

6-86 SIGNALS, LIGHTING AND ELECTRICAL SYSTEM

6 86.01 GENERAL -- Traffic signals and lighting equipment shall be furnished and installed at the approximate locations shown on the plans as directed by the Engineer, in conformance with the applicable provisions of Section 86 "Signals, Lighting and Electrical Systems" of the 2010 Standard Specifications and these Special Provisions.

All work shall meet the requirements of Section 86-1.02 "Regulations and Code" of the Standard Specifications.

6-86.02 CONTRACT SUBMITTALS -- The Contractor shall furnish information as required in Sections 86-1.04 "Equipment Lists and Drawings" and 86-1.05 "Warranties, Guarantees and Instruction Sheets" of the Standard Specifications and these Special Provisions.

All equipment and materials that the Contractor proposes to install shall conform to these specifications and the contract plans.

The Contractor shall also furnish the following information:

A cost breakdown of equipment to be furnished, in manufacturer's catalog sheets for the following items, identified as to what is being furnished including all options, accessories, mounts and manufacturer's certifications.

The Contractor shall provide contract submittals for the following:

- signal heads
- standards/signal mast arms
- pedestrian heads/countdown LED equipment
- pedestrian push buttons
- detector wire
- luminaires/mast arms
- signs/hardware
- controller assembly
- service equipment enclosure
- battery back-up system
- emergency vehicle pre-emption system
- conductors
- conduits
- detection system or radar/video detection system

The list shall be complete as to the name of manufacturer, size and identifying number of each item. The list shall be supplemented by such other data as may be required. In all cases, the judgment of the Engineer shall be final as to whether substitute equipment and/or material, recommended by the Contractor conform to the intent of these specifications and is acceptable for use.

6-86.03 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS –
Maintaining existing and temporary electrical systems shall conform to the provisions in Section 86-1.06 "Maintaining Existing and Temporary Electrical Systems" of the Standard Specifications and these Special Provisions

The Contractor shall maintain existing electrical system or authorized temporary replacement in working order during the progress of the work. Shutdown is allowed for alteration or removal of the system. Traffic signal shutdown must be limited to normal working hours. Lighting system shutdown must not interfere with the regular lighting schedule. Notify the Engineer before performing work on the existing system.

Notify the local traffic enforcement agency before traffic signal shutdown.

If lane closures are specified, traffic signal system shutdowns must be limited to the hours allowed for lane closures.

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

Notify the Engineer immediately if existing facility is damaged by your activities. Repair or replace damaged facility promptly. If you fail to complete the repair or replacement, promptly, the Department will repair or replace and deduct the costs.

If the roadway remains open to traffic while an existing lighting system is modified:

1. Keep the existing system in working order
2. Make the final connection so the modified circuit is in operation by nightfall

Contractor to maintain temporary electrical installations in working order until no longer required and remove temporary installations under Section 86-7 "Removing, Reinstalling, or Salvaging Electrical Equipment".

During traffic signal system shutdown, place W3-1, "Stop Ahead," and R1-1, "Stop," signs in each direction to direct traffic through the intersection. For 2-lane approaches, place two R1-1 signs per approach. Minimum R1-1 sign size is 30 inches.

Contractor to cover signal faces when the system is shut down overnight and cover temporary W3-1 and R1-1 signs when the system is turned on.

Full compensation for furnishing, installing, maintaining and removing temporary "Stop Ahead" and "Stop" signs and for covering signs not in use shall be considered as included in the contract lump sum price paid for the signal item involved and no additional compensation will be allowed therefor.

6-86.04 INSTALLATION -- Traffic signal and lighting system installation shall be in accordance with the following sections of the Standard Specifications:

- 86-1.07 Scheduling of Work
- 86-1.08 Safety Precautions
- 86-2.01 Excavating and Backfilling
- 86-2.02 Removing and Replacing Improvements

The Contractor's attention is also directed to Section 15 "Existing Facilities" of these

Special Provisions.

Replacement of curb and gutter, wheelchair ramps, exposed foundations and other concrete where skilled finish work is required - not including flat sidewalk sections - shall be done by qualified concrete finishers.

6-86.05 FOUNDATIONS -- Foundations shall conform to the provisions in Section 86-2.03 "Foundations" of the Standard Specifications and these Special Provisions.

This work includes constructing cast-in-drilled-hole concrete pile foundations for traffic signal and lighting standards.

Concrete must contain not less than 590 pounds of cementitious material per cubic yard.

For standards located in sidewalk areas, the pile foundation must be:

1. Placed to final sidewalk grade before the sidewalk is placed
2. Square for the top 4 inches

Use sleeve nuts on Type 1-B standards. The bottom of the base plate must be flush with finished grade.

The controller cabinet foundation shall be constructed per the applicable details of State of California, Department of Transportation Standard Plan ES-3C, except the height of the foundation pedestal shall be 18 inches. Contractor shall furnish anchor bolts.

6-86.06 STANDARDS, STEEL PEDESTALS AND POSTS -- Standards, steel pedestals and posts shall conform to the provisions in Section 86-2.04 "Standards, Steel Pedestals and Posts" of the Standard Specifications and these Special Provisions and the following requirements.

Steel bolts not designated on the plans as high-strength (HS) or stainless steel shall be for general applications and shall conform to the requirements in ASTM Designation: A 307.

Anchor bolts shall conform to the requirements in ASTM Designation: F 1554, Grade 36. High-strength (HS) anchor bolts shall conform to the requirements in ASTM Designation: F 1554, Grade 105.

The sign mounting hardware shall be installed at the locations shown on the plans.

Street name signs shall be installed per City's Standard Plan 146.

Handhole reinforcement rings for standards, steel pedestals, and posts shall be continuous around the handholes.

After installation, the Contractor shall touch up damaged galvanizing per Section 75-1.05 of the Standard Specifications.

At the end of all signal mastarms, the MAS side attachment mounting with a slipfitter shall be used. Type 1-B pedestals shall be used as designated on the pole schedule. The vehicle and pedestrian signals shall use the unimount mounting hardware.

See the plans for Unimount Mounting (UM) hardware detail and City Standard Plan 147.

6-86.07 CONDUIT -- Conduit shall conform to the provisions in Section 86-2.05, "Conduit," of the Standard Specifications and these Special Provisions.

Insulated bonding bushings will be required on metal conduit.

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 1.

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 4 inches above the conduit with minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," of the 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 2 feet of, and parallel with the face of the curb, by the trenching in pavement method in conformance with the provisions in Section 86-2.05C, "Installation," of the Standard Specifications. Pull boxes shall be located behind the curb or at the locations shown on the plans.

After conductors have been installed, the ends of conduits terminating in pull boxes, service equipment enclosures, and controller cabinets shall be sealed with an approved type of sealing compound.

Contractor to install conduit prior to final asphalt concrete (3/4" grading) lift.

At other locations where conduit is to be installed by jacking or drilling as provided in Section 86-2.05C "Installation" of the Standard Specifications, and if delay to any vehicle will not exceed 5 minutes, conduit may be installed by the trenching method as follows:

TRENCHING INSTALLATION OF CONDUIT: Conduit shall be placed under existing pavement in a trench approximately 2 inches wider than the outside diameter of the conduit to be installed. Trench shall not exceed 6 inches in width. Conduit depth shall not exceed 12 inches or conduit trade-diameter plus one inch, whichever is greater, except that at pull boxes the trench may be hand dug to required depth. The top of the installed conduit shall be a minimum 8 inches below finish grade. If the conduit is installed in existing pavement that will be removed in a later stage of the project, the conduit shall be placed at a depth where it will not be damaged by construction activities when the existing pavement is removed and the new pavement is constructed.

No trenching within the new pavement will be allowed. All new conduits within the new pavement areas shall be installed prior to paving, either installed within the existing pavement at a depth where it will not be damaged by later stage construction activities or after the existing pavement has been removed and prior

to installing the new pavement.

The outline of all areas of pavement to be removed shall be cut to a minimum depth 3 inches with an abrasive type saw or with a rock cutting excavator specifically designed for this purpose. Cuts shall be neat and true with no shatter outside the removal area.

The conduit shall be placed in the bottom of the trench and the trench shall be backfilled to 2 inches above the top of the conduit with clean compacted sand or material excavated with a rock cutting excavator.

The remainder of the trench shall be backfilled to not less than 0.1 foot below the asphalt pavement surface with commercial quality concrete containing not less than 540 pounds of cement per cubic yard. The top 0.1 foot shall be filled with asphalt concrete, Type B, ½ inch maximum aggregate, per Section 39 "Asphalt Concrete" of the Standard Specifications. Prior to spreading asphalt concrete, see Section 39 - 4.02, "Prime Coat and Paint Binder (Tack Coat)."

Spreading and compacting of asphalt concrete shall be performed by any method which will produce an asphalt concrete surfacing of uniform smoothness, texture and density.

All excavated areas in the street shall be completely backfilled at the end of each work day.

Other methods of placing conduit must be approved by the Engineer.

6-86.08 PULL BOXES – Pull boxes shall conform to the provisions in Section 86-2.06, "Pull Boxes," of the Standard Specifications and these Special Provisions.

The pull box and cover must comply with ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity," for Tier 22 load rating and must be gray or brown in color.

Extension for the pull box must be of the same material as the pull box and attached to the pull box to maintain the minimum combined depths as shown.

The bolts, nuts, and washers must be a captive bolt design.

The captive bolt design must be capable of withstanding a torque range of 55 to 60 ft-lb and a minimum pull out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test to the minimum pull out strength.

Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts under Section 75-1.05, "Galvanizing."

Manufacturer's instructions must provide guidance on:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below Tier 22 load rating
2. Where side entries cannot be made
3. Acceptable method to be used to create the entry

Tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

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.

Grout in bottom of pull boxes will be required.

Recesses for suspension of ballasts will not be required.

All pull boxes shall be No. 5 unless otherwise noted on the plans. Extensions shall be installed if wires will be within 6 inches of the top of a single box.

Provide a 2-year manufacturer replacement warranty for pull box and cover from the date of installation of the pull box and cover. All warranty documentation must be submitted to the Engineer before installation.

6-86.09 CONDUCTORS AND WIRING – Conductors and wiring shall conform to the provisions in Section 86-2.08 "Conductors and Cables" and Section 86-2.09 "Wiring" of the Standard Specifications and these Special Provisions.

Conductors shall be spliced by the use of "C"-shaped compression connectors. Splices shall be insulated by "Method B" in accordance with Section 86-2.09E "Splice Insulation".

Fused splice connectors as specified in Section 86-2.09F shall not be installed.

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.

6-86.09A SIGNAL CABLE AND SIGNAL INTERCONNECT CABLE – Signal cable and signal interconnect cable shall conform to the provisions in Section 86-2.08D, "Signal Cable" and Section 86-2.08E "Signal Interconnect Cable" of the Standard Specifications and these Special Provisions.

Signal Interconnect Cable (SIC) shall be the 6-pair type.

Conductors shall be spliced by the use of "C" shaped compression connectors as shown on the Standard Plans.

6-86.10 BONDING AND GROUTING – Bonding and grounding shall conform to the provisions in Section 86-2.10 "Bonding and Grounding" of the Standard Specifications and these Special Provisions.

6-86.11 SERVICE – Service shall conform to the provisions in Section 86-2.11, "Service," of the Standard Specifications and these Special Provisions.

The Contractor shall furnish and install Type III-AF service equipment at the Ham Lane/Harney Lane intersection.

The Contractor shall furnish and install TESCO Model 1400XL battery backup system with ambient temperature enclosure anodized aluminum complete with six 24 volt batteries full LED operation.

The service pedestal, battery backup cabinet and the controller cabinet shall be painted Rustoleum "Dunes Tan," Sherwin Williams "Deer Valley" #SW2184 gloss, direct to metal (DTM) or approved equal.

Circuit breakers shall be the cable-in/cable-out type, mounted on non-energized clips. All circuit breakers shall be mounted vertically with the up position of the handle being the "ON" position.

6-86.12 TESTING – The Contractor shall perform testing in accordance with Section 86-2.14B "Field Testing" of the Standard Specifications. The Contractor shall perform insulation resistance test in the presence of a Public Works electrician prior to the turn-on.

6-86.13 GALVANIZING AND PAINTING – Galvanizing shall conform to Section 86-2.15 "Galvanizing" of the Standard Specifications.

Painting shall conform to Section 86-2.16 "Painting" of the Standard Specifications.

6-86.14 SOLID-STATE TRAFFIC ACTUATED CONTROLLER – Solid-state traffic actuated controller unit, cabinet and auxiliary equipment shall conform to the provisions in Section 86-3, "Controller Assemblies," of the Standard Specifications and these Special Provisions.

Contractor shall furnish and install Econolite Cobalt controller with auxiliary equipment and Type P TS2 Type 1 cabinet.

The Contractor shall arrange to have a signal technician, qualified to work on the controller unit and employed by the controller unit manufacturer or his representative, present at the time the equipment is turned on.

The turn-on of the signal at the above-mentioned locations shall not commence without the presence of a representative of the City Engineer's Office. The City representative shall assign all controller timing.

6-86.15 MODULATED LIGHT SIGNAL DETECTION SYSTEM – Emergency vehicle preemption shall be 3M "Opticom" Model 752 phase selector unit or approved equal completely wired in a controller cabinet and optical detector units (3M Model 721 or approved equal) mastarm mounted per signal plans.

6-86.16 VEHICLE SIGNALS – Vehicle signal faces, signal heads and auxiliary equipment as shown on the plans, and the installation thereof, shall conform to the provisions in the following Sections of the Standard Specifications and these Special Provisions:

86-4.01	Vehicle Signal Faces
86-4.02	Directional Louvers
86-4.03	Backplates
86-4.06	Signal Mounting Assemblies

All visors shall be "Tunnel" type, with open slot at the bottom.

All vehicle signal faces shall be provided with 12 inch sections.

Backplates shall be powdered coated and signal section housing shall be metal type and louvered.

All new red, yellow and green signal indications shall utilize light emitting diode (LED) modules. The modules shall be as manufactured by Dialite or approved equal. Requests for use of an approved equal shall be submitted, in writing, to the City Engineer prior to ordering and shall have all technical specifications and catalog "cut sheets" attached as an appendix. A list of locations where the requested hardware has been previously installed must accompany the written request as an additional appendix. In addition, a sample of the hardware must be supplied to the City for inspection and approval. Red indications shall meet Caltrans and ITE standards and details shall be submitted to the Engineer for approval.

LED (Light Emitting Diode) Traffic Signal Modules

General Description

This specification covers LED pedestrian signal modules for 16" housings. It also covers red, green, and yellow LED modules to be used in place of the incandescent lamp, reflector, socket, gasket, and lens assembly of the vehicle signal sections.

Referenced vehicle type LED modules shall fit in all standard, incandescent vehicle traffic signal housings. Each module shall be complete and shall incorporate a red lens for red modules, a yellow lens for yellow modules, and an un-tinted lens for green modules. Each module shall also incorporate a printed circuit board inclusive of all of the LEDs and required circuit components, 36 inch 16 AWG wire leads with strain relief and spade terminals, a rigid housing for protection in shipping, handling and installation, and a one piece neoprene gasket. *Screw-in* type products are not allowed for vehicle signals. Red *ball* type signals shall utilize the *LumiLeds* (1) light engine as their source of illumination.

Lenses for ball type modules shall be made of ultraviolet stabilized polycarbonate, and incorporate facets that serve to enhance the optical efficiency of the LED traffic signal module. Facets for Type S green and yellow ball shall be arranged in horizontal rows, and shall be on the inside of the lens. Individual *lens-lets* are specifically not allowed. The red ball type signals shall incorporate an inner lens that is sealed to the lamp housing, and serves to collimate the light emitted by the *LumiLeds* (1) light engine. An

outer lens shall also be incorporated, that serves to focus the collimated light, so as to meet ITE intensity and distribution standards. Additionally, red lamps shall almost perfectly, approximate to the motorist, the appearance of an incandescent traffic signal. This means that the face of the red ball LED lamp shall appear to the motorist as nearly totally uniform in illumination, and have a wide viewing angle that makes it suitable for installation on wide boulevards or single-tethered span wire. This also means that it shall not be apparent that LEDs are used as the light source for the red traffic signal ball. The external lens surface for all vehicle signals shall be smooth, with no raised features, so as to minimize the collection of dirt, diesel smoke, and other particulate contaminants, and to facilitate periodic cleaning. External lens facets are not allowed. The lens shall be keyed to the housing of the LED signal module to insure the proper orientation and to avoid possible rotation during any handling. External lenses shall be hard-coated in compliance with Caltrans specifications.

The LEDs shall be mounted and soldered to a printed circuit board. The LED signal module shall be watertight when properly installed in a traffic signal housing. The LED signal module shall utilize the same mounting hardware used to secure the incandescent lens and gasket assembly, and shall only require a screwdriver or standard installation tool to complete the mounting. The LED signal module assembly shall weigh less than 5 pounds. For vehicle signals, the incandescent lamp sockets and reflectors shall be removed from the signal head housings. So as to minimize possible maintenance problems, the LED lamp module may not protrude into the signal visor area more than three-quarters of an inch in depth.

The housing of the LED signal module shall be marked 'TOP' to designate the proper orientation of the LED signal module in the traffic signal housing. The housing of red LED ball type traffic signal modules shall utilize a *partial, embedded and integral metal layer*, in its design and construction. Manufacturers part number, date code, and electrical characteristics of the LED signal module shall be visible on the rear of the assembly. A label shall be affixed to back of the red and green ball type modules, that certifies their complete compliance with the July 1998 ITE VTCSH, Part II specification for LED traffic signal modules.

The LED traffic signal manufacturer shall be ISO 9001 certified.

Optical

The light intensity and distribution from red LED signal modules, and also stand-alone pedestrian hand signals, shall as a minimum, meet the July, 1998 ITE VTCSH Part II, and current CAL TRANS standards and measurement criteria for LED traffic signal modules. Green LED signals shall be certified to meet the July 1998 ITE VTCSH, Part II intensity requirements @ 74 degrees centigrade. Test data to verify the performance for red and green ball signals as meeting the July 1998 ITE VTCSH, Part II intensity requirements @ 74 degrees Centigrade, shall be supplied from either:

Lighting Sciences
7630 East Evans Road
Scottsdale, AZ 85260

ETL Testing Laboratories
3933 US Route 11
Cortland, NY 13045-0950

or, other certified **independent** test lab. The light output of all LED vehicle signal modules and LED pedestrian "hand" signal retrofit kits shall meet ITE specifications for chromaticity.

Type "E" expanded viewing angle LED traffic signal modules shall maintain intensity that is in compliance with Exhibit "A" *Intensity Table For Expanded Viewing Angle LED Traffic Signal Modules* (attached), for a period of (3) three years, when measured at 120 VAC.

The LEDs shall be connected in series parallel strings. For 12 and 8 inch green and yellow *balls*, the failure of any one LED, and its associated string of LEDs, shall not cause the loss of more than 4 LEDs, nor more than 2.5% of lens surface definition. No more than 1% of the total luminosity of the entire signal module may be lost in the event of a single string failure. For red LED ball type signals, the failure of a single LED shall cause loss of light from only that LED. No loss of light output from the complete module assembly shall occur as a result of a single LED failure in a red LED ball lamp.

For green and yellow LED lamps, so as to prevent *current hogging* of the LEDs, *cross-linking* of every LED is specifically not allowed. For green and yellow lamps, no less than 4 LEDs are allowed to be crossed-linked, or electrically grouped together, so as to minimize this current hogging effect.

The control circuitry shall prevent the current flow through the LEDs in the off state to avoid any false indication as may be perceived by the human eye, during daylight and *evening* hours. The LED traffic signal module shall be operationally compatible with NEMA TS - 1 and NEMA TS - 2 *conflict monitoring* parameters. The intensity of the LED signal module shall not vary by more than 10% over the allowable voltage range as specified in the electrical section below.

Red and green balls shall maintain required intensity, as defined by the July, 1998 ITE VTCSH, Part II intensity standards for LED traffic signal modules, over the temperature range of -40 degrees centigrade to +74 degrees centigrade, at 120 volts A.C., when new, and also after 3 years.

Electrical

Power factor shall be 90% or greater, at nominal rated voltage, at 25°C, after 60 minutes of operation. Total harmonic distortion (THD) shall be less than 20% at rated voltage, at 25°C.

All LED traffic signal modules shall be in compliance with FCC noise regulations.

The red, yellow, and Portland Orange LEDs shall utilize exclusively AlInGaP technology, either AS (Absorbing Substrate) or TS (Transparent Substrate), and shall not exhibit degradation of more than 30% of their initial light intensity following accelerated life testing (operating at 85 degrees C and 85% humidity, for 1000 hours). AlGaAs technology is not acceptable.

The green LEDs shall utilize Indium gallium nitride technology. Green LED traffic signal modules shall not be illuminated when the applied voltage is less than 35 VAC. They shall be illuminated (unregulated) when the applied voltage is 45 VAC to 80 VAC. Their illumination shall be in compliance with the July 1998 ITE VTCSH, Part II, when the

applied voltage is between 80 VAC and 135 VAC.

The LED signal modules shall be connected directly to line voltage, **120 Volts AC nominal**, and shall be able to operate over the voltage range of 80 VAC to 135 VAC.

The 8" and 12" red ball units shall consume no more than a nominal 7 and 10.5 watts respectively, at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 9 and 12 watts respectively, at 120 VAC, at 25 degrees centigrade.

Type "S" green ball LED traffic signal modules shall consume no more than a nominal 6 and 11 watts for the 8" and 12" lamps respectively, at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 8 and 13 watts respectively, at 120 VAC, at 25 degrees centigrade.

Type "E" (expanded viewing angle) green LED ball traffic signal modules shall consume no more than a nominal 7.5 and 13.5 watts for the 8" and 12" lamps respectively at 120 VAC, at 25 degrees centigrade. Maximum power consumption shall not exceed 9 and 16 watts respectively, at 120 VAC, at 25 degrees centigrade.

Yellow LED ball traffic signal modules shall consume no more than a nominal 18 and 32 watts respectively, for the 8" and 12" balls.

Red arrow type LED traffic signal modules shall be temperature-compensated so as to maintain intensity at elevated temperatures. Red arrow type LED traffic signal shall be tested and documented by CAL TRANS as being in compliance with CAL TRANS intensity standards for red arrows at elevated temperatures.

Stand-alone pedestrian *hand* signal LED retrofit kits shall be Portland Orange, and consume no more than a nominal 12.5 watts at 25 degrees Centigrade, and shall be a *filled-in figure* symbol. Outline type symbols are not acceptable for hand symbols. Stand-alone pedestrian hand signals shall be temperature-compensated so as to maintain intensity at elevated temperatures. Stand-alone ped hand signals shall be tested and documented by CAL TRANS as being in compliance with CAL TRANS specifications for intensity at elevated temperatures.

Combination *hand-walking person* LED *Pedestrian* signal modules shall incorporate a Lunar-white LED walking person symbol. The hand and walking person symbols shall be filled-in. Outline symbols are not acceptable. In order to insure accurate color transmittance, the module shall incorporate a replacement lens that is precisely matched to the dominant wavelength of the LEDs. The hand and walking person symbols shall be overlaid on top each other so that the illuminated image appears to be in the middle of the signal housing. The hand and walking person symbols in the combination module, shall consume no more than a nominal 9.5 and 8.3 watts each, respectively. The module shall be compliant with NEMA 4 water penetration prevention standards.

Transient voltage suppression rated at 1500 watts for 1 millisecond and fusing with a maximum rating of 2 amps shall be provided to minimize the effect and repair cost of an extreme over voltage situation or other failure mode.

WARRANTY

All LED traffic signal modules supplied shall be warranted for 5 years against

manufacturing defects.

Red and green ball LED traffic signal modules, red arrow traffic signal modules, and stand-alone pedestrian hand modules, shall be performance warranted to be in compliance with July, 1998 ITE VTCSH, Part II, and CAL TRANS minimum intensity standards for LED traffic signal modules, at 74 degrees centigrade, for a period of three (3) years.

Failures due to acts of God, abuse, and accidents are excluded from warranty coverage.

(1) LumiLeds is a trademark of LumiLeds Corporation.

6-86.17 PEDESTRIAN SIGNALS – LIGHT EMITTING DIODE (LED) PEDESTRIAN AND COUNTDOWN SIGNAL MODULE – Pedestrian signals shall conform to the following provisions:

All pedestrian heads shall be countdown LED traffic signals, 16-inch X 18-inch Type - Full Hand/Full Man Overlay + countdown modules and conform to Manual on Uniform Traffic Control Devices (MUTCD). The numbers shall have a minimum height of 9 inches.

Warranty

- A. The unit shall be repaired or replaced by the Contractor if it exhibits a failure due to workmanship or material defect within the first sixty (60) months of delivery.
- B. The unit shall be repaired or replaced if the intensity level falls below fifty percent (50%) of the original values within sixty (60) months of delivery.

6-86.18 DETECTORS – Detectors shall conform to the provisions in Section 86-5 "Detectors" of the Standard Specifications and these Special Provisions.

Loop wire shall be Type 2.

Loop detector lead-in cable shall be Type B

The Third paragraph of Section 86-5.01A (4), "Installation Details," of the Standard Specifications is amended to read:

Slot cut in the pavement shall be washed clean, blown out and thoroughly dried before installing conductors. Residue resulting from slot cutting operations shall not be permitted to flow across shoulders or lanes occupied by public traffic and shall be removed from the pavement surface before any such material flows off of the pavement surface. Residue from slot cutting operations shall be disposed of outside the highway right of way in accordance with Standard Specifications.

Signal loop detector lead-in cable, from the pullbox adjacent to the loop to the field terminals in the cabinet, shall be Type B per Section 86-5.01A(3) "Construction Materials" of the Standard Specifications. The ends of all lead-in cables and all loop conductors shall be sealed and made waterproof prior to being installed in conduit and prior to being left for splicing.

City detectors shall use EDI Model LM622t rack detectors and Econolite MMU-16E

traffic monitors.

The Contractor shall furnish four (4) spare Econolite Model LM622t detector amplifiers

Slots shall be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be 2 inches, minimum.

6-86.18A RADAR/VIDEO DETECTION SYSTEM – (Not Applicable for all Projects) *The radar/video detection system shall be Econolite Autoscope Duo Radar/Video Detection system or approved equal. The duo radar/video detection system shall be installed per manufacturer's recommendation and as shown on the plans. See Appendix for cables, Duo Detection Module (DDM), Interface Panel and all other component details.*

6-86.19 PEDESTRIAN PUSH BUTTONS – Pedestrian push buttons shall conform to the provisions in Section 86-5.02 "Pedestrian Push Button Assemblies" of the Standard Specifications and these Special Provisions.

All pedestrian push button housing shall be the metal type and furnished and installed by the Contractor.

The pedestrian push button housing shall be made of machined or die-cast aluminum. The housing shall be black, matching color 17038, 27038, or 37038 of Federal Standard No. 595b. The conical actuator shall be made of stainless steel or aluminum and extend 7/16-inch to 1/2-inch above the bezel of the housing.

The Contractor shall furnish and install "Fortel-Metal Duraped" or approved equal pedestrian push buttons.

The pedestrian push button sign shall be Contractor-furnished and porcelain-enameled metal as shown on the City's Standard Plan 148. The Contractor shall furnish and install tamper proof safety screws (Kendall #9018 or approved equal)

6-86.20 LUMINAIRES – Luminaires shall conform to the provisions in Section 86-6.01 "High Pressure Sodium Luminaires" of the Standard Specifications and these Special Provisions.

Two hundred fifty watt (250) high pressure sodium luminaire with integral regulated type ballasts shall be provided by the Contractor.

Lamps shall be of the following manufacturer's code numbers, unless otherwise specified:

<u>Code Number</u>	<u>Wattage</u>
LU 250:	250
C250S50:	250

Luminaires shall be H.P.S. with Type III light distribution for multiple operation, equipped with photoelectric twist-lock type receptacle and shortening cap. The reflector shall be removable and highly specular.

Photoelectric controls shall conform to the provisions in Section 86-6.11 "Photoelectric Controls" of the Standard Specifications and these Special Provisions.

Outer housing shall be similar in design to ITE Series 13 and shall be cast aluminum. Refractor latch will be vibration proof to prevent accidental opening of door. Illuminating Engineering Society (I.E.S.) type acrylic refractor shall be furnished; lamp socket shall be adjustable. Gaskets will be used to seal the optical assembly at socket entry and between the reflector and refractor. Luminaire slip fitter shall be adjustable from 1-1/4-inch through 2-inch pipe without rearrangement of mounting parts, adjustable plus or minus 5 degrees from the horizontal.

Glare shields are not required.

6-86.21 SIGNS – The Contractor shall furnish and install street name signs and other signs as shown on the plans and in accordance with these Special Provisions.

The street name signs shall be mounted as shown on the City's Standard Plan 146. Attachment hardware shall be Signfix, Scotchbrand VHB acrylic foam tape, or approved equal. The signs shall be mounted at three attachment points. Fastening hardware on sign face will not be allowed.

The signal street name signs shall be on single faced 0.08 inch aluminum blanks with white high intensity legends and border with green background of engineering grade reflective sheeting (Scotchlite or approved equal). All letters should be lower case (8") with initial letter upper case (10.67"), unless otherwise notice on the plans. The following is a list of the required street name signs:

<u>Name</u>	<u>Number</u>
<i>(To be specified on plans)</i>	

Contractor shall submit shop drawings of street names signs to the Engineer. The minimum width for street name sign shall be 5 feet.

All other signs are single faced, fabricated on 0.08 inch aluminum blanks with 3M or equal high intensity reflective sheeting.

6-86.22 MEASUREMENT AND PAYMENT – Payment for traffic signal and street lighting shall conform to the provisions in Section 86-8 "Payment" of Standard Specifications and these Special Provisions.

The contract lump sum price for "Signal and Lighting" shall include providing and maintaining construction warning devices, lighting in connection with signals, maintaining existing electrical systems, *replacing and repairing damaged irrigation system* (if applicable), furnishing and installing signs mounted on the traffic signal mastarm, video detection system and emergency detector system and complete traffic signal installation as specified herein, and no additional compensation will be allowed therefor.