels shall be soldered. No pressure or solder-less connectors shall be used. Printed circuit boards shall not be used on main panels.

Flashing Operation

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash Red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

Detector Rack and Interface

~~Two (2)~~ TS-2 Vehicle Loop detector racks with field termination panel, TS-2 power supply, and SDLC cable shall be provided. Each individual rack shall support up to sixteen (16) channels of loop detection, four (4) channels of emergency vehicle pre-emption (EVP) detection and one (1) BIU. The number of racks installed shall be determined by the number of detection channels required on the signal plans.

Additional spare SDLC connection (for audible pedestrian push button central control unit connectivity).

Main Panel Configuration

The main panel shall be fully wired in the following configuration:

1. Sixteen (16) load sockets.
2. Six (6) flash transfer relay sockets.
3. One (1) flasher socket.
4. Wiring for both Type 1 and Type 2 Controllers.
5. Wiring for one Type 16 MMU.

Field Terminal Locations

Field terminals shall be located at the bottom of the main panel and angled forward for easy viewing and wiring. The order shall be from left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

Cabinet Equipment

Detectors

New cabinets shall be equipped with the proper number of detectors, as required.

Controller Unit

New cabinets shall be equipped with one (1) ASC/3-2100 Econolite TS2-Type 2 controller.

Malfunction Management Unit (MMU)

New cabinets shall be equipped with a NEMA TS2 Type 16 MMU with the latest current released software. MMU jumper cards shall be programmed to specific intersection's requirements.

Bus Interface Unit (BIU)

BIU's shall meet all TS2-1992, Section 8 requirements. In addition, all BIU's shall provide three (3) separate front panel indicators: Power, Valid Data, and Transmit.

Cabinet Power Supply

The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator LED for each of the four (4) power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

Interconnect Termination

New cabinets shall be supplied with interconnect termination and sub-base assembly.

Flasher Unit

All flasher units shall meet NEMA TS-2, Section 6 requirements and shall be EDI Model 810, or City approved equivalent.

Intersection Diagram

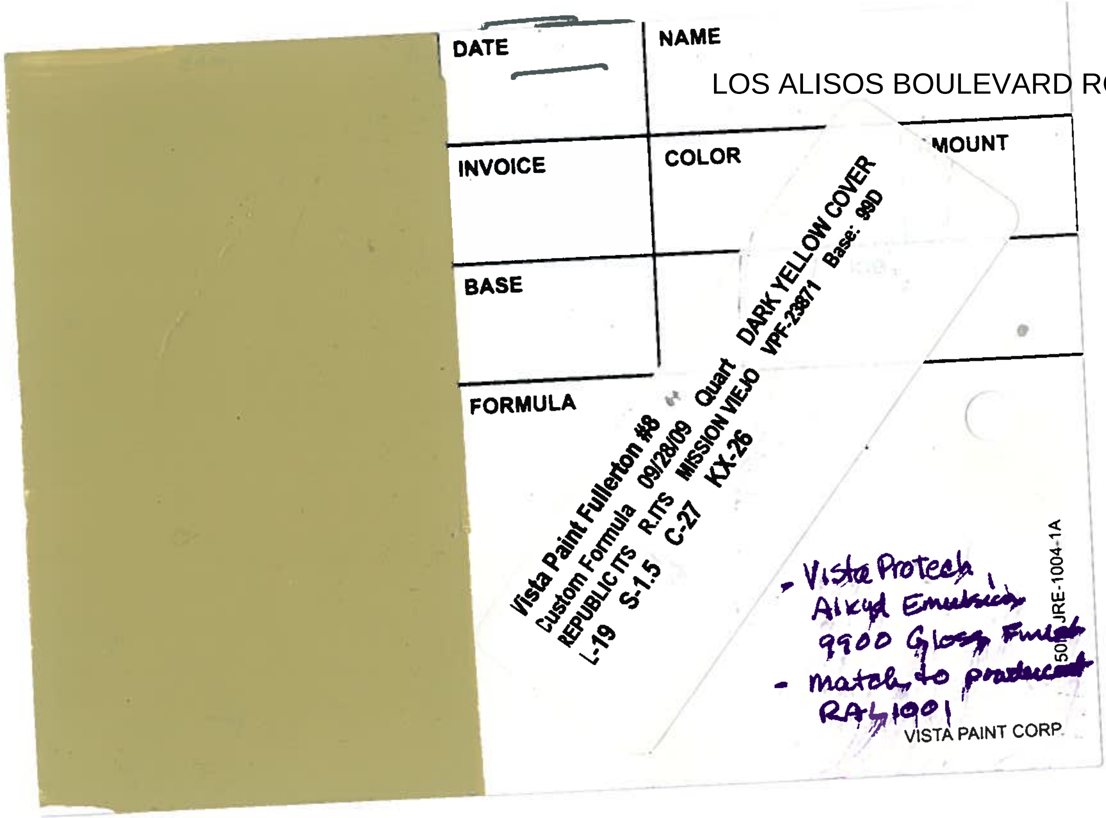
For the new cabinets, an intersection diagram prepared in AutoCAD shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the Auxiliary Panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and north arrow. The top of the diagram will be north and the diagram shall be pre-approved by the City Engineer.

Cabinet Wiring Diagram

New cabinet wiring diagrams shall be arranged on three (3) separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second sheet everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the City Engineer.

City of Mission Viejo Specifications

Paint Sample


DATE
NAME
INVOICE
COLOR
MOUNT
BASE
FORMULA
Vista Paint Fullerton #8
Custom Formula 09/28/09 Quart DARK YELLOW COVER
REPUBLIC ITS R.ITS MISSION VIEJO VPF-23871 Base: 99D
L-19 S-1.5 C-27 KX-26
- Vista Protech
Alkyd Emulsion
9900 Gloss Finish
- match to product
RAL 1001
JRE-1004-1A
VISTA PAINT CORP.

City of Mission Viejo Specifications

Traffic Signal Plan Submittal Sheet

CITY OF MISSION VIEJO
TRAFFIC SIGNAL PLAN SUBMITTAL SHEET

INTERSECTION: _____ IMPROVEMENT PLAN CHECK NO.: _____

TRACT/PM NO.: _____ PLAN NAME: _____

TENTATIVE TRACT/PM NO.: _____ GRADING PERMIT NO.: _____

SUBMITTED BY: _____ RECEIPT NO.: _____

COMPANY: _____ RECEIVED BY: _____

TELEPHONE: _____ DATE: _____

THE FOLLOWING ITEMS MUST ACCOMPANY EACH SUBMITTAL:

FIRST CHECK

- ☐ 4 Sets of prints (must be signed) (with title sheet, standard details, and plotted sight distance)
- ☐ 2 Cost estimates
- ☐ 2 Tract maps
- ☐ Street improvement plan (for reference only)
- ☐ 2 Signed conditions of approval
- ☐ 2 Sets of specifications
- ☐ Microfilm/Scanning fee of $50
- ☐ Pre-inspection fee of $400

SUBSEQUENT CHECKS

- ☐ 3 Sets of prints
- ☐ Previous check print

FINAL SUBMITTAL FOR CITY APPROVAL

- ☐ Originals (all sheets must be stamped and signed by civil engineer)
- ☐ 1 Set of prints

REQUIRED PLANS AFTER APPROVAL

- ☐ Originals
- ☐ 3 Sets of prints (1 folded, 2rolled)
- ☐ 3 Additional sets of prints if applying for encroachment permit (folded)

Cost Estimate Amount	Deposit	Cost Estimate Amount	Deposit
1 Lot – Homeowner	$395	$200,001 – $500,000	$6,000
$1 – $50,000	$1,500	$500,001 – $1,000,000	$9,000
$50,001 – $200,000	$3,000	$1,000,001 – Up	$10,000

☐ Extraordinary Overtime plan check requested: ☐ No ☐ Yes (App. Initials) _____
(Plan check fees will be 1½ times standard fees)

REVISION SUBMITTAL:

1. Submit one print with revisions ***marked in red*** or ***highlighted*** for City Engineer's review and fee determination.
2. Check print will be returned with any corrections or changes needed.
3. Submit one revised print with the corrections or changes highlighted, last check print, and originals for the City Engineer's review and approval. Pay any additional fees as required.
4. After revision has been approved, City requires three sets of prints and the approved originals (reduced Mylar set if plans are larger than 24" by 36").

NOTE: Upon completion of the project, as-built plans, the timing chart, wiring diagram, and reduced 11” x 17” in KP-5 paper are required of approved as-built plans. See the handout titled “As-Built Submittal Process” available from Public Works.

City of Rancho Santa Margarita Specifications

Type “P” Controller Cabinet Specifications

Type “P” Controller Cabinet Specifications

E-XV SIGNALS AND LIGHTING

FUNCTIONAL TESTING

Testing shall conform to the provisions in Sections 86-2.14B and 86-2.14C, "Field Testing," and "Functional Testing", respectively, of the Caltrans Standard Specifications and these Special Provisions.

The Contractor shall submit the wiring schematic of the controller cabinet assembly for approval once design is completed (before assembly) to the City Engineer. The Contractor will be responsible for all the costs involved in testing the controller cabinet assembly, including transportation to and from the testing facility. Contractor is responsible for ordering and purchasing the controller cabinet assembly as specified in the following Section 86-3, “CONTROLLER ASSEMBLIES”.

In lieu of state testing, the testing of traffic signal equipment, including controller units, fully-wired cabinets and auxiliary equipment as specified in Section 86-3, "Controller Assemblies", of the Caltrans Standard Specifications will be performed by a testing facility designated by the City Traffic Engineering Section. Approximately **21 calendar days** will be required for testing and notification of the final results.

Contractor shall be responsible for having the new cabinet assembly tested by the Econolite Systems Testing Lab, located at 1250 E. La Palma Avenue, Anaheim, CA 92807, unless otherwise approved by the City Engineer. The testing facility shall contact City Engineer or its representative when controller assembly is available for inspection. After completion of testing, Econolite Systems will notify the contractor that the equipment is available for pickup.

The Controller supplier will be responsible for all the costs involved in testing the controller cabinet assemblies, including transportation to and from the testing facility. Contractor is responsible for ordering and purchasing the controller cabinet assembly as specified in the following section, SOLID STATE TRAFFIC ACTUATED CONTROLLERS. Cabinets shall not be released to the Contractor until full payment for testing is received by the testing agency.

It shall be the Contractor's responsibility to arrange pick-up and delivery of these items to the project site. Any cost involved to deliver and install these items at the project site shall be borne by the Contractor, and no additional compensation shall be allowed there for.

In addition to the five days of continuous satisfactory operation, called for in Section 86-2.14C, "Functional Testing," of the CALTRANS Standard Specifications, five more days of satisfactory operation will be required when the signal system is connected to the City's Master System Controller.

Turn-on of the traffic signal systems shall not be made on a Friday or the day preceding a legal holiday. The City Traffic Engineer shall be notified 48 hours prior to the intended "turn-on". If turn-on is to be on a Monday, notification shall be made no later than the Thursday prior to turn-on. **Turn-on shall begin before noon of the approved day.**

Following notification, Contractor must complete a satisfactory "turn-on" within or his representative shall determine what a reasonable time will be. When a "Turn-on" is not completed, as specified above, it shall be canceled and rescheduled with the Traffic Engineer.

E-XV SIGNALS AND LIGHTING (Cont'd)

The signal-monitoring unit (MMU) shall be tested in the field before "turn-on".

A knowledgeable representative for the manufacturer of the traffic signal controller equipment and components shall be present for the first day of the functional test.

The insulation resistance shall not be less than 100 megohms on all interconnect and loop circuits and 50 megohms for power circuits when the megger tests are performed. Testing shall not be conducted until all control and/or sensor units and probes have been disconnected from the circuit.

The fifth paragraph in Section 86-2.14C, "Functional Testing," of the Caltrans Standard Specifications is amended to read:

During the test period, the City will pay the cost of electrical energy for the operation of the facilities that are undergoing testing. The cost of any maintenance necessary, except electrical energy, shall be at the Contractor's expense and will be deducted from any monies due, or to become due to the Contractor.

SOLID STATE TRAFFIC ACTUATED CONTROLLERS

Solid-state traffic actuated controller units, cabinets and auxiliary equipment shall conform to the provisions in Section 86-3 "Controller Assemblies" of the Caltrans Specifications, these Special Provisions, and NEMA TS-2 standards. Where differences occur, this specification shall supersede. The cabinet shall meet the following criteria:

Controller/Cabinet Assembly

Contractor shall furnish Aries ready Econolite Cobalt TS2 Type 2 system Controller unit and appurtenances. Signal cabinets shall have an unpainted aluminum finish.

Contractor shall furnish and install Type "P" non "Plug N Go" cabinet and assemblies, which include the following items:

a. 1 - Fully wired (8) eight-phase NEMA TS2 Type 2 "P" cabinet.
b. 1 - Econolite Aries System ready Cobalt controller with 25 pin FSK module, ethernet port, data key, and SD card.
c. 1 - Malfunction Management Unit with LCD display (programmed for each specific intersection).
d. 1 – 8 position detector rack with 16 channels of detection and 1 bus interface unit.
e. 16 position load bay.
f. Load switches.
g. 1 - Controller cabinet power supply.

Cabinet Construction

A complete NEMA TS2 Type 2 “P” cabinet shall be supplied. Cabinets shall meet, as a minimum, all applicable sections of the NEMA Standard Publication. Where differences occur, this specification shall govern. The cabinets shall meet the following criteria:

a. Material shall be 5052-H32 0.125-inch thick aluminum.
b. The cabinet exterior and interior shall be unpainted aluminum finish as indicated.
c. The door hinge shall be of the continuous type with a stainless steel hinge pin.
d. The door handle shall be cast aluminum.
e. All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet.
f. Cabinet lock shall be of the Corbin No. 2 type.
g. Each cabinet shall have 4 sets of cabinet wiring diagrams.
h. Each cabinet shall have 1 set of equipment manuals (Controller, MMU, etc.).
i. For cabinets that are installed to replace existing cabinets, existing communications, CCTV, BBS equipment, and alternative detection systems shall be moved to the new cabinet and verified operational on day of “Turn On”.
j. Cabinets shall be constructed to accommodate existing attached items such as existing Type ll service, BBS cabinet, exterior conduit(s), etc. as well as interior items referred to in (i).

Shelves

Two (2) aluminum shelves extending across the back of the cabinet shall be provided to support the controller and any required auxiliary equipment. The rear of each shelf shall be turned upward in order to prevent any shelf mounted equipment from coming in contact with the back wall or electrical panels. The first aluminum shelf shall be the top shelf, and extend completely across the back of the cabinet. It shall be provided to support the detector rack(s), power supply, and other ancillary equipment. The second aluminum shelf extending completely across the back of the cabinet, shall be provided to support the controller and the MMU. The shelves or any other appurtenances shall not interfere with the lowering or removal of the main panel.

Equipment Accessibility

All mounted panels and equipment shall have a minimum tool access clearance of 6".

Ventilating Fan

The cabinet shall be provided with a thermostatically-controlled ventilation fan (adjustable between 80 –150 F) and shall be installed in the top of the cabinet plenum.

Air Filter Assembly

The cabinet Air Filter shall be a one-piece removable, medium efficiency, synthetic, pleated (Econolite Part No. 57389P11) air filter and shall be firmly secured to the air entrance of the cabinet.

Cabinet Light Assembly

The cabinet shall be equipped with an LED light fixture that shall be mounted on the inside of the cabinet near the front edge. This light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the door is closed.

The cabinet shall have a gooseneck type LED lighting fixture mounted on the inside of the cabinet near the hinge. The gooseneck light shall be activated by an on/off switch that is turned on when the cabinet door is opened and turned off when the cabinet door is closed.

Computer table/drawer

A roll out computer table/drawer shall be mounted at a location designated by the City Representative.

Lightning Suppression

The cabinet shall be equipped with an HESCO/FLS-HE-300-15, or City-approved equivalent surge arrester.

Power Panel

The Power Panel shall house the following equipment:

a. A 40-amp main breaker shall be supplied. This breaker shall supply power to the main panel, controller, MMU and cabinet power supply.
b. A 15-amp auxiliary breaker shall supply power to the fan, light and GFCI outlet.
c. A 50 amp, 125 VAC radio interference line filter.
d. A normally-open, 60-amp, mercury contactor, Durakool Model BBC-7032, or City-approved equivalent.

Convenience Outlet

Two types of outlets shall be supplied, as per the following:

a. The first is a duplex outlet for short-term equipment use and shall be a 120 volt AC, 15 Amp NEMA 5-15 GFCI duplex outlet shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

b. The second is for long-term equipment use and shall be a 120 volt AC,

15 Amp NEMA power strip(s) or panel(s) conveniently located and sufficient to provide power to all existing ancillary equipment. Power shall be supplied from un-switched filtered power.

Inside Auxiliary Control Panel Switches

The inside door panel shall contain three (3) switches: Auto/Flash; Stop Time and Controller; and Power On/Off. Auxiliary door panel switches shall be hard wired only. No printed circuit boards shall be used for the door panel switches.

2-Position Auto/Flash Switch

In the Auto position the intersection shall operate normally. When in the Flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash. A guard shall be installed to prevent the switch from being shut off accidentally.

3-Position Auto/Off/On Stop-Time Switch

When in the Auto position the controller shall be stop timed when the police door AUTO/FLASH switch is in the flash position or MMU flash. If in the Off position the switch will release all stop time from controller. In the On position the switch shall maintain a continuous stop time to the controller.

2-Position Controller Power On/Off Switch

This switch shall control the controller's AC power. A guard shall be installed to prevent the switch from being shut off accidentally.

Police Panel Switches

The Police Panel shall contain two (2) switches: 1) SIGNALS ON/OFF and 2) AUTO/FLASH. All police panel switches shall be hard wired.

2-Position Signals On/Off Switch

In the On position the field displays shall show either normal operation or flash. In the Off position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. In the Off position, the MMU shall not conflict or require reset.

In the Auto position the intersection shall operate normally based on all other switches. In the Flash position, power shall not be removed from the controller and stop time shall be applied based on the STOP TIME switch.

Cabinet Wiring

Cables

All Controller and MMU cables shall be of sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length. Cables shall not obstruct the display or use of any cabinet equipment.

All cabinet wiring shall be color coded as follows:

Purple	=	Flash color programming
Brown	=	Green Signal Wiring
Yellow	=	Yellow signal wiring
Red	=	Red signal wiring
Blue	=	Controller wiring
Gray	=	DC ground(return),(logic ground)
Black	=	AC+
White	=	AC-
Green	=	Chassis

Main-Panel and Wire Terminations

All wires terminated behind the main-panel and other panels shall be soldered. No pressure or solderless connectors shall be used. Printed circuit boards shall not be used on main panels. The main panel shall have a minimum clearance of 4 inches from the cabinet floor.

Flashing Operation

Cabinet shall be wired for NEMA flash. All cabinets shall be wired to flash red for all phases. Flashing display shall alternate between phases 1, 4, 5 and 8, and phases 2, 3, 6 and 7.

Detector Rack and Interface

A minimum of one vehicle loop detector rack and one detector interface panel shall be provided in each cabinet. Each rack shall support up to sixteen (16) channels of loop detection and one (1) BIU. Detector rack shall be labeled for each detector channel used, and shall correspond with the cabinet door diagram. Labeling shall be a minimum of an 11 pt. font.

Main Panel Configuration

The main panel shall be fully wired in the following configuration:

a. Sixteen load sockets.
b. Six flash transfer relay sockets.
c. One flasher socket.
d. Wiring for Type 2 Controllers.
e. Wiring for one Type -16 MMU.

Field Terminal Locations

Field terminals shall be located at the bottom the main panel, angled forward for easy viewing and wiring. Their order shall be left to right beginning with phase one and following the order of the load switches. Field terminals shall be of the barrier type.

Cabinet Equipment

Loop Detectors, Load Switches, Flashers, and Relays
Cabinet shall be equipped with the proper number of loop detectors, load switched, flashers, and relays to perform the intended operation.

Controller Unit
Cabinet shall be equipped with one (1) Econolite Cobalt TS2 Type 2 system controller complete with the latest Econolite recommended software and operating system, and shall be equipped with a 25 pin FSK telemetry module. Controller shall system ready for communication on the ARIES Traffic Signal Management/Monitoring software. Controller cabinet communications shall be verified with a Master controller. If BBS is used, controller shall allow logging of three (3) alarm inputs as required in the specification for battery back-up system.

MMU (Malfunction Management Unit)
Cabinets shall be equipped with NEMA TS2 Type 16 Malfunction Management Unit with latest current released software. MMU jumper cards shall be programmed to each intersection's requirements.

BIU (Bus Interface Unit)
BIU's shall meet all TS2-1992, Section 8 requirements. In addition, all BIU's shall provide three (3) separate front panel indicators: Power, Valid Data, and Transmit.

Cabinet Power Supply
The cabinet power supply shall meet the NEMA TS2 specification. All power supplies shall also provide a separate front panel indicator LED for each of the four power outputs. Front panel banana jack test points for 24 VDC and logic ground shall also be provided.

Flasher Unit
All flasher units shall meet NEMA TS-2, Section 6 requirements and shall be EDI Model 810, or City-approved equal.

Telemetry Interface Panel (If required)
Cabinet shall be wired with a 25 pin telemetry interface panel and telemetry connecting cable so as to communicate with the ARIES Traffic Signal Management/Monitoring master software. The cabinet shall be wired for telemetry transient suppression, EDCO Model No. PC642C-00-AD, or City-approved equivalent.

Battery Back Up Unit (If required)
See BBS alarm wiring diagram

Intersection Diagram

An intersection diagram prepared in AutoCAD shall be provided on an 8.5" x 11" sheet of paper and enclosed in a protective plastic cover. The diagram and protective cover shall be located on the inside of the cabinet door above the Auxiliary Panel. The diagram shall depict the general intersection layout, phases, overlaps, detector assignments, and north arrow. The top of the diagram will be North and shall be pre-approved by the City Engineer.

Cabinet Wiring Diagrams

Cabinet wiring diagrams shall be arranged on three separate sheets in a simplistic way to facilitate the reading of it. The first sheet shall represent everything on the left side of the cabinet, the second everything in the middle of the cabinet including the main panel, and the third sheet everything on the right side of the cabinet. The final cabinet wiring diagram layout shall be approved by the City Engineer.

The Complete Controller Cabinet Assembly, including controller, completely wired cabinet and appurtenances shall be supplied by Econolite Control Products.

The Contractor shall arrange to have an Econolite Control Products, the BBS manufacturer, alternate detection equipment manufacturer, and Opticom Preemption employee and representative present at the time of the controller assembly and BBS turn-on. The representatives shall be fully-qualified to work on the controller assembly and BBS equipment. The Manufacturers representatives and City shall be notified at least (7) working days prior to intersection turn-on.