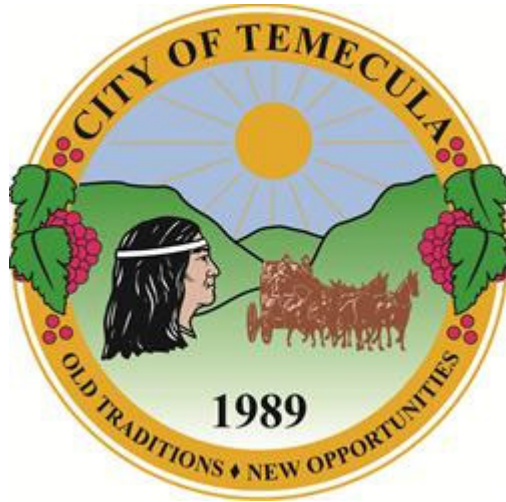


Department of Public Works



Traffic Signal Standards and Guidelines

December 2021

A handwritten signature in black ink that reads "Patrick Thomas".

Patrick Thomas, P.E.
Director of Public Works

FORWARD

This guideline establishes policies and procedures for the preparation of traffic signal design plans in the City of Temecula. The guideline is intended to establish design uniformity and to provide the design engineer with sufficient information to prepare the desired plans. It is not intended to substitute for engineering knowledge, experience, or judgment of the design engineer.

Deviations from these guidelines shall be requested from the City Engineer for approval prior to commencement of work.

REVISIONS

1. March 22, 2022
2. June 15, 2022

GENERAL DESIGN REQUIREMENTS

The Engineer preparing traffic signal and communication designs shall:

- A. Utilize the City of Temecula special requirements as defined in this Traffic Signal Standards and Guidelines.
- B. Utilize Caltrans Standard Plans and Standard Specifications and Caltrans Revised Standard Plans and Standard Specifications (latest edition).
- C. Utilize Caltrans Standard Special Provisions (latest edition).
- D. Utilize latest Caltrans standards and California Manual on Uniform Traffic Control Devices (CA MUTCD) recommended design practices, where applicable.
- E. The order of precedents (in case of omissions and/or discrepancies) in the manuals shall be City of Temecula Traffic Signal Standards and Guidelines, Caltrans Standard Plans and Standard Specifications, CA MUTCD, and then the "Greenbook".
- F. Coordinate with the serving utility for service points and conflicts.
- G. Coordinate with the City of Temecula Traffic Division prior to design for concept review and scheduling a field walk as necessary.
- H. Provide as-built documentation after construction completion.

TRAFFIC SIGNAL DESIGN PLAN REQUIREMENTS

The City requires all plans to be produced in AutoCAD format. Plans shall be submitted through the Cit's CSS (Citizen Self Service) portal. Final approved plans shall be provided in both PDF and DWG formats.

Plan preparation and design principles shall adhere to the following requirements:

- A. North shall always be oriented up or to the right on all plans. The major arterial shall be horizontal on the plan.
- B. Signal plans shall be drawn at a 1"=20' scale. Signing and striping plans shall be drawn at a minimum 1"=40' scale.
- C. Signing and striping modifications shall be provided on separate plan sheets.
- D. Letters shall be used to identify traffic signal poles and shall always go in alphabetic order clockwise around the intersection with the "A" pole always being on the controller corner.
- E. Conduit run identification numbering shall start at the conduit for the service pedestal and increase clockwise around the intersection. The final home run shall include 2-4" conduits.
- F. ADA compliant curb ramps shall be provided and/or upgraded at all pedestrian crossing locations for any new or modified traffic signal. If any digging for conduit or signal poles is occurring, pedestrian ramp upgrades will be required for all non-compliant ADA ramps.
- G. The traffic signal design plans shall contain, at a minimum, the following: conductor schedule, pole schedule, detector schedule, phase diagram, sign legend, construction notes, and appropriate details as necessary. Certain areas of the traffic signal may need enlarged details or have a separate sheet to allow for clarifications.
- H. Modified traffic signals will require equipment upgrades. Affected equipment may include controller unit, switches, CCTV, BBS system, EVPE system, cabinets, pedestrian heads, push buttons, and street name signs. Contact City Traffic Division and these guidelines for latest equipment requirements.
- I. Modified traffic signals may require signal wiring/conductor replacement depending on the existing wire condition.
- J. Modified traffic signals may require conduit replacement depending on the existing conduit

condition.

- K. All traffic signal designs will require field work by the design Engineer. All traffic signal infrastructure, conduit, and wiring shall be accurately depicted on the plans. Please contact City Traffic Division for access to the traffic signal cabinet.
- L. The SCE service point location shall be shown on all traffic signal designs.
- M. Plans shall show R/W and centerline stationing information.
- N. Plans shall show all existing wet and dry utilities screened back.

Any deviations from the design plan requirements shall be approved by the City staff prior to preparation of the plans.

TRAFFIC SIGNAL GENERAL NOTES AND CONSTRUCTION NOTES

Traffic signal plan shall contain the following general notes. The design shall confirm that all general note elements are addressed on the design plan.

GENERAL NOTES

1. All work material and equipment shall conform to the provisions of the City of Temecula Traffic Signal Standards and Guidelines, Standard Plans and Standard Specifications of the State of California, Department of Transportation (Caltrans) latest edition, and the Special Provisions.
2. A City of Temecula Encroachment Permit shall be required to perform work within the public right-of-way. City approved plans do not relieve the contractor from the responsibility of obtaining an Encroachment Permit. A copy of the permit shall be kept on the construction site at all times.
3. The contractor shall be responsible for providing a detailed traffic control plan for any lane closures associated with the traffic signal construction.
4. The location of all existing underground utilities is approximate only. The contractor shall be responsible for verifying the exact location and depth of all utilities including those not shown on the plan prior to start of work. Contact Underground Service Alert at (800) 422-4133.
5. The contractor shall be responsible for obtaining an Electrical Permit from the City's Building and Safety Department for the service pedestal.
6. The contractor shall be responsible for obtaining all necessary permits and notifying affected agencies at least 72 hours prior to start of work.
7. The Conductor Schedule is furnished as an installation guideline only. It shall be the Contractor's responsibility to provide the appropriate number of conductors required for the intended operation.
8. The contractor shall verify with the Engineer the exact location of all traffic signal equipment prior to installation.

9. Each conductor shall be permanently identified. Identification shall be by direct labeling, tags or bands permanently fastened to the conductors. The identification shall be placed on each conductor or group of conductors in each pull box and near the end of each conductor where the conductors are terminated.
10. Underground traffic signal conductors between pull boxes or otherwise shall not be spliced.
11. Any landscaping damaged by the traffic signal construction shall be repaired or replaced to the satisfaction of the Engineer and the property owner.
12. The contractor shall be responsible for completing all "punch list" items prior to traffic signal turn-on.

CONSTRUCTION NOTES (EXAMPLE)

1. FURNISH AND INSTALL NEW MCCAIN MODEL 352I ATC CABINET AND FOUNDATION COMPLETE PER CALTRANS STANDARD PLANS ES-3C. CABINET SHALL BE EQUIPPED WITH MCCAIN FLEX CONTROLLER ASSEMBLY RUNNING OMNI EX FIRMWARE, MODEL 2010 ECLIP CONFLICT MONITOR BY EDI, EVPE DISCRIMINATION MODULES, AND APS CONTROL MODULE. CABINET SHALL HAVE 48 INPUT ASSEMBLY CHANNEL, 16 OUTPUT ASSEMBLY CHANNEL, INTERNAL LED LIGHTS, PULL-OUT DOCUMENT DRAWER, RACK MOUNTED SURGE PROTECTOR, AND BE WIRED FOR RED MONITOR CAPABILITY. CONTRACTOR SHALL PURCHASE TRANSPARITY CONTROLLER SOFTWARE LICENSE. THE CONTROLLER SHALL INCLUDE FUNCTIONS INDICATED ON THE PLANS AND INCLUDE ALL NECESSARY CABLING AND AUXILIARY EQUIPMENT NECESSARY FOR THE INTENDED OPERATION. THE CABINET'S POLICE PANEL SHALL BE EQUIPPED WITH A CONNECTION FOR A TRAFFIC SIGNAL CONTROLLER MANUAL OVERRIDE SWITCH.
2. FURNISH AND INSTALL A DUAL-METERED TYPE III-CF SERVICE EQUIPMENT ALUMINUM ENCLOSURE ONLY (NO STEEL) WITH THE FOLLOWING CIRCUIT BREAKERS:
 - 120/240V - 100A MAIN
 - 120V – 50A METERED SIGNALS
 - 240V – 40A METERED LIGHTING
 - DUAL TYPE V – P.E.C.THE TYPE III-CF SERVICE ENCLOSURE'S CONTACT SWITCH SHALL BE "MERCURY FREE".
3. FURNISH AND INSTALL 3" CONDUIT WITH MULE TAPE FROM SERVICE ENCLOSURE TO SERVICE POINT PER SCE REQUIREMENTS. COORDINATE INSTALLATION OF SERVICE CONDUCTORS WITH SCE AT LEAST 4 WEEKS IN ADVANCE OF SERVICE CONNECTION TO ENERGIZE SERVICE.
4. FURNISH AND INSTALL BATTERY BACK-UP SYSTEM IN AN EXTERNALLY SIDE MOUNTED BBS CABINET WITH GENERATOR PLUG ASSEMBLY AND MANUAL BYPASS SWITCH PER CITY OF TEMECULA SPECIFICATIONS. ALL BATTERY BACK-UP EQUIPMENT SHALL BE MOUNTED IN THE BATTERY BACK-UP CABINET AND SHALL BE WIRED PER MANUFACTURER'S SPECIFICATIONS.

5. FURNISH AND INSTALL EMERGENCY VEHICLE PRE-EMPTION EQUIPMENT AND REQUIRED 4-CHANNEL DISCRIMINATION EQUIPMENT IN THE CONTROLLER CABINET PER CITY OF TEMECULA SPECIFICATIONS. MOUNT EVPE OPTICAL DETECTORS ON MAST ARM.
6. FURNISH AND INSTALL MAST ARM MOUNTED SIGN PER STANDARD PLAN ES-7N, DETAIL "U".
7. FURNISH AND INSTALL FIBER ETHERNET SWITCH ON DIN-RAIL MOUNT WITH 2 SMALL FORM FACTOR PLUGGABLE TRANSCEIVERS AND POWER SUPPLY IN CONTROLLER CABINET.
8. FURNISH AND INSTALL FIBER OPTIC JUMPER (2M DUPLEX LC TO SC) IN CONTROLLER CABINET.
9. FURNISH AND INSTALL FIBER DISTRIBUTION UNIT (FDU) WITH SC 6 PORT PANEL IN CONTROLLER CABINET.
10. FURNISH AND INSTALL A 12-STRAND SINGLE MODE FIBER OPTIC (SMFO) BREAKOUT CABLE WITH 30' OF SLACK IN CONTROLLER CABINET.
11. FURNISH AND INSTALL FIBER OPTIC SPLICE ENCLOSURE IN "DOUBLE-STACKED" #6 CONCRETE PULL BOX WITH FIBERLYTE PULL BOX COVER. A MINIMUM OF 50 FOOT OF SLACK SHALL BE PROVIDED AND A MINIMUM OF 100 FOOT OF SLACK WHERE A SPLICE IS REQUIRED.
12. FURNISH AND INSTALL AXIS CCTV CAMERA ON TRAFFIC SIGNAL POLE WITH WALL-AND-POLE MOUNT PER MANUFACTURERS SPECIFICATIONS AND CONNECT TO MIDSPAN CONVERTER. PROVIDE ALL PATCH CABLES AND CONNECTORS NECESSARY FOR COMMUNICATION.

TRAFFIC SIGNAL SPECIAL PROVISIONS, INSTALLATION, AND EQUIPMENT REQUIREMENTS

The following sections provide traffic signal special provisions, equipment, and installation requirements as required by the City of Temecula. The City adheres to the latest editions of the Caltrans Standard Plans and Standard Specifications in addition to the following provisions below:

1.1 POLES AND MAST ARMS

1.1.1 POLES

- 1) Standards shall be placed on opposite sides of the pedestrian ramp (see ES-4C of the Caltrans Standard Plans for the typical location of signal standard placement). All traffic signal plans shall indicate required traffic signal pole locations as referenced from BCR, ECR, and curb face.
- 2) No poles or pull boxes are allowed within the limits of pedestrian ramps including the ramp slopes.
- 3) Pole anchor bolts shall be cut and finished no more than 2 inches above the nut.
- 4) Where modifications will leave holes in existing poles, the holes shall be repaired pursuant to a City approved method.
- 5) Poles shall not be installed within center medians unless approved by City Engineer.

1.1.2 MAST ARMS

- 1) Mast arms shall be provided for all approaches unless otherwise approved by the City Engineer.
- 2) All traffic signal mast arms shall present a uniform and level appearance when complete.
- 3) If fully protected left turn phasing is provided, the mast arm shall be long enough to align the left-turn signal head as close as possible to the center of the left-turn lane where there is one left-turn lane, or to the lane line between the left-turn lanes if there are two left-turn lanes.
- 4) Street light mast arms shall be 15 feet long or as determined by the Engineer.

1.2 PULL BOXES

- 1) Pull boxes and extensions shall be concrete and size No. 6 unless otherwise indicated. A No. 5 pull box may be used for advance loops.
- 2) Pull box lids shall be Fiberlyte and stamped "Traffic Signal".
- 3) Pull boxes shall not be placed: In raised or painted medians, in paved shoulder, in traveled way, in driveways, in landscape areas, within one foot of a sidewalk access ramp or flares unless approved by City Engineer.
- 4) Pull boxes placed in dirt shall utilize paddle markers for easy location of pull box.
- 5) Pull boxes shall be spaced at intervals of 300 feet or less.
- 6) Electrical power pull box shall be No. 5 with extension and placed within 5 feet from the service cabinet.
- 7) Where the sump of an existing pull box is disturbed by the CONTRACTOR's operations, the sump shall be reconstructed and, if the sump was grouted, the old grout shall be removed and replaced with new grout and 1" drain hole.
- 8) Pull boxes shall be tamper resistant and utilize a special key tool for opening.
- 9) When four or more conduits enter a pull box, an extension shall be added to the #6 pullbox.
- 10) Pull boxes shall be grouted and have a 1" drain hole.

1.3 CONDUIT

- 1) Traffic signal conduit shall be schedule 80 rigid PVC.
- 2) Conduits shall be three inches (3") minimum. All legs of the intersection shall have a conduit crossing installed (one spare with mule tape). All conduits shall contain mule tape and a No. 12 AWG bare solid copper tracing wire. Pull rope will not be allowed.
- 3) All conduits shall utilize 45 degree sweeps into pull boxes.
- 4) Conduit shall be laid out perpendicular to the curb line of the street crossing under the center of the crosswalk as much as practical.
- 5) Conduit fill shall not exceed the NEC maximum of 40% for conduits with three or more conductors. For traffic signal modifications, max percent conduit fill shall be approved by the City Engineer.
- 6) Install two, four-inch (2-4") conduits from controller cabinet base to the adjacent home run pull box with signal cable in one conduit and the balance of conductors in the other.
- 7) All conduits entering pull boxes, vaults and cabinets shall be protected with duct seal. No open holes are allowed. The ends of all conduits shall have Carlon or approved equal bell fittings.
- 8) Install conduit to a depth of not less than 30 inches below finished grade, except in sidewalk and curbed paved median areas, where it must be at least 18 inches below grade.

1.4 CONDUCTORS AND WIRING

- 1) 3 conductor signal cable and 12 conductor signal cable shall be used for traffic signal wiring and be continuous from the signal cabinet to the terminal block on the signal standard it services. No splicing of signal cable shall be permitted unless otherwise directed by the City Engineer.
- 2) The signal cables shall be labeled (permanently affixed printed labels) in each pull box and at the signal cabinet, indicating the cable/wire type and signal standard to which it is connected. Labels are required for loops, signal conductors, SIC, fiber, and any other conductors within cabinet and pull box.
- 3) All traffic signal field conductors shall have a 6-foot coil of extra wire in each pull box to allow for servicing. The signal conductors shall be organized in a bundle to allow for easy identification of wires and cables.
- 4) Multi conductor video cable shall meet vendor specifications.
- 5) Loop detector lead-in cable shall be Type B Caltrans Standard 16 AWG.
- 6) Loop detector wire shall be Type 2. All lead-in DLCs shall be labeled in the cabinet with lane number and phase assignment.
- 7) Conductors for Safety Lighting (SL) shall be No. 10 XHHW-2. The conductors shall be black and white.
- 8) The Street Light conductors may be spliced to branch the Street Light circuit as it progresses around the intersection.
- 9) Fused splice connectors shall be installed in the pole hand hole for each luminaire. See City of Temecula Street and Safety Lighting Guidelines for more information.
- 10) All field installed wiring shall be Megger-Ohm tested. The CONTRACTOR shall provide documentation showing results that the wiring has passed the test.

1.5. DETECTION

- 1) Inductive loop detection is required on all streets and approaches and shall not be substituted unless special conditions exist that preclude the installation of in-pavement detection or at the discretion of the City Engineer. Special conditions may include private driveways, decorative

concrete, bridge decks, or interim road conditions.

- 2) Loop detection shall be installed on all limit line, advance detection, left turn lanes, and bike lanes. Loops shall be circular Type E (6' diameter). Limit line detectors shall be Type F loops. Limit line loops shall be installed 1 foot before the intersection limit line or crosswalk.
- 3) All bicycle lane detector loops shall be Type Q and fit within the bike lane.
 - o If the approach has a bike lane, install a six-foot-long Type Q loop, 44 feet in advance of crosswalk or limit line in the bike lane (or where the bike lane drop transition occurs if further back).
 - o Width of Type Q loop varies minimum 6" inside bike lane line and 6" minimum outside gutter or other channelization line, providing a 3-foot wide to 5-foot wide loop.
- 4) Advance detection is required on all approaches with an 85th percentile speed or posted speed limit greater than 25 mph (if not available, use design speed). Install a single loop per lane with each its own DLC. Detection setbacks from the limit line shall be per CAMUTCD Table 4D-101.
- 5) All lanes shall have separate DLC's.
- 6) If a minor street approach has advance detection, install two loops per lane spaced 10 feet apart starting at the crosswalk or limit line.
- 7) Install four loops spaced 10 feet apart in advance of the crosswalk or limit line in left-turn lanes and for approach lanes without advance detection.
- 8) Minor street right-turn only lanes will have 2 loops spaced 10 feet apart. Provide separate DLC to controller cabinet.
- 9) On a minor street, if there is no right-turn only lane, install one loop at the limit line, adjacent to the curb for sneak-by traffic.
- 10) All detection cables and cards shall be labeled in the cabinet with lane number and phase assignment.

1.5.1 LOOP DETECTION INSTALLATION

- 1) Prior installation, the City Engineer or his designated representative shall verify all loop detector locations. All necessary striping shall be in place prior to position of detectors.
- 2) Loop detectors in asphalt shall use rubberized hot melt type sealant (Brewer/Flex or approved equal).
- 3) Loop detector splices shall be soldered and sealed with heat-shrink containing waterproof sealant.
- 4) The number of sensor units and lead-in cables required to achieve the specified detection shall be installed.
- 5) Four (4)-channel sensor units shall not be used.
- 6) Sensor units shall be Eberle Design Inc (EDI)

1.5.2 VIDEO DETECTION INSTALLATION

When special conditions exist that preclude the installation of in-pavement detection, video detection shall be used. The video detection system shall be Iteris Vantage Vector Hybrid camera system or City approved equal. All installation shall include necessary components to run the system including but not limited to video processor(s), flat panel monitor (10.4" TFT LCD video monitor or City approved equal), Ethernet modules, and camera(s).

1.6 CABINET AND EQUIPMENT

The controller and cabinet shall be manufactured and furnished by the same manufacturer.

1.6.1 CONTROLLER

- 1) The Controller shall conform to latest ATC/ITE industry standards.
- 2) The controller unit shall be a McCain FLeX running McCain Omni eX firmware.
- 3) The controller shall be delivered pre-loaded with the latest version of McCain Omni eX controller firmware. The controllers shall be delivered at least two weeks prior to scheduled signal turn on.
- 4) The CONTRACTOR shall provide and schedule the controller manufacturer to be present at time of signal turn on in the field.
- 5) The CONTRACTOR shall furnish a Transparency intersection user license with each controller furnished.
- 6) The controller manufacturer shall submit a notarized Certificate of Compliance with the State testing specifications prior to or at the time the controller is delivered to the jobsite. The controller shall not be installed until the Certificate is received and approved by the Traffic Engineer /Inspector/City Electrician or their assigned representative. Testing of control equipment and cabinet wiring shall be accomplished by the controller manufacturer in accordance with the State Standard Specifications (all references to State testing facilities or laboratories shall be interpreted as the controller manufacturer's testing facility; however, State testing procedures referred to shall remain in effect). All testing costs for the complete control system shall be borne by the CONTRACTOR.
- 7) The CONTRACTOR shall furnish one (1) maintenance and operation manual for all new controller units, auxiliary equipment, vehicle detector sensor units, ITS and communication equipment, and interactive plug-ins to the City's Maintenance Division. The operation and maintenance manuals shall be submitted upon equipment delivery. The O&M manual(s) 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) Troubleshooting procedure (diagnostic routine).
 - f) Block circuit diagram.
 - g) Geographical layout of components.
 - h) Schematic diagrams.
 - i) List of replaceable component parts with stock numbers.
 - j) As-built drawings.
 - k) Detector assignment table.

1.6.2 Controller Cabinet

- 1) Controller cabinet shall be McCain model 352i ATC with an anodized aluminum finish and include front and back door switches per latest Caltrans TEES requirements.
- 2) The preferred location for cabinets shall be on the approach-side corner of the minor arterial. Where sufficient right of way exists, a minimum of 48-inches of concrete sidewalk and clearance shall be provided at the around the cabinet(s). Clearances shall be unobstructed by any above ground facilities. The City Engineer must approve any variance from the preferred location.

- 3) The front side of traffic signal controller cabinet shall be oriented such that the technician faces the intersection when viewing the controller front panel and the front door handle should be on the right and the door shall open toward the street.
- 4) The controller cabinet shall be equipped with two (2) interior LED lights (Dialight Part # CL2-CF-TC4 or approved equal) at the front and rear of the cabinet.
- 5) The controller cabinet shall be caulked at the bottom.
- 6) The controller cabinet shall be wired for red monitoring.
- 7) The controller cabinet shall include emergency vehicle preemption equipment as required.
- 8) The controller cabinet shall be wired for all phases as shown on the signal plans.
- 9) The control cabinet shall include twelve (12) 200 load switches.
- 10) The controller cabinet shall have EDI vehicle loop detector cards.
- 11) The controller cabinet shall include an integral rack mounted document drawer assembly for the purpose of document storage and writing surface. The document drawer shall have an interior depth of approximately 1.5 inches, have drawer guides made of anodized aluminum, have drawer mounting brackets made of stainless steel, and have a hinged lift top writing area with a textured powder coat surface.
- 12) The controller cabinet output files shall be equipped with UL rated multi-conductor terminal lug.
- 13) The controller cabinet shall come with 48 channel input assembly and 32 channel output assembly.
- 14) The controller cabinet shall include an "AS-BUILT" blueprint of the signal and timing plan inside the cabinet.

If the controller cabinet design deviates in any way from the details in these guidelines, such deviation shall be submitted to the City Engineer or their assigned representative for review before fabrication of the contract cabinets. If deemed necessary by the City Engineer or their assigned representative, one complete prototype cabinet shall be delivered to him for review at least 30 days before fabrication of the contract fixtures. The prototype cabinet will be returned to the CONTRACTOR and if permitted by the City Engineer, the cabinet may be installed.

1.6.3 CONFLICT MONITOR

- 1) The conflict monitor shall meet all the requirements of the latest Caltrans TEES requirements.
- 2) The conflict monitor shall be a model 2010ECLip by EDI or City approved equal.
- 3) The base design shall be tested by an independent lab for transient and environmental requirements.
- 4) The conflict monitor shall have 16 channel capability with a 10/100 Ethernet port.
- 5) A portable laptop computer shall not be required to program or verify monitor setting (only used for log events).
- 6) The conflict monitor shall be capable of monitoring 5 section heads.
- 7) The conflict monitor shall display active colors independently during operation.
- 8) The conflict monitor shall display active colors independently at time of fault.
- 9) Shall be compatible with McCain Omni eX intersection control software.

1.6.4 OTHER EQUIPMENT

- 1) For other miscellaneous required cabinet equipment including switches, CCTV, wireless radios, and fiber equipment, see section 2.0 of these provisions.

1.7 SERVICE AND ELECTRIC SERVICE CABINET

The CONTRACTOR shall be responsible for applying for and arranging with the serving utility to complete service connections for both temporary and permanent installations and the CONTRACTOR shall pay all costs and fees required by the utility except for falsework lighting.

The City will provide the SCE service address for the meters.

The electrical service cabinet shall:

- 1) Be fabricated with an anodized aluminum finish.
- 2) Provide Type III-C dual meter electrical service for all new signal installation. Deviations shall be approved by City Engineer.
- 3) Meet the SCE Service Guide service requirements and the Caltrans standard cabinet specifications.
- 4) Have separate main disconnect circuit breakers for metered and unmetered sections.
- 5) Have plug-in type circuit breakers. Cable bussing is not allowed.
- 6) Have 2-time delay control contactors.
- 7) Have dual TYPE V photoelectric control unit.
- 8) Be caulked at the bottom.
- 9) Be a model, part, class or type number as approved by City.
- 10) Have a No. 5 pull box with extension within 5 feet from the service cabinet.
- 11) Have 3" conduit with pull tape and appropriate service conductors per SCE requirements.

1.8 BATTERY BACK-UP SYSTEM

- 1) The BBS assembly and all associated BBS equipment shall be housed in a cabinet attached to the rear side of the controller cabinet. Stand-alone cabinet may be requested by City for special circumstances.
- 2) The BBS cabinet dimensions shall be 56"Hx26"Wx12"D (McCain Part #M34196).
- 3) The BBS cabinet shall contain a thermostatically controlled cooling fan and air filter.
- 4) The battery back-up system shall be a Alpha FXM HP 1100 Rugged Traffic BBS or City approved equal.
- 5) The BBS must be Ethernet/IP compatible and wired for communication to the TMC and for an alarm output to the controller unit. The wiring shall consist of a CAT5 cable and 2 pair #20 cable. The alarm output shall provide Railroad 1 flashing operation upon 40% batter power remaining.
- 6) Install a 2 pair communication cable between the BBS and controller cabinet and wire up to provide an alarm when batteries are in service.
- 7) The BBS shall have a manual bypass switch with automatic transfer.
- 8) The BBS cabinet shall have an auxiliary generator plug installed and include any necessary generator kits.

1.9 SIGNAL INDICATION HARDWARE FINISH SPECIFICATIONS

- 1) Except for anodized components, all exposed metal signal housings, doors, visors, backplates and framework parts shall have a black powder coated finish and be a City approved process.
- 2) A 3-5 stage pretreatment consisting of: Degrease, Rinse, Iron Phosphate, Rinse, and Seal. Note: Degrease and Iron Phosphate can be combined, thereby eliminating Rinse, making this a 3-stage process.

- 3) A dry off cycle for at least 10 minutes at 300° to 400° F.
- 4) Electrostatically applied powder at 75-90KV.
- 5) Thermal setting cycle for 20 minutes at 400° F.
- 6) All parts shall be coated with an ultraviolet resistant polyester powder. The only exception is for items of flat black, which can be coated with a self-cleaning flat black epoxy.
- 7) All threaded fitting hardware to be assembled with anti-seize compound.
- 8) All terminal boxes are to be made of bronze.
- 9) The CONTRACTOR shall furnish manufacturer's certificate of compliance with City approved powder coating process prior to installation of equipment.

1.10 FOUNDATIONS

- 1) Foundations shall be constructed per Caltrans Standard Plans and Standard Specifications.

1.11 GROUNDING AND BONDING

- 1) The 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 the adjacent pullbox.
- 2) The grounding jumper shall be visible after the cap has been poured on the foundation.
- 3) Equipment grounding conductor #8 AWG is required in all conduits.

1.12 REFLECTORIZED STREET NAME SIGNS (RSNS)

- 1) Street name signs shall be single sided with Diamond Grade material reflective sheeting.
- 2) Street name signs shall have street names only, no block numbers.
- 3) Street name signs background shall be Traffic Green PMS 342 in color with a 1" white border.
- 4) Font shall be Federal highway Series E Modified, 8" upper case and 6" lower case letters in size, white in color.
- 5) Street name signs shall be max 8' in length and 1.5' in height.
- 6) Street name sign mounting bracket shall be Tapco Mast Arm Swing Bracket or approved equal.

1.13 EMERGENCY VEHICLE PRE-EMPTION

- 1) Emergency vehicle pre-emption (EVPE) shall be provided for all approaches.
- 2) The emergency vehicle preemption (EVPE) shall be a Tomar System. EVPE detector shall be an Tomar Strobecom II 4090 ST detector series.
- 3) The EVPE discriminator module shall be a 4140V2-4 Strobecom II Optical Signal Processor with 21-ST-1IC-W self-test detector.
- 4) The detector shall be mounted on the mast arm using an Astro bracket with threaded nipples and lock washers.
- 5) EVPE detectors shall not be mounted on the signal head, unless exception made by the City Engineer.
- 6) Prior to installation, the City Engineer or designated representative shall determine the exact location of detector in the field.

1.14 SIGNAL HEADS

- 1) All traffic and pedestrian signal section housings shall be black metal. Plastic housings are not permitted.
- 2) All traffic signal modules shall be LED and fully compliant with the latest Institute of

Transportation Engineers (ITE) specifications. City approved manufacturer is Dialight.

- 3) All (red, yellow, and green) LED (light-emitting diode) signal modules shall be Type 1 and meet the following specifications:
 - a. LED signal modules for all balls and arrows shall be twelve-inch diameter (12").
 - b. LED signal modules shall be complete and factory installed in aluminum signal sections.
 - c. LED signal modules shall be mounted and soldered onto a printed circuit board.
 - d. LED indications shall be clear lens
- 4) LED signal module shall have a minimum 15-year warranty beginning after traffic signal system has been accepted by the City
- 5) Each LED product bid must be certified in the Intertek LED Traffic Signal Module Certification Program. Proof of certification must be documented and approved by the City Inspector prior to installation.
- 6) The failure of one LED signal module shall not deactivate any other LED signal module

1.14.1 VEHICULAR SIGNAL HEADS

- 1) All signal faces shall have one-piece backplates and tunnel visors.
- 2) Left turn signal modules shall be all arrows.
- 3) Plastic signal heads, plastic visors, or plastic backplates are not acceptable.
- 4) Terminal block shall be mounted in red section on the MAS signal heads. There shall be a drip loop for field installed signal wires.
- 5) Mast arm signal heads shall all be MAS type mount.
- 6) Should the City require yellow backplates, the yellow backing shall be a retroreflective 3" border with 3M 3990 sheeting.

1.14.2 PEDESTRIAN SIGNAL HEADS

- 1) All pedestrian indications shall be of the LED type with clear lens. City approved pedestrian indications shall be Dialight with 15-year warranty.
- 2) All new traffic signals and traffic signal modifications with pedestrian phasing shall use pedestrian indications of the "Countdown" type. For traffic signal modifications, new pedestrian housings may be necessary to accommodate the "Countdown" type pedestrian indications.
- 3) Pedestrian indications shall be Type A with international symbol displays.
- 4) All pedestrian heads shall be side mounted with appropriate housing and bracketry.
- 5) Clam shell housing shall not be permitted.

1.15 PEDESTRIAN PUSH BUTTON ASSEMBLY

- 1) Pedestrian push button location shall meet latest edition of CA MUTCD.
- 2) Pedestrian push buttons shall be 2-inch minimum in diameter complying with all Federal and State ADA requirements.
- 3) The pedestrian push button assembly shall be Type B with a five inch (5") by seven inch (7") international symbol push button plate.
- 4) The push button frame shall include adjustable mounting brackets to accommodate most standard Caltrans traffic signal poles.
- 5) The pedestrian push button housing shall be:
 - a. Made of die cast aluminum.
 - b. A telescoping, vandal-proof design.

- c. Painted a Federal Standard color black.
- 6) Plastic push buttons housings are not acceptable.
- 7) Accessible Pedestrian Signal (APS) push buttons may be requested at the City's discretion at locations deemed necessary. Possible locations include but are not limited to schools, senior areas, hospitals, heavy pedestrian areas, etc. The APS system shall be the Polara iNavigator iNS3 or other as approved by the City Engineer.

1.16 LED BLANKOUT SIGNS

- 1) LED Blank-out signs may be used at specific locations (upon approval by City Engineer) to minimize undesirable vehicular movements.
- 2) The signs shall be compliant with the latest CA MUTCD requirement.
- 3) The window dimensions shall be 24"x24" for near side sign, and 30"x30" for far side sign.

1.17 SAFETY LIGHTING STANDARDS

- 1) Safety lighting luminaires above the traffic signals shall conform to the City of Temecula Street and Safety Guidelines.
- 2) Safety Lighting shall be:
 - a. Completely assembled.
 - b. 120 volt.
 - c. Have photoelectric control unit and switches (Type IV). The photoelectric control unit shall have a shorting cap and capable of being controlled from the meter pedestal.
 - d. Full cutoff type LED.
 - e. Have fifteen feet (15') mast arms (maximum) unless otherwise directed by the City Engineer.

1.18 SALVAGED EQUIPMENT

- 1) The CONTRACTOR shall deliver all salvaged equipment to the City of Temecula Facility Operations Center (43230 Business Park Dr) unless other directed to dispose.
- 2) All unusable equipment shall be lawfully disposed by the CONTRACTOR at the contractor's expense.

2.0 TRAFFIC SIGNAL INTERCONNECT (SIC)

- 1) Traffic signal interconnect shall be provided on all new traffic signals and existing traffic signal modifications to all adjacent traffic signals.
- 2) All traffic signal interconnect designs shall be fiber optic unless otherwise approved by the City Engineer and shall be designed and installed per the latest edition of the Caltrans Fiber Optic Design Guidelines.
- 3) Under special conditions wireless or other methods of interconnect may be used when approved by the City Engineer.
- 4) The existing SIC system shall be maintained at all times during construction. In the event of damage, the CONTRACTOR or responsible party, as determined by the project inspector, shall commence repairs immediately. Repairs shall be completed within 10 working days or the City shall have the option to complete necessary repairs and charge the responsible CONTRACTOR(s) for any associated repair costs.

2.1 INTERCONNECT PULL BOXES AND SPLICE PULL BOXES

- 1) All interconnect pull boxes shall be #6 concrete.

- 2) At locations where fiber splicing will occur, a #6 concrete pull box with extension shall be installed.
- 3) Interconnect pull box lids shall be Fiberlyte and be stamped "COMMUNICATION".
- 4) Boxes shall be installed between 300 feet (minimum) and 600 feet (maximum) apart unless geographical or site conditions necessitate a shorter run.
- 5) SIC conduit shall be installed in pull boxes using 45-degree, UL approved elbows. These elbows shall be placed as far apart in the pull box as possible, oriented in the direction of the cable, and offset to one side to facilitate cable pulling and coiling.
- 6) Approximately 50 feet of SIC slack shall be coiled inside of each splice box (12 and 72 SMFOC). Approximately 50 feet of SIC slack shall be coiled on either side of the splice enclosure where present.
- 7) Approximately 20 feet of SIC slack shall be coiled inside of each pull box.
- 8) Approximately 20 feet of SIC slack shall be coiled inside each controller cabinet.
- 9) See Section 1.2 of this Specification for additional pull box information.

2.2 INTERCONNECT CONDUIT

- 1) All interconnect conduits shall be three inches (3") schedule 80 rigid PVC.
- 2) All interconnect conduits shall have mule tape and a No. 12 AWG bare solid copper tracing wire.
- 3) All new intersections shall include separate conduits for SIC and signal wiring (including DLC). Sharing of the DLC and CCTV wiring in the same conduits with SIC will be allowed on intersection modifications, as long as conduit fill is less than 40%.
- 4) All conduits entering pull boxes, vaults and cabinets shall be protected with duct seal. No open holes are allowed.
- 5) Install conduit to a depth of not less than 30 inches below finished grade, except in sidewalk and curbed paved median areas, where it must be at least 18 inches below grade.
- 6) See Section 1.3 of this Specification for additional conduit information.

2.3 TRACER WIRE

- 1) All interconnect conduits shall contain a No. 12 AWG bare solid copper tracing wire.
- 2) No splices are permitted between pull boxes.
- 3) Proper operation of the tracer wire shall be demonstrated prior to acceptance.

2.4 INTERCONNECT CABLE

- 1) All fiber optic cable shall be single mode. Approved cable is Altos Loose Tube All Dielectric Gel-Free Cables with Binderless FastAccess Technology or approved equal. Trunk fiber optic cable shall be minimum 72 fiber count unless approved by City Engineer. Product code is 024-ZU4-T4F-22-D-20 or approved equal.
- 2) Cable installed in runs between splice enclosures and cabinet termination equipment shall be minimum 12 fiber count unless approved by City Engineer. Product code is 012-ZU4-T4F-22-D-20 or approved equal.
- 3) Splices are to be made in splice enclosures in fiber optic splice box only. SIC shall be continuous and unspliced between cabinets. Exceptions must be approved by City Engineer.
- 4) The design engineer shall perform a site survey to determine slack availability on existing SIC runs or require cable replacement when sufficient slack is not available.
- 5) A patch panel shall be installed to terminate the 12 SMFOC. In instances where there is insufficient rack capacity, a spider fan out kit shall be installed upon approval of City Engineer.

- 6) New SIC shall be connected to the City network and a revised assignment table shall be submitted as part of the final design.
- 7) Where existing copper SIC (CuSIC) is to be retained, CuSIC shall be a minimum of six (6) twisted pair 20 AWG conductor communication cable with standard color code and water resistant as required by Caltrans specifications. CuSIC must be approved by the City Engineer.

2.5 FIBER OPTIC INTERCONNECT EQUIPMENT

Termination components for vaults and signal cabinets are listed in Table 1 below. The fiber optic cables shall be terminated and/or spliced with these components per the fiber assignment provided by Traffic Engineering during project design or before signal turn-on. A minimum of 5 working days-notice will be required for Traffic Engineering to produce this documentation.

Table 1: Cabinet and Vault Fiber Termination Components

Description	Manufacturer	Model
Splice Closures	Corning	SCF-4C18-01
Splice Closure Splice Tray	Corning	SCF-ST-099
Splice Housing	Corning	
Splice Trays	Corning	M67-048
Cabinet Termination	Corning	CCH-01U
24 Port Patch Panel with MTP Adapter	Corning	CCHE-CP72-89
6 Port Panel	Corning	CCH-CP12-A9
Fiber Distribution Unit	Corning	CCS-O1U
Splice Cassette	Corning	CCH-CS12-A9-P00RE
Jumpers	Generic	2M Duplex LC to SC
Connectors	Generic	LC

2.6 COMMUNICATION DATA NETWORK

The communication protocol shall be Ethernet. New or modified signals shall receive the communication standard components in Table 2.

Table 2: Data Communication Standards

Description	Manufacturer	Model
Ethernet Switch	Cisco- Fiber	IE-4000-4S8P4G-E (16 ports)
	Actelis- Copper	ML688
Power Supply	Cisco	PWR-IE170W-PC-AC
Cat 6 Patch Cable RJ45	Generic	
Power Connection	Generic	
Gigabit Fiber SFP Transceivers	Cisco	GLC-LX-SM-RGD
Cabinet Din Rail Mount	Cisco	STK-RACK-DINRAIL

2.7 ETHERNET SWITCHES

Ethernet switches shall provide the following functionality:

- 1) All switches shall be managed and support advanced features including:
 - a. Port based VLAN segregation.
 - b. DHCP snooping and/or IGMP snooping
 - c. MAC address filtering
 - d. Quality of Service
 - e. SNMP
 - f. Remote Management
- 2) Fiber uplinks shall be single mode and support 10/100/1000 Duplex Ethernet ports and provide long haul capacity.
- 3) In addition to the above requirements, local switches (located at intersections) shall meet the following requirements:
 - a. Shall be environmentally hardened (-40 to 160 degrees F) and NEMA TS-2 rated.
 - b. Provide a minimum sixteen ports with a minimum of eight 10/100 Base TX copper ports and four duplex fiber uplink ports.
 - c. The fiber uplink ports shall be SC or LC type connectors. Connectors shall be compatible with Gigabit speed.
 - d. Power supply shall support 120 VAC and/or 24 VDC.
 - e. The switch shall support standard controller rack mount, DIN rail or 19" rack mountable.
- 4) All switches shall provide a minimum 2-year warranty on parts and 1 year "live" technical support (either in person or over the phone) during business hours (either in person or over the phone) during business hours (Pacific time) 9AM to 5PM Monday through Friday, from the date of installation. Warranty parts replacement shall be within three business days. A warranty certificate meeting these requirements shall be provided on the date of installation.

The CONTRACTOR shall provide, install and configure all Ethernet switches at the local intersections and test the communication between the field switch and the TMC. The switches shall be configured with IP address provided by Traffic Engineering during project design or before operational tests. A minimum of 5 working days-notice will be required for Traffic Engineering to produce this documentation. The testing of the ethernet switches shall provide for the necessary operation of all devices connected to the ethernet system.

Approved manufacturers of ethernet communications shall include Cisco. Non-listed manufacturers shall be approved by the City Engineer.

2.8 BROADBAND WIRELESS ETHERNET COMMUNICATION

The Broadband Wireless Ethernet Communication System shall provide traffic signal and CCTV video and control communication. The CONTRACTOR shall furnish and install such other items or details not mentioned below, that are required to construct a complete and operational system including: antennas, radios, mounting equipment, hardware, cabling, and incidental materials shall be performed, placed, constructed or installed.

The CONTRACTOR shall follow the manufacturer recommendations and instructions for installation.

Wireless communication shall provide the following functionality:

- 1) Support Ethernet communications.
- 2) Support mesh network topology and point-to-point and point-to-multipoint configuration.
- 3) 802.11 Compliant and operate on a license free band.
- 4) Provide a minimum of 300 Mbps data rate.
- 5) Provide a minimum of 10 miles range.
- 6) Provide security encryption (WPA, WPA2, MAC, and Radius)
- 7) Be compatible with Ethernet switching and routing protocols including:
 - a. VLAN
 - b. VPN
 - c. DHCP snooping
 - d. Quality of Service
 - e. SNMP
 - f. Remote Management
- 8) Be a NEMA rated enclosure.
- 9) Power supply support 120 VAC and/or 24 VDC.
- 10) All wireless equipment shall provide a minimum 2-year warranty on parts and 1 year “live” technical support (either in person or over the phone) during business hours (either in person or over the phone) during business hours (Pacific time) 9AM to 5PM Monday through Friday, from the date of installation Warranty parts replacement shall be within three business days. A warranty certificate meeting these requirements shall be provided on the date of installation.
- 11) Radio shall come with management software with no licensing fees.

The CONTRACTOR shall perform a wireless site survey to determine the exact radio path and signal strength values to each wireless site. The results of the survey (path quality, data integrity, and spectrum analysis) shall be provided to the Engineer to determine optimized system configuration and performance.

The CONTRACTOR shall test the completed system and ensure the proper functioning of all wireless components and connected devices to the satisfaction of the Engineer.

Approved manufacturers of Wireless Ethernet communication solutions include Encom or approved equal. Non-listed manufacturers shall be approved by the City Engineer.

2.9 CCTV VIDEO NETWORK

All new traffic signal installations shall include, as part of the standard safety systems, the installation of CCTV camera equipment and transmission equipment and any additional wiring or hardware required to support an operational CCTV system. This requirement shall apply unless otherwise specified by the City Traffic Engineer. Table 3 provides the camera equipment.

- 1) The CCTV communication protocol shall be Ethernet. Ethernet requirements are provided in Section 2.7.
- 2) A License Key shall be provided for each CCTV camera.
- 3) The approved location for new CCTV camera installations shall be specified by the City Traffic Engineer.
- 4) Installation: The CCTV system shall be installed per manufacturer’s installation recommendations.

- 5) Power for CCTV systems at new intersections shall consist of a power cord plugged into a power strip mounted on the rail of the controller cabinet plugged into Equipment Receptacle 2. The next alternative locations in order of preference are the ECB and least used signal breaker (auxiliary). The power cord shall be routed through the pole and terminated in the CCTV housing per the manufacturer's instructions.
- 6) The CCTV transmission equipment shall be installed and tested for operation by the CONTRACTOR to the satisfaction of the City Engineer before acceptance of the system.

CCTV Camera and Transmission components required to accommodate a typical CCTV installation are shown in Table 3 below.

Table 3: CCTV Camera and Transmission Equipment

Description	Manufacturer	Model
CCTV Camera	Axis	Q6100-E with Q6315-LE PTZ
Coaxial cable	Generic	
Data cable	Generic	
Pole/ Mount Bracket	Axis	T91L61
Axis mid-span converter	Axis	T8154 60W SFP
Power Cycle Relay Switch	Digital Loggers, Inc	DIN Relay IV

2.10 TESTING

- 1) The CONTRACTOR will be responsible for ensuring the operability and quality of SIC delivered from the manufacturer before installation. SIC shall not be removed from the reel or installed until it has been successfully tested by the CONTRACTOR. The pre-installation test results shall be documented and provided to the Engineering Division Inspector for approval. SIC found to be defective or damaged shall be returned to the source for replacement by the CONTRACTOR.
- 2) Fiber optic SIC shall be installed, spliced, terminated, and tested in accordance with NECA/FOA 301-2009 standards. This includes pre-installation and post installation testing of the cable.
- 3) Pre-installation testing shall be performed on all fibers using an Optical Time-Domain Reflectometer (OTDR) to preclude manufacturing and shipping damage. The CONTRACTOR shall perform such testing either on-site or at a holding facility prior to installing the cable into conduit.
- 4) Post-installation testing of all terminated fibers shall be performed using launch cables at both ends as specified in NECA/FOA 301-2009 Annex B.3. The CONTRACTOR shall perform such testing on-site after all termination and splicing work is completed.
- 5) Test results, in the form of pre-installation test data and post installation OTDR traces, shall be provided to the Engineering Division Inspector in a bound hard copy format along with the electronic file and appropriate viewing software, for review and approval after installation and splicing/termination work are completed.
- 6) The pre-installation test results shall be in the form of a spreadsheet detailing the length and loss/km for each fiber as well as the parameters used for testing. The post-installation OTDR traces shall clearly show each continuous fiber, the connectors on each end, and the loss for each

event.

- 7) The Engineering Division Inspector shall approve the test results before final acceptance.

3.0 TRAFFIC CALMING DEVICES

3.1 SPEED RADAR SIGNS

- 1) Speed radar signs shall be Traffic Logix SafePace Evolution 15.
- 2) Speed radar shall be solar powered unless otherwise approved by City Engineer.
- 3) Speed radar shall have Bluetooth and ethernet communications capability.
- 4) Speed radar device shall have remote monitor and management capabilities.
- 5) Speed radar signs shall be mounted on 1A pole (16' high) or existing streetlight.

3.2 SCHOOL FLASHER SIGNS

- 1) School flasher signs shall be determined by City Engineer.
- 2) School flasher shall be solar powered unless otherwise approved by City Engineer.
- 3) School flasher shall have Bluetooth and ethernet communications capability.
- 4) School flasher device shall have remote monitor and management capabilities.
- 5) School flasher signs shall be mounted on 1A pole (16' high) or existing streetlight.

3.3 RECTANGULAR RAPID FLASHING BEACON (RRFB) SIGNS

- 6) RRFB signs shall be determined by City Engineer.
- 1) Speed radar shall be solar powered unless otherwise approved by City Engineer.
- 2) RRFB signs shall be mounted on 2" solid quick punch telespar pole, 1A pole (16' high), or existing streetlight.