EBIX Insurance No. S200004708

AGREEMENT FOR SERVICES BETWEEN THE CITY OF SANTA CLARA, CALIFORNIA, AND BEAR ELECTRICAL SOLUTIONS, LLC

PREAMBLE

This Agreement is entered into between the City of Santa Clara, California, a chartered California municipal corporation (City) and Bear Electrical Solutions, LLC, a California limited liability company, (Contractor). City and Contractor may be referred to individually as a "Party" or collectively as the "Parties" or the "Parties to this Agreement."

RECITALS

A. City desires to secure the services more fully described in this Agreement, at Exhibit A, entitled "Scope of Services";

B. Contractor represents that it, and its subcontractors, if any, have the professional qualifications, expertise, necessary licenses and desire to provide certain goods and/or required services of the quality and type which meet objectives and requirements of City; and,

C. The Parties have specified herein the terms and conditions under which such services will be provided and paid for.

The Parties agree as follows:

AGREEMENT TERMS AND CONDITIONS

1. AGREEMENT DOCUMENTS

The documents forming the entire Agreement between City and Contractor shall consist of these Terms and Conditions and the following Exhibits, which are hereby incorporated into this Agreement by this reference:

Exhibit A – Scope of Services

Exhibit B – Schedule of Fees

Exhibit C – Insurance Requirements

Exhibit D – Labor Compliance Addendum

Exhibit E – Notice of Exercise of Option to Extend Agreement Form

This Agreement, including the Exhibits set forth above, contains all the agreements, representations and understandings of the Parties, and supersedes and replaces any previous agreements, representations and understandings, whether oral or written. In the event of any inconsistency between the provisions of any of the Exhibits and the Terms and Conditions, the Terms and Conditions shall govern and control.

2. TERM OF AGREEMENT

A. Unless otherwise set forth in this Agreement or unless this paragraph is subsequently modified by a written amendment to this Agreement, the term of this Agreement shall begin on the Effective and terminate on June 30, 2031 ("Initial Term").

B. After the Initial Term, City reserves the right, at its sole discretion, to extend the term of this Agreement for up to two (2) additional years through June 30, 2033 ("Option Periods") in such increments as determined by City. See Exhibit E – Notice of Exercise of Option to Extend Agreement Form. The Initial Term and Option Periods shall collectively be referred to as "Term".

3. SCOPE OF SERVICES & PERFORMANCE SCHEDULE

Contractor shall perform those Services specified in Exhibit A within the time stated in Exhibit A. Time is of the essence.

4. WARRANTY

Contractor expressly warrants that all materials and services covered by this Agreement shall be fit for the purpose intended, shall be free from defect and shall conform to the specifications, requirements and instructions upon which this Agreement is based. Contractor agrees to promptly replace or correct any incomplete, inaccurate or defective Services at no further cost to City when defects are due to the negligence, errors or omissions of Contractor. If Contractor fails to promptly correct or replace materials or services, City may make corrections or replace materials or services and charge Contractor for the cost incurred by City.

5. QUALIFICATIONS OF CONTRACTOR - STANDARD OF CARE

Contractor represents and maintains that it has the expertise in the professional calling necessary to perform the Services, and its duties and obligations, expressed and implied, contained herein, and City expressly relies upon Contractor's representations regarding its skills and knowledge. Contractor shall perform such Services and duties in conformance to and consistent with the professional standards of a specialist in the same discipline in the State of California.

6. COMPENSATION AND PAYMENT

In consideration for Contractor's complete performance of Services, City shall pay Contractor for all materials provided and Services rendered by Contractor in accordance with Exhibit B, entitled "SCHEDULE OF FEES." The maximum compensation of this Agreement is **NINE MILLION SIX HUNDRED THREE THOUSAND THIRTY DOLLARS** ($9,603,030), subject to budget appropriations, which includes all payments that may be authorized for Services and for expenses, supplies, materials and equipment required to perform the Services. All work performed or materials provided in excess of the maximum compensation shall be at Contractor's expense. Contractor shall not be entitled to any payment above the maximum compensation under any circumstance.

7. TERMINATION

A. Termination for Convenience. City shall have the right to terminate this Agreement, without cause or penalty, by giving not less than Thirty (30) days' prior written notice to Contractor.

B. Termination for Default. If Contractor fails to perform any of its material obligations under this Agreement, in addition to all other remedies provided by law, City may terminate this Agreement immediately upon written notice to Contractor.

C. Upon termination, each Party shall assist the other in arranging an orderly transfer and close-out of services. As soon as possible following the notice of termination, but no later than ten (10) days after the notice of termination, Contractor will deliver to City all City information or material that Contractor has in its possession.

8. ASSIGNMENT AND SUBCONTRACTING

City and Contractor bind themselves, their successors and assigns to all covenants of this Agreement. This Agreement shall not be assigned or transferred without the prior written approval of City. Contractor shall not hire subcontractors without express written permission from City.

Contractor shall be as fully responsible to City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for the acts and omissions of persons directly employed by it.

9. NO THIRD PARTY BENEFICIARY

This Agreement shall not be construed to be an agreement for the benefit of any third party or parties and no third party or parties shall have any claim or right of action under this Agreement for any cause whatsoever.

10. INDEPENDENT CONTRACTOR

Contractor and all person(s) employed by or contracted with Contractor to furnish labor and/or materials under this Agreement are independent contractors and do not act as agent(s) or employee(s) of City. Contractor has full rights to manage its employees in their performance of Services under this Agreement.

11. CONFIDENTIALITY OF MATERIAL

All ideas, memoranda, specifications, plans, manufacturing procedures, data, drawings, descriptions, documents, discussions or other information developed or received by or for Contractor and all other written information submitted to Contractor in connection with the performance of this Agreement shall be held confidential by Contractor and shall not, without the prior written consent of City, be used for any purposes other than the performance of the Services nor be disclosed to an entity not connected with performance of the Services. Nothing furnished to Contractor which is otherwise known to Contractor or becomes generally known to the related industry shall be deemed confidential.

12. OWNERSHIP OF MATERIAL

All material, which shall include, but not be limited to, data, sketches, tracings, drawings, plans, diagrams, quantities, estimates, specifications, proposals, tests, maps, calculations, photographs, reports, designs, technology, programming, works of authorship and other material developed, collected, prepared or caused to be prepared under this Agreement shall be the property of City but Contractor may retain and use copies thereof. City shall not be limited in any way or at any time in its use of said material. However, Contractor shall not be responsible for damages resulting from the use of said material for work other than Project, including, but not limited to, the release of this material to third parties.

13. RIGHT OF CITY TO INSPECT RECORDS OF CONTRACTOR

City, through its authorized employees, representatives or agents shall have the right during the term of this Agreement and for four (4) years from the date of final payment for goods or services provided under this Agreement, to audit the books and records of Contractor for the purpose of verifying any and all charges made by Contractor in connection with Contractor compensation under this Agreement, including termination of Contractor. Contractor agrees to maintain sufficient books and records in accordance with generally accepted accounting principles to establish the correctness of all charges submitted to City. Any expenses not so recorded shall be disallowed by City. Contractor shall bear the cost of the audit if the audit determines that there has been a substantial billing deviation in excess of five (5) percent adverse to the City.

Contractor shall submit to City any and all reports concerning its performance under this Agreement that may be requested by City in writing. Contractor agrees

to assist City in meeting City's reporting requirements to the State and other agencies with respect to Contractor's Services hereunder.

14. HOLD HARMLESS/INDEMNIFICATION

A. To the extent permitted by law, Contractor agrees to protect, defend, hold harmless and indemnify City, its City Council, commissions, officers, employees, volunteers and agents from and against any claim, injury, liability, loss, cost, and/or expense or damage, including all costs and attorney's fees in providing a defense to any such claim or other action, and whether sounding in law, contract, tort, or equity, in any manner arising from, or alleged to arise in whole or in part from, or in any way connected with the Services performed by Contractor pursuant to this Agreement – including claims of any kind by Contractor's employees or persons contracting with Contractor to perform any portion of the Scope of Services – and shall expressly include passive or active negligence by City connected with the Services. However, the obligation to indemnify shall not apply if such liability is ultimately adjudicated to have arisen through the sole active negligence or sole willful misconduct of City; the obligation to defend is not similarly limited.

B. Contractor's obligation to protect, defend, indemnify, and hold harmless in full City and City's employees, shall specifically extend to any and all employment-related claims of any type brought by employees, contractors, subcontractors or other agents of Contractor, against City (either alone, or jointly with Contractor), regardless of venue/jurisdiction in which the claim is brought and the manner of relief sought.

C. To the extent Contractor is obligated to provide health insurance coverage to its employees pursuant to the Affordable Care Act ("Act") and/or any other similar federal or state law, Contractor warrants that it is meeting its obligations under the Act and will fully indemnify and hold harmless City for any penalties, fines, adverse rulings, or tax payments associated with Contractor's responsibilities under the Act.

15. INSURANCE REQUIREMENTS

During the term of this Agreement, and for any time period set forth in Exhibit C, Contractor shall provide and maintain in full force and effect, at no cost to City, insurance policies as set forth in Exhibit C.

16. WAIVER

Contractor agrees that waiver by City of any one or more of the conditions of performance under this Agreement shall not be construed as waiver(s) of any other condition of performance under this Agreement. Neither City's review, acceptance nor payments for any of the Services required under this Agreement

shall be constructed to operate as a waiver of any rights under this Agreement or of any cause of action arising out of the performance of this Agreement.

17. NOTICES

All notices to the Parties shall, unless otherwise requested in writing, be sent to City addressed as follows:

City of Santa Clara
Attention: Department of Public Works
1500 Warburton Avenue
Santa Clara, CA 95050
and by e-mail at jroque@santaclaraca.gov

And to Contractor addressed as follows:

Bear Electrical Solutions, LLC
PO Box 924
Alviso, CA 95002
and by e-mail at Contracts@bear-electrical.com

The workday the e-mail was sent shall control the date notice was deemed given. An e-mail transmitted after 1:00 p.m. on a Friday shall be deemed to have been transmitted on the following business day.

18. COMPLIANCE WITH LAWS

Contractor shall comply with all applicable laws and regulations of the federal, state and local government, including but not limited to "The Code of the City of Santa Clara, California" ("SCCC"). In particular, Contractor's attention is called to the regulations regarding Campaign Contributions (SCCC Chapter 2.130), Lobbying (SCCC Chapter 2.155), Minimum Wage (SCCC Chapter 3.20), Business Tax Certificate (SCCC section 3.40.060), and Food and Beverage Service Worker Retention (SCCC Chapter 9.60), as such Chapters or Sections may be amended from time to time or renumbered. Additionally Contractor has read and agrees to comply with City's Ethical Standards (http://santaclaraca.gov/home/showdocument?id=58299).

19. CONFLICTS OF INTEREST

Contractor certifies that to the best of its knowledge, no City officer, employee or authorized representative has any financial interest in the business of Contractor and that no person associated with Contractor has any interest, direct or indirect, which could conflict with the faithful performance of this Agreement. Contractor is familiar with the provisions of California Government Code section 87100 and

following, and certifies that it does not know of any facts which would violate these code provisions. Contractor will advise City if a conflict arises.

20. FAIR EMPLOYMENT

Contractor shall not discriminate against any employee or applicant for employment because of race, sex, color, religion, religious creed, national origin, ancestry, age, gender, marital status, physical disability, mental disability, medical condition, genetic information, sexual orientation, gender expression, gender identity, military and veteran status, or ethnic background, in violation of federal, state or local law.

21. NO USE OF CITY NAME OR EMBLEM

Contractor shall not use City's name, insignia, or emblem, or distribute any information related to services under this Agreement in any magazine, trade paper, newspaper or other medium without express written consent of City.

22. GOVERNING LAW AND VENUE

This Agreement shall be governed and construed in accordance with the statutes and laws of the State of California. The venue of any suit filed by either Party shall be vested in the state courts of the County of Santa Clara, or if appropriate, in the United States District Court, Northern District of California, San Jose, California.

23. SEVERABILITY CLAUSE

In case any one or more of the provisions in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, it shall not affect the validity of the other provisions, which shall remain in full force and effect.

24. AMENDMENTS

This Agreement may only be modified by a written amendment duly authorized and executed by the Parties to this Agreement.

25. COUNTERPARTS

This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but both of which shall constitute one and the same instrument.

The Parties acknowledge and accept the terms and conditions of this Agreement as evidenced by the following signatures of their duly authorized representatives.

CITY OF SANTA CLARA, CALIFORNIA
a chartered California municipal corporation

Approved as to Form: Dated: _____

GLEN R. GOOGINS
City Attorney

JŌVAN D. GROGAN
City Manager
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050
Telephone: (408) 615-2210
Fax: (408) 241-6771

"CITY"

BEAR ELECTRICAL SOLUTIONS, LLC
a California limited liability company

Dated: _____

By (Signature): _____
Name: Andrew Bader
Title: President
Principal Place of Business Address: PO Box 924 Alviso, CA 95002
Email Address: Contracts@bear-electrical.com
Telephone: (408) 449-5178
Fax: N/A

"CONTRACTOR"

EXHIBIT A
SCOPE OF SERVICES

1. GENERAL

1.1 Contractor shall provide all necessary supervision, labor, and services, plus all tools, equipment, materials, and supplies required to provide traffic signal maintenance, repair, and support services on an as-needed basis ("Services").

1.2 Contractor shall perform the Services in accordance with generally accepted industry best practices and the original equipment manufacturer (OEM) specifications. Any deviations must be approved in writing by City.

2. BACKGROUND

2.1 The City of Santa Clara (City) operates and maintains approximately one hundred forty-five (145) traffic signals, sixteen (16) pedestrian hybrid beacons, twenty-four (24) flashing beacons, thirty-six (36) radar speed feedback signs, six (6) lighted crosswalks, a reversible lane system with controlling blank-out signs on Lafayette Street, and ten (10) permanent changeable message signs. The City, at its discretion, reserves the right to add or remove traffic signals, pedestrian hybrid beacons, flashing beacons, radar speed feedback signs, lighted crosswalks, reversible lane systems with controlling blank-out signs, and permanent changeable message signs.

2.2 Approximately 143 of the 145 traffic signals and 9 of the 16 pedestrian hybrid beacons are interconnected back to the City's Traffic Management Center (TMC) using either copper twisted pair or fiber optic cable. All signal interconnect and fiber optic cables are entirely owned and maintained by the City.

2.3 The City's traffic signal system is National Electric Manufacturer's Association (NEMA) based. The majority of traffic signals that are interconnected back to the City's TMC are using 2070 controllers running D4 firmware and are centrally controlled on a Kadence Advanced Traffic Management System. There is one traffic signal operating on a Traconex 390 controller that does not communicate back to the TMC that is planned for future replacement.

2.4 Controller cabinets are entirely NEMA-based with mostly TS2-Type 1 P cabinets. Auxiliary equipment also housed in some of the controller cabinets include EMTRAC preemption/priority equipment, Etherwan and Actelis communication equipment, Iteris Velocity Bluetooth travel time readers, Iteris, Econolite, and NoTraffic video detection systems, Polara APS, etc.

2.5 The City also deploys a number of Bosch and Axis CCTV cameras at traffic signals throughout the City. All CCTVs are dome cameras with full pan/tilt/zoom control. Images from CCTV cameras are transmitted back to the TMC using IP-based video over the copper and fiber network.

3. DEFINITIONS

3.1 The following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

3.1.1 **Business Hours**: Monday through Friday from 7:00 AM to 4:00 PM, excluding City holidays.

3.1.2 **City Engineer:** The Assistant Director of Public Works/City Engineer or designee.

3.1.3 **City Specifications:** City of Santa Clara Standard Specifications, See Appendix A-3.

3.1.4 **Collision**: An event or happening that is not expected, foreseen or intended, including but not limited to traffic accidents.

3.1.5 **Emergency**: When used in connection with this Agreement, shall mean a traffic collision, malfunction or occurrence that renders the traffic signal inoperable or hazardous to the orderly movement of traffic. Service rendered to emergencies shall have priority over all other services or maintenance repairs.

3.1.6 **Engineer**: The Traffic Operations Engineer, Senior Engineer, or Transportation Manager of the City of Santa Clara.

3.1.7 **Equipment**: The equipment, machinery, and/or vehicles required to perform the work described in this attachment.

3.1.8 **Fiber Optic Technician**: Primary duties are to troubleshoot and repair the fiber optic communications infrastructure. Performs all required optic testing (OTDR and power meter), fusion splicing, and installation/removal of various fiber optic equipment (termination panels, splice enclosures, etc.).

3.1.9 **Laboratory**: The designated laboratory authorized by the City to test cabinets.

3.1.10 **Overtime:** Hourly rate paid for emergency repair work or as-needed services performed under this Agreement outside Business Hours as approved by the Engineer.

3.1.11 **Preventive Maintenance**: Activity that is performed annually for the upkeep of signal equipment and traffic signal infrastructure. It includes but is not limited to checking, testing, inspecting, record keeping, cleaning,

repairing, and replacement of traffic signal equipment and traffic signal infrastructure. Also referred to as Routine Maintenance.

3.1.12 **Response Time**: The time elapsed between receipt of notification by the Contractor that service or repairs are required and the time the Contractor arrives at the location with the necessary tools, personnel, and equipment to affect such service repair.

3.1.13 **Responsive Maintenance**: The repair or replacement of failed signal equipment and traffic signal infrastructure and its restoration to safe and normal operation.

3.1.14 **Service**: When used in connection with this Agreement, shall mean that the Contractor shall proceed without undue delay and within the response time to the location of the signal system which has been reported inoperative or malfunctioning and shall service, repair, replace parts, or place in temporary operating condition, or otherwise activate damaged or inoperative equipment when notified either orally or in writing by the City′ s Traffic Division, City′s Police Department, or any other recognized City authority.

4. STANDARDS

4.1 The Contractor shall adhere to all Federal, State, Local, and Industry standards while providing services specified herein to the City which include, but not limited to, the following:

4.1.1 Caltrans Standard Plans, latest edition;

4.1.2 Caltrans Standard Specifications, latest edition;

4.1.3 City of Santa Clara Standard Details;

4.1.4 City of Santa Clara Standard Specifications, see Appendix A-3;

4.1.5 National Electric Code (NEC), latest edition; and

4.1.6 California Manual on Uniform Traffic Control Devices, latest edition.

5. PREVENTIVE AND ROUTINE MAINTENANCE REQUIREMENTS

5.1 The Contractor shall provide a routine and comprehensive preventive maintenance program to minimize incidence of outages and malfunctions and extend the useful life of the City's traffic signal system. The program shall include annual inspections to check, replace, and repair all parts of the traffic signal infrastructure.

5.2 The Contractor shall submit a work plan schedule to identify when locations will be visited to complete preventive maintenance. Should the Contractor fail to perform any items listed in this section in accordance with this schedule, the Contractor shall pay the City, as liquidated damages, $250 per calendar day for each intersection that is overdue for preventive and routine maintenance. The total amount of liquidated damages will be deducted from any subsequent invoice payment.

5.3 The Contractor shall provide annual inspections of each traffic signal, radar speed feedback sign, pedestrian hybrid beacon, pedestrian beacon, and lighted crosswalk at all locations listed in Appendix B-1. Appendix A-1 – City of Santa Clara Form TSM-1 – Traffic Signal Preventive Maintenance Form must be submitted to the City to verify completion of activities. In general, the steps to complete preventive maintenance includes:

5.3.1 Record arrival time, date, work performed, and name of traffic signal technician on Appendix A-2 – City of Santa Clara Form TSM-2 Traffic Signal Maintenance Log Form TSM-2. Retain a copy in the controller cabinet and maintenance/inventory management software system.

5.3.2 Visually inspect and verify proper operation of all signal indications, blank-out signs, full-matrix signs, pedestrian indications, beacons, in-roadway light fixtures, and radar speed feedback signs for proper operation, alignment, broken lenses, or missing parts. Align all signal and pedestrian indications as necessary. Check all pedestrian push buttons, pedestrian detectors, as well as any audible or accessible pedestrian systems for functional operation.

5.3.3 Observe and check for proper operation of the detector loops and amplifiers in relation to actual traffic demand, verifying that detector calls placing calls to the designated phases are reflected in the signal controller. Adjust or re-tune detector amplifiers and test detector loops and lead-in cables as necessary.

5.3.4 Remove all postings and adhesive material on cabinets and signal poles.

5.3.5 Check related photoelectric circuitry and adjust or repair as necessary.

5.3.6 Check power control units, controllers, and solar panels. Clean solar panels as necessary.

5.3.7 Provide Controller Cabinet Service:

5.3.7.1 Inspect all relays, switches, etc. inside signal cabinet and replace or make adjustments or minor repairs if necessary.

5.3.7.2 Inspect all screws on terminal strips inside signal cabinet and tighten connections as necessary.

5.3.7.3 Check signal cabinet for rust. Remove rust and paint over when possible. Report to the Engineer on the cause of the rust.

5.3.7.4 Check signal cabinet and service panel/box for presence of graffiti. Report any graffiti to the Engineer. If requested, remove graffiti either by brushing, wiping, or painting over it. If painting, obtain written approval from the Engineer prior to performing the work.

5.3.7.5 Check for presence of pests and mitigate appropriately.

5.3.7.6 Check and adjust signal cabinet fan operation. Reset thermostat for 90 degrees Fahrenheit.

5.3.7.7 Check and replace cabinet light in conjunction with cabinet door.

5.3.7.8 Examine interior for water, excessive dampness, and plant or animal intrusion. Determine cause and correct if necessary.

5.3.7.9 All defective or malfunctioning controller cabinet assemblies, including power supplies, power outlets, bus interface units (BIU), detector amplifiers, auxiliary equipment, and appurtenances, such as relays, load switches, flashers, transformers and related items, shall be replaced with new parts as specified in Appendix A-2 and report to the Engineer as part of the monthly activity report. For items covered under the manufacturer's warranty, the Contractor shall exercise the warranty for the City.

5.3.7.10 With respect to the traffic signal controller, when the controller becomes obsolete or deteriorated to the point of being beyond repair, the Contractor shall report such conditions to the Engineer and provide evidence that replacement is necessary. The Contractor shall prepare estimates indicating the breakdown of material and labor costs for replacement of the controller and submit this information to the Engineer. No permanent changes, including timing changes, to the traffic signal controller shall be done without prior written approval from the Engineer.

5.3.7.11 Vacuum cabinet and remove any foreign material. Replace signal cabinet filter. Check signal cabinet for water-tightness

and re-seal where necessary. Oil and lube hinges and locks.

5.3.7.12 Check signal cabinet for loose and burned terminals and repair. Check breakers and replace if necessary.

5.3.7.13 Check load switch leakage and replace if over 5v AC.

5.3.7.14 Test and certify all Conflict Monitor Units (CMU) or Malfunction Management Unit (MMU) and furnish results of the tests to the Engineer within two weeks after the month in which the test was performed. For any units found to have failed the test, the Contractor shall notify the Engineer within 24-hours.

5.3.8 Inspect video detection and Pan-Tilt-Zoom cameras for any damages, clean the camera lenses, check and secure the camera mounting, tighten all connections, verify proper detection of vehicles, and adjust detection zones as necessary.

5.3.9 Clean and polish all signal and pedestrian indication lenses and reflectors.

5.3.10 Check alignment of all vehicle signals, pedestrian signals, and any mast arm signs, including blank-out signs for tightness and tighten as necessary.

5.3.11 Check all poles and mast arms for damage and correct torque/tightness of anchor bolt nuts.

5.3.11.1 Notify the Engineer of any poles that require immediate replacement.

5.3.11.2 Inspect all traffic signal pull boxes and hand-hole locations, exposing any buried conduits and resealing conduits if necessary.

5.3.11.3 Visually check pavement condition around detector loops and reseal if necessary.

5.3.11.4 Perform operational check of safety lights by removing or covering photoelectric units.

5.3.11.5 Replace all malfunctioning safety lights when discovered by the Contractor during routine maintenance or when reported to the Contractor by the City. All new safety lights shall be LED as approved by the Engineer prior to replacement.

5.4 While completing preventive maintenance activities, the Contractor shall document existing conditions to be included in a maintenance deficiency plan.

5.4.1 For any deficiencies found, upload color, high resolution, digital photographs to the maintenance management system, and include descriptions of the deficiency on maintenance form (Appendix A-1).

5.4.2 Examples of deficiencies may include, but not limited to:

5.4.2.1 Non-LED safety lights.

5.4.2.2 Controller cabinet equipment showing age or poor physical condition.

5.4.2.3 Vehicle signals missing backplates or using 8-inch indications.

5.4.2.4 Pedestrian countdown signals and push button missing despite the presence of a crosswalk.

5.4.2.5 Service cabinets not in compliance with latest City Standards.

5.4.2.6 Conduits whose fill makes it impassable for new conductor to pass through.

5.5 The Contractor shall document and record inventory of each traffic signal location, at a minimum, including but not limited to:

5.5.1 Cabinet make and model

5.5.2 Traffic signal controller make

5.5.3 Detection equipment type and configuration (loops, video, etc.)

5.5.4 Communication equipment type (switch model)

5.5.5 Presence of auxiliary equipment such as preemption devices, PTZ cameras, travel time readers, APS, etc.

5.6 The Contractor shall enter all inventory information in the maintenance and inventory management system.

6. RESPONSIVE MAINTENANCE REQUIREMENTS

6.1 During business hours of Monday – Friday 7:00AM to 4:00PM, the Contractor shall perform responsive maintenance work on any deficiencies identified either through preventive maintenance activities or reported by the City. Responsive

maintenance includes, but is not limited to, the repair and/or replacement of the following signal equipment when necessary and after written approval from the Engineer:

6.1.1 Cabinets and all electrical hardware, vehicle signals pedestrian signals, push buttons, pedestrian APS equipment, flashing beacons, blank-out signs, cameras, fuse holders, photoelectric cells, conductors and wiring, conduits, solar panels, pull boxes, power control units, poles, bolts, and all mounting hardware, etc.

6.1.2 Repair and/or replacement of inductive pavement loops shall be done per City Specifications.

6.2 The Contractor may be required to replace traffic signal infrastructure and traffic safety devices as requested by the City if repairs have a greater cost.

6.3 The Contractor shall respond to as-needed repair services requests regarding the City's communication infrastructure, which includes, but is not limited to, fiber optic and copper interconnect cables, fiber optic jumper cables, fiber optic termination panels, fiber optic splice trays, splice closures, copper terminal blocks, ethernet switches, and ethernet cables.

6.3.1 It shall be the Contractor's responsibility to request any existing network infrastructure information (splice diagrams, locations of splice enclosures, routing of cables, etc.) from the City and perform any field work to verify existing conditions to have a clear understanding of the work to be performed. This understanding shall be reflected in the proposal for any communications work.

6.3.2 Maintenance work on the fiber optic cable infrastructure may require fiber optic cable splicing, OTDR testing, installation, and trouble shooting. Fiber optic splicing and testing shall be done per City Specifications.

6.3.3 When directed as part of the work, fiber optic splicing and testing shall be started within a 72-hour period (calendar days, including weekends). Fiber optic cable splicing that is not started within a 72-hour period will result in the Contractor paying $500 per day to the City in liquidated damages. The total amount of liquidated damages will be deducted from any subsequent invoice payment. Permission to extend the 72-hour period must be requested in writing to the Engineer (e.g. if new conduit is required).

6.4 The Contractor shall enter all responsive maintenance work in the maintenance and inventory management system.

7. EMERGENCY REPAIR REQUIREMENTS

7.1 The Contractor shall provide emergency repair services on a 24-hour, seven days a week basis, including all holidays. The Contractor shall respond without delay upon notification by the Engineer or local emergency dispatch to repair a signal failure, malfunction, or damage due to a collision, acts of nature, or any other cause. Immediate action shall be taken to safeguard the public at any time a signal installation becomes partly or fully inoperative from any cause whatsoever. Please refer to Section 10.2 regarding the required response times for emergency repairs.

7.2 Damage as a result of a collision shall include cleanup of traffic signal equipment debris from an incident, erection of barricades or signs, hookup of a temporary signal controller, temporary power generator, temporary poles, and signal if necessary, traffic control, and any other work required to safeguard against any or all injury or damage to the public and reduce to a minimum any impact to the traveling public.

7.3 Emergency Repairs include, but is not limited to, the following:

7.3.1 Knocked down poles and damaged conductors, controllers, cabinets, detection malfunctions resulting in non-detection including priority/preemption equipment, sensing elements, flashing beacons, and other equipment issues resulting in a blacked out/dark signal or all-red flash condition.

7.3.2 The replacement of malfunctioning vehicle signal indications shall be considered emergency repair, except when there are at least two (2) indications still operative for each direction of travel (including one mast-arm signal). Malfunctioning traffic signal indications on traffic signal mast-arms shall be replaced immediately when notified.

7.3.3 In the case of a pole knock-down where the foundation and anchor bolts are still intact, the Contractor shall make all necessary repairs with all new equipment to return the pole to its original, undamaged condition upon the initial response. No additional compensation shall be provided for subsequent work to the original damage.

7.4 Temporary repairs made under emergency conditions shall be replaced with permanent work within twenty-one (21) calendar days of the initial emergency response subject to availability of materials, unless otherwise approved in writing by the Engineer. The Contractor shall notify the Engineer of the schedule for permanent restoration and shall obtain written authorization for any extension of the 21-day period. Failure to complete permanent restoration of an emergency repair within twenty-one (21) calendar days of the initial emergency response and without prior written approval from the Engineer for an extension will result in the Contractor paying the City liquidated damages in the amount of One Thousand

Dollars ($1,000) per calendar day beyond the twenty-one (21) day period until the permanent restoration is completed and accepted by the Engineer.

7.5 The Contractor shall enter all emergency repair work in the maintenance and inventory management system.

8. CONSTRUCTION SUPPORT REQUIREMENTS (AS-NEEDED SERVICES)

8.1 If requested by the City, the Contractor shall provide construction support services for capital improvement projects. Support work includes, but is not limited to:

8.1.1 Cabinet Testing. Setup and conduct a 21-day functional test of a traffic controller cabinet as defined in the City Specifications.

8.1.2 Traffic Signal Activation. Support activation of traffic signals by verifying proper installation of cabinet assembly components, wiring connections, display of vehicle and pedestrian signals head displays, operation of loop detectors and push buttons, view of cameras, and other related tasks necessary to successfully activate a traffic signal.

8.1.3 Construction Inspection. Upon notification from the City's inspection staff, inspect locations of traffic signal construction, verify work has been completed in accordance with the City's Standard Specifications, and preparation of a punch list of any work required to be completed prior to acceptance.

8.1.4 Acceptance. Upon completion of punch list work, accept construction work on behalf of the City. If the location is not already under the list of locations in Appendix B-1, the Agreement shall be amended to include the location. Contractor shall notify the City of the new location rates or if the new location rates are at the applicable cost for preventive and responsive maintenance at proposed rates for maintenance as existing traffic signals, safety lights, radar speed feedback signs, flashing beacons, hybrid beacons, and lighted crosswalks, commencing on the date of acceptance of the installation. Upon acceptance, the Contractor shall immediately incorporate maintenance of such equipment into the program.

8.2 The contractor shall enter all construction support work in the maintenance and inventory management system.

9. UNDERGROUND SERVICE ALERT (USA) MONITORING

9.1 The Contractor shall be required to adequately locate and mark all traffic signal conduits, traffic signal interconnect/communication lines, and equipment in accordance with California Government Code Section 4216 et seq. within 24 hours of notification by the City. The Contractor shall assume all liability for satisfying

the City's obligations to adequately identify underground structures in accordance with this law.

9.2 The City anticipates 500 to 1,000 dig alerts each year around traffic signals.

10. COMMENCEMENT OF WORK

10.1 Dispatch and Response

10.1.1 The Contractor shall establish, maintain, and make available to the City, a single toll-free phone number that the City can call to request responsive and emergency repairs for the duration of the contract. This phone number shall be established and operational at Agreement initiation. This phone number shall be in service 24-hours a day, 7-days a week with a live person. The use of an automated, machine answering system will not be accepted.

10.1.2 The Contractor shall only respond to requests for service made by the City Engineer, the Engineer, Silicon Valley Power dispatch, or the City's Police Department. Compensation will not be made for unauthorized responsive maintenance or emergency repairs.

10.1.3 The Contractor is pre-authorized to perform maintenance and emergency repair work if the cost of such work is less than Two Thousand Dollars ($2,000). All work in excess of this amount must be requested in a written request and approved in writing by the Engineer prior to performing the work.

10.2 Response Time

10.2.1 Non-Emergency Responsive Maintenance Response Time

10.2.1.1 When requested by the Engineer to complete non-emergency responsive maintenance, the Contractor shall submit a written response within five (5) working days.

10.2.1.2 Each written response shall outline the work to be performed, a schedule that defines the work including start and end dates, the associated fee that includes a breakdown of labor hours, material cost, product submittals/cut-sheets for materials, and any other details that may be requested by the Engineer.

10.2.1.3 Upon written approval by the Engineer, the Contractor shall commence work no later than fourteen (14) calendar days and inform the Engineer via e-mail when work is complete.

10.2.2 Emergency Repair Response Time

10.2.2.1 When notified that traffic signal equipment is malfunctioning or is out of order due to collision damage, Acts of Nature, malicious mischief, or other unforeseen events, the Contractor shall be at the location to correct the malfunction or failure within two (2) hours of receiving a notification for emergency repair.

10.2.2.2 The Contractor shall notify the Engineer via email of any emergency repair performed by the next business day. If follow-up repairs are required, Contractor shall submit a written response that outlines the work to be performed, a schedule including start and end dates, and the associated fee that includes a breakdown of labor hours, material cost, product submittals/cut-sheets for materials, and any other details that may be requested by the Engineer. The Contractor shall submit this written response within five (5) working days of the emergency repairs being performed and inform the City Engineer via e-mail when work is complete.

10.2.2.3 It is understood and agreed that failure on the part of the Contractor to respond within the required response time will result in the Contractor paying Two Thousand and Five Hundred Dollars ($2,500) per incident to the City as liquidated damages. The total amount of liquidated damages will be deducted from any subsequent invoice payment. Repetitive failure to respond within the required time shall be sufficient cause for the City to terminate this contract.

11. TRAFFIC CONTROL AND SIGNAL SHUTDOWN REQUIREMENTS

11.1 The Contractor shall erect flags, signs, flashing lights, arrow boards, and barricades as required to properly protect the workers and traveling public when work is being performed on or near the roadway, or when cleaning debris and hauling away and disposing of damaged equipment.

11.2 All typical traffic control plans used to carry out the services in this Agreement shall conform to the 2014 California Manual on Traffic Control Devices (Revision 8), Section 12 of the 2024 Caltrans Standard Specifications, or the latest, as well as the City's current Standard Specifications. All other traffic control plans shall be approved by the Engineer in writing.

11.3 Whenever it is necessary to close any traffic lanes to complete any portion of work, at least one (1) lane of traffic shall be kept open in each direction at all times. On major arterials, lane closures shall be avoided on weekdays between 7:00 AM to 9:00 AM and between 3:30 PM and 6:00 PM, unless approved in writing in advance by the Engineer or needed for emergency work.

11.4 The Contractor shall immediately notify the Engineer, Silicon Valley Power Dispatch, and the City's Police Department of any signal turn-offs or signal on flash necessitated by work under this Agreement. Signal shutdown of any duration and signal on flash operation exceeding thirty (30) minutes must be authorized beforehand by the Engineer.

12. RESOURCES AND QUALIFICATIONS

12.1 Upon issuance of a Notice to Proceed, Contractor shall submit all personnel anticipated to work on this Agreement, including administration staff and technical staff. The Contractor shall submit resumes of all personnel and a copy of certificates to the Engineer.

12.2 The Contractor shall designate a project manager and a lead signal technician/foreman to be assigned to the City and be available during the entire length of the Agreement. The project manager shall serve as the City's main point of contact for all matters and shall obtain the Engineer's written approval to use personnel that were not submitted. The City also reserves the right to request a different project manager and/or lead signal technician/foreman to be assigned at any time during the length of the Agreement.

12.3 All personnel performing traffic signal related work within the City must have at least one (1) year of field experience and have an International Municipal Signal Association (IMSA) Level I or State of California Department of Industrial Relations Electrician certificate. The lead signal technician/foreman must have at least three (3) years of field experience and a IMSA level II certificate is desirable. All personnel demonstrate experience with the operation and maintenance of all equipment listed in the City's Standard Specifications.

12.4 All personnel performing fiber optic cable work within the City must have at least one (1) year of field experience and have an equivalent of an IMSA Fiber Optics Level I or Fiber Optic Association (FOA) Fiber Optic Technician certificate. If personnel are requested to configure network settings on devices, the personnel must have at least three (3) years of field experience and have an equivalent of a Cisco Certified Network Associate (CCNA) or Cisco Certified Network Professional (CCNP) certificate.

12.5 The Contractor shall ensure that all staff obtain necessary safety certifications and permits from the Valley Transportation Authority (VTA), Caltrain, and Union Pacific Railroad, to work in and around VTA and railroad right of way.

12.6 All personnel performing work under this Agreement shall maintain current and valid certifications for the entire duration of the Agreement. The Contractor shall provide verification of certification renewal or recertification to the Engineer upon request.

13. STORAGE FACILITIES, EQUIPMENT, AND SPARE MATERIALS

13.1 The Contractor shall maintain adequate storage and shop repair facilities to perform the services and requirements of this Agreement, including a sufficient stock of spare parts and signal equipment to perform permanent repairs to the system within 21 calendar days of the incident. Permission to extend the 21-day period must be requested in writing to the Engineer (e.g. for a new traffic signal pole).

13.2 The Contractor shall have hydraulic lift (bucket) trucks while performing work in the City. The hydraulic lift trucks shall be capable of reaching a height of at least 35 feet to perform work. Should a technician respond to a service call without proper vehicles or equipment for the work, no additional compensation shall be provided for the subsequent time, labor, and equipment.

13.3 The Contractor shall store at least spare materials equivalent to one 8-phase traffic signal, including one (1) fully tested standby cabinet and controller assembly compatible with the City's traffic signal system. All spare materials shall meet the City's Standard Specifications and shall deviate from this requirement only upon written advance approval from the City. Contractor shall provide spare equipment on a temporary basis at no additional charge to the City whenever the original units are removed for repair or servicing.

13.4 The Contractor shall furnish temporary traffic signal cabinets, control equipment, and/or signal poles as required to operate traffic signals until permanent equipment can be installed.

13.5 The Contractor shall have shop and laboratory facilities within 50 miles of the City of Santa Clara to perform all maintenance and repair of equipment. The facility shall have test equipment to perform bench tests of traffic signal controller cabinets, conflict monitors, load switches, flashers, detector amplifiers, controllers, and LEDs. The facility shall be staffed and open for meetings/inspections at any time, Monday thru Friday during normal working hours.

14. MAINTENANCE AND INVENTORY MANAGEMENT SYSTEM

14.1 Upon issuance of Notice to Proceed, the Contractor shall establish, maintain, and make available to the City, a maintenance and inventory management system that is GIS based with geographic display, geocoded, and provides the following minimum features:

14.1.1 Database – A complete database of all maintenance locations including all maintenance and repair history, equipment inventory, electronic photo images, and equipment installation date of any equipment utilized at each location.

14.1.2 Assets – Asset inventory, maintenance/repair history, and ability for future replacement and budgeting.

14.1.3 Parts – Real-time available inventoried replacement parts, current status of reordered equipment, and inventory tracking.

14.1.4 Service/Emergency Calls – A searchable record of all calls, date and time stamped at moment of receipt, dispatch, the Contractor arrival and departure times, and a description of problem(s) found and repair(s) made. All records shall be updated in real time by the Contractor.

14.1.5 Other Support Tasks – A record of all calls, requests, and pre-authorized repair work, date and time stamped at moment of receipt, dispatch, the Contractor arrival and departures times, and a description of support work performed. All records shall be updated in real time by the Contractor.

14.2 The entire system shall reside with and be hosted by the Contractor. Access to this system by the City shall be through the internet on a secured web portal using any standard web browser (e.g. Internet Explorer, Chrome, etc.). Any data populated into the system, including all data identified in items 14.1.1 to 14.1.5 in this section, shall be the property of the City.

14.3 Within thirty (30) days from the end of this Agreement, the Contractor shall provide all data to the City for its possession. The data shall be provided in both electronic and hardcopy format. Electronic format shall be in a non-proprietary format approved by the City.

15. RECORDS

15.1 The following records shall be created and maintained by the Contractor covering all signal maintenance activities. The Contractor shall provide these records to the City in both electronic and hardcopy format upon request.

15.1.1 Service Calls

15.1.1.1 A record of all service calls, repairs, and pertinent data pertaining to each individual intersection shall be kept in the controller cabinet and properly noted by the signal technician at the time of the regularly scheduled preventive and routine maintenance, responsive maintenance, and emergency repair work, or any other work or inspection performed, using a form provided by the Contractor and approved in writing by the Engineer.

15.1.1.2 Each record logged shall indicate the name of the person responding, arrival time at the location, description of the failure or problem, actions taken, and details of any repaired

or replaced parts or equipment.

15.1.1.3 The Contractor shall provide the City a monthly summary report of this log for all maintenance locations in conjunction with the monthly invoice.

15.1.2 Accounting

15.1.2.1 The Contractor shall maintain all accounting records related to this Agreement in accordance with generally accepted accounting principles and state law requirements for the duration of this Agreement. Within thirty (30) days from the end of this Agreement, the Contractor shall provide all records to the City for its possession.

15.1.2.2 The Contractor's accounting records shall include, at a minimum, all documents which support the Contractor's costs and expenses related to this Agreement, including personnel, sub-consultant invoices, and payments, and reimbursable expenses.

15.1.2.3 The accounting records shall be made available to the City within thirty (30) days after City's request, during normal business hours.

16. MONTHLY ACTIVITY REPORT

16.1 The Contractor shall submit to the City, at the same time as the submission of monthly invoices, a report covering all work performed under this Agreement during the previous month. The monthly activity report shall be provided in electronic format to be determined by the Contractor and the City. The Contractor shall maintain a copy of the monthly activity report (either electronic or hardcopy) for the duration of this contract. The monthly report shall include at a minimum:

16.1.1 Time any service calls, including emergency calls, were received by the Contractor, time at which the call was dispatched to the technician, the arrival time of the technician at the requested location, the length of time spent repairing or diagnosing the problem, and the departure time.

16.1.2 A complete record of any and all work performed under this Agreement during the previous month, including replacement and/or installation of equipment at each location.

16.1.3 The date and time that any preventive maintenance work was performed, including work performed at night.

16.1.4 Any and all pending repair work needed at each location.

16.1.5 Within thirty (30) days from the end of this Agreement, the Contractor shall provide all records to the City for its possession.

17. MEETINGS

17.1 The Contractor shall be available to meet, when deemed necessary, with City staff at a mutually agreed upon time and place to review and discuss any items related to all work performed under this contract.

Appendix A-1
City of Santa Clara Form TSM-1 Traffic Signal Preventive Maintenance Form

City of Santa Clara
The Center of What's Possible

Public Works Department
Traffic Division

1. Location:_____ ID #_____
2. Date:_____TOA:_____TOC:_____Work Done By:_____
   Date:_____TOA:_____TOC:_____Work Done By:_____
   Date:_____TOA:_____TOC:_____Work Done By:_____
3. Controller:_____Mfr:_____S/N_____
   ___
4. Cabinet:_____Mfr:_____S/N_____
5. Utility Power: AC_____Volts DC_____Volts Ripple_____
6. BBS: Battery condition %____ # of fails:___Hrly usage:_____
   Install Date:_____

VERIFY WITH TMC
___ Check detector slots
___ Check camera view/video zones

CABINETS
___ Clean/vacuum
___ Check lock (lubricate if necessary)
___ Check/lubricate hinges
___ Check fans
___ Check/replace filters
___ Check anchor bolts
___ Check police door functions
___ Check inside/outside of cabinet
___ Check for water accumulation
___ Check weatherproof gaskets
___ Check/report Graffiti

DC/BATTERY BACKUP SYSTEM
___ Check power transfer
___ Check battery voltage
___ Check/clean solar panel

CONTROLLER & HARDWARE

___ Check switches, relays, flashers, etc
___ Check flash transfer operation (non-peak hrs.)
___ Remove and test Conflict Monitor/operation
CMU type _____
Date Tested_____
___ Check detection cards/operation
___ Check pushbutton ISO cards/operation
___ Check wire terminals/tightness
___ Check DLC terminals/soldering
___ Check Railroad/EM vehicle pre-emption
___ Check GFCI operation

Notes:

_____
_____
_____

SIGNAL HEADS

___ Check alignment
___ Check mounting hardware
___ Check/paint back plates
___ Check/clean visors
___ Check/clean lenses
___ Check gaskets
___ Check hinges & wing nuts
___ Check housing for cracking/wear
___ Check locking rings
___ Check Astro brackets for wear
___ Check LED/countdown operation
___ Check PV lamp operation/alignment
___ Check wire termination/tightness

SAFETY LIGHTS

___ Check safety light operation at night
___ Check/clean lenses
___ Check mounting hardware
___ Check gaskets

DETECTOR LOOPS/CAMERAS

___ Check detector loops/splicing
___ Check loop sealant on pavement
___ Check loop stubout/add sealant (if needed)

CAMERAS
___ Check cameras/connections/brackets
___ Clean camera lenses
___ Check camera power: AC_____volts
___ Check drip loop

SIGNAL OPERATION
___ Walk each crosswalk
___ Check/view each pedestrian signal head
___ Press each push button
___ Walk each street approach
___ Check/view each vehicle signal head
___ Observe Ø operation/signal cycling

SIGNAL POLES & MAST ARMS
___ Check bolts/welds @ arm/pole connection
___ Check end bushings/caps on arm
___ Check anchor bolts
___ Check/replace hand hole covers
___ Check terminal strips/splicing
___ Check pedestrian push buttons/plates
___ Check/report Graffiti
___ Check alignment of mast arm
___ Check horizontal & vertical angles of arms
___ Check arm/base plates for rust & cracks
___ Check base plate/dry pack
___ Check mast arm sign mounting hardware

PULL BOXES
___ Check/replace lids
___ Check conduit height
___ Check conduit bushings & tightness
___ Check ground wire
___ Check drainage/gravel
___ Check wire splices/tape
___ Clean all pull boxes from debris/insects

Notes**:**

_____
_____
_____

EXISTING DEFICIENCIES FOUND:

_____
_____
_____

PICTURES OF DEFICIENCIES

Staff Name**:** _____
Staff Signature**:** _____
Date: _____

Appendix A-2
City of Santa Clara Form TSM-2 Traffic Signal Maintenance Log

City of Santa Clara
The Center of What's Possible

Public Works Department
Traffic Division

LOCATION: _____ INID:_____

DATE	TOA	TOC	DESCRIPTION OF WORK	NAME

Appendix A-3
City of Santa Clara Standard Specifications

SECTION 02086

SIGNALS, LIGHTING, AND ELECTRICAL SYSTEMS

1.0 GENERAL

1.1. GENERAL DESCRIPTION OF WORK

This work shall consist of traffic signal installation as provided in the Contract Documents. The performance of a complete job in all respects as indicated by the Plans and the Specifications and as directed by the Engineer is required.

2.0. PLANS AND SPECIFICATIONS

2.1 Unless otherwise specified, the work embraced herein shall conform to:

A. The Contract Documents.

B. The appropriate details of the Standard Details.

C. The appropriate specifications of the Standard Specifications insofar as the same may apply.

D. The appropriate plans of the Standard Plans.

2.2 In the event of apparent conflicts between the Standard Specifications, the Standard Plans, the Standard Details, or the Contract Documents, those requirements, as determined by the Engineer, which gives the greatest protection to the City or result in the best installation shall govern.

3.0 ACCESS TO ACTIVE CONTROLLER CABINET

No access to an active traffic signal controller cabinet or associated equipment is allowed unless a Silicon Valley Power (SVP) technician or Traffic Division Engineer is present, at the intersection, to monitor the operation of the traffic signal.

4.0 MATERIALS

4.1 LOOP DETECTOR PROTECTION AND INSTALLATION

The Contractor shall take precautions to ensure that trenching operations to install conduit do not cut existing loop detector

conductors embedded in pavement. Either of the following methods may be used by the Contractor to avoid loop conductors:

1. New conduit may be routed to pull boxes where loop conductors terminate. The existing loop termination pull boxes shall be replaced by No. 6 pull boxes.
2. New conduit may be routed under loop conductors if possible without disturbing the loop conductors.

If existing loop conductors are cut or damaged by the Contractor's operations, they shall be replaced to their original condition and original configuration at the Contractor's expense. Contact the SVP traffic personnel at least forty-eight (48) hours before trenching for exact location of existing loop conductors.

If existing loop conductors will be replaced by new loop conductors, contact SVP traffic personnel and Traffic Operations at least 48 hours prior to any trenching or sawcutting to allow for the deactivation of the existing loops and signal timing adjustments. All contact with the SVP traffic personnel and Traffic Operations and shall be made through the City's Public Works Inspector.

New loop installation shall be in accordance with Section 86 of the Standard Specifications. Type 1 loop wire shall be used along with Type B lead-in cable (86-5.01A (4)). Installation shall conform to Section 86- 5.01A (5) of the Standard Specifications. Sealant shall be Hot-Melt Rubberized Asphalt.

No loops shall be installed until pre-marking has been verified by City Traffic Operations.

Detector loops shall be laid out by the Contractor. Location of detector loops will be verified and approved by City Traffic Operations prior to start of loop saw-cutting. A minimum of 2 Working Days notice is normally required for loop verification. Verification of loop location(s) must be scheduled through the City's Public Works Inspector.

Loops located in the vehicle lanes are to be cut in a modified 6x6 Quad configuration on the traffic lane center marks approved by City personnel unless otherwise noted. Loop wiring is to be wrapped in a 3-6-3 configuration. Each individual loop will have its wiring brought into the proper pull box for connection to Type B detector lead-in cable (DLC).

Loop wiring in street shall enter a detector hand hole box to be installed at lip of gutter at transition from street to conduit. When requested or needed temporarily, soft patch asphalt material is to be applied at lip of gutter street excavation where loop wiring enters

conduit. Soft patch is to be tamped so no settling of material will occur and finished at street level.

The Contractor shall test each detector loop as they are installed. Acceptable testing results for each individual loop pair shall be 124 micro- henries inductance and infinite meg-ohms to ground. Values of the test results for loop inductance shall vary no more than ±5 percent (± 6 micro- henries). No loop wiring is to be connected to a DLC until tested and approved by SVP traffic personnel. Any detector loop that fails to meet acceptable testing results shall be replaced immediately at no additional cost to the City.

The Contractor shall provide the City with the detector loop test results in the form of a detector loop test report. The report shall include the readings for the loop detectors installed in the field. The following information shall be provided for every detector loop the Contractor installs.

1. Phase number the detector loop will service.
2. Lane Number the detector loop is in.
3. Type of detector loop (presence or advanced)
4. Location (in lane from stop bar).
5. Meg-ohms reading.
6. “L”: Inductance Reading
7. “R”: Resistance Reading
8. “Q”: Quality factor reading/calculation
9. Initials of Person performing Test.
10. Date test was made.

To aid in the clarification, of the location of the detector loop, being tested, the following guidelines shall be used: The lane closest to the center of the roadway is the #1 Lane. The loop closest to stop bar will be labeled “A” the second loop in the lane will be labeled “B” the third loop in the lane will be labeled “C” and the fourth loop in the lane will be labeled “D”. Loops shall be grouped on the test report first by phase number (1-8) then by lane (1-6) and then by location in the lane (A-D), or as directed by the Engineer.

A blank “Detector Loop Test Results” form is located at the end of this Section 02086.

The City may verify the test results submitted. If more than two loops fail to match the passing test results, submitted by the Contractor, the Contractor is required to retest all loop detectors. Any detector loop that fails to meet acceptable testing results shall be replaced immediately at no additional cost to the City. The City may charge up to $500 per unacceptable loop per occurrence for damages and retesting.

No loop wiring is to be connected to a DLC until tested and approved by SVP traffic personnel.

Any traffic loop wire connection(s) shall be “C” tapped, soldered, and covered with waterproof heat shrink. See Section 4.4, “CONDUCTORS AND WIRING”. Butt splices may be allowed with previous approval from the Traffic Engineer.

All DLC forked connectors to be laid down in signal cabinet shall be soldered. DLC shield conductors inside cabinet are **not** to be bonded to ground but wrapped around and secured to its respective owner. They are not to be shorter than six inches (6”).

For projects that include new asphalt concrete overlay at the intersection, all new detector loops shall be in place before final asphalt concrete paving surface is applied. Contractor shall not be allowed to cut into the final paving surface to install new detector loops. Contractor may be charged up to $1,000 per loop for cutting into the final paving surface.

4.2 PULL BOXES

Pull boxes shall conform to all applicable specifications in Section 86- 2.06, Pull Boxes, of the Standard Specifications and this Section 02086.

Pull boxes shall be No. 6 unless otherwise directed by Engineer or noted in the Contract Documents. Pull boxes larger than No. 6 shall be equipped with lightweight polymer concrete covers. Covers shall not weigh more than 120 pounds. Covers may be constructed in two pieces to maintain a maximum weight per section of 120 pounds. Pull boxes shall be installed at the locations shown on the plans or as directed by the Engineer. Existing pull boxes, which are damaged, shall be replaced. Pull boxes shall be installed no closer than six inches (6”) to the nearest score mark on existing sidewalk. The bottoms of pull boxes shall be bedded in a minimum of six inches (6”) of crushed rock. A minimum of one inch (1”) of grout shall be placed on top of the crushed rock within the pull box and trowelled smooth prior to the installation of cable/wire. A layer of roofing paper shall be placed between the grout and the crushed rock sump. A one inch (1”) diameter drain hole shall be provided in the center of the pull box through the grout and the roofing paper.

The grout shall be sloped to drain toward the drain hole in the center of the box.

Unless otherwise noted on the plans or directed by the Engineer all pull box covers on this job shall be marked “CSC Traffic Signal” or “CSC Interconnect”. Pull box covers are to be non-securing without holes for locking hardware. Pull box extensions will be installed as determined necessary in the field or as directed by the Engineer.

Conduits shall enter through the side of pull boxes from the direction of the run unless otherwise specified on plans. Conduit shall be sloped slightly toward the top of box to facilitate pulling of cable. Each conduit terminating in a pull box shall be grouted to the pull box prior to cable installation.

4.3 BONDING AND GROUNDING

Bonding and grounding shall conform to the specifications in Section 86- 2.10, Bonding and Grounding, of the Standard Specifications and this Section 02086. Metal conduit shall be made electrically secure to form a continuous system, and shall be effectively grounded using ground rod and ground clamp at pull boxes at intervals of not more than 500 feet. Bonding and grounding jumpers shall be copper wire or copper braid. PVC/HDPE conduits shall have continuous bare #8 solid copper wire installed in conduit and grounded to ground rod. Grounding jumper shall be attached by a 3/16-inch or larger brass bolt in the standard or pedestal and shall be run to the conduit or a ground rod in adjacent pull box. Grounding rod for the controller cabinet shall be placed in the pull box next to the controller cabinet.

4.4 CONDUCTORS AND WIRING

Contractor shall not damage existing conductors or conductor insulation. With the exception of detector lead-in cable, if an existing conductor or any conductor insulation is damaged, Contractor shall install a new conductor from the existing controller cabinet to the new pull box and connect to the existing traffic control system. If a loop detector lead-in cable is damaged, Contractor shall install and connect a new detector lead-in cable from the existing controller cabinet to the terminus of the existing field loop wires.

Unless previously approved methods are approved by City Traffic Engineer all connections in pull boxes are to be “C” tapped, soldered, and covered with waterproof heat shrink. All heat shrink shall be Thomas & Betts Shrink-kon HS Series or City-approved equal.

All wiring shall be labeled as to their function in each and every pull box with Partex PK cable markers or City-approved equal.

Signal cabinet ground rod is to be installed inside first main pull box closest to cabinet, not in cabinet foundation.

Safety lighting on signal poles shall not have wiring fused in pull box nor require any additional electrical protection other than power panel circuit breaker.

No more than two (2) field wires are to be laid down on an empty terminal. All field wiring shall have soldered lugs.

A. Wiring

When new conductors are to be added to existing conductors in a conduit, all conductors shall be removed; the conduit shall be cleaned as provided in Section 86-2.05C of the Standard Specifications, and both old and new conductors shall be pulled into the conduit as a unit.

Cable shall be spliced and insulated to provide a watertight joint and to prevent absorption of moisture by the cable. A cast insulation of self-curing epoxy resin, which is compatible with wire insulation, shall be poured to form a moisture-resistant joint into molds of dimensions suitable for the splice. The resin shall be resistant to weather, aromatic and straight chain solvents and shall not sustain combustion.

All traffic signal field wiring shall be solid copper THW with 600 volt PVC 45 mil insulation thickness minimum. All traffic signal field wiring shall be meggared at 500 V by Contractor and results given to traffic engineering.

B. Disturbed Wiring

All disturbed wiring with existing splices shall be soldered and re- spliced. Splices shall be soldered with a soldering iron (no propane torches shall be used) and a resin-core solder acceptable to the Engineer.

4.5 INTERCONNECT CABLE

A minimum of three feet (3') of slack shall be provided for 25-pair interconnect cable in controller cabinets.

All new interconnect cable shall be fixed with identification bands in pull boxes and near termination points. Identification bands shall indicate that the cable is "INTERCONNECT" and the direction in which the cable is traveling (North-South or East-West).

Splices of interconnect cable shall be enclosed within PVC chambers. Splices to the interconnect cable shall be performed by the City, but Contractor is responsible for providing watertight seal on cable ends prior to cable splicing.

4.5.1 WIRING AND SPLICING

Wiring shall conform to the appropriate specifications in Section 86-2.09, Wiring, of the Standard Specifications and this Section 02086.

A minimum of eight feet of slack shall be provided for each 25-pair or 12-pair cable in pull boxes where splices occur. Where cable is looped through pullboxes (not spliced), the loop shall consist of a minimum of eight feet of cable.

4.5.2 CABLE TESTING

Cable testing shall be performed by the Contractor before final acceptance of the Project is given by the City. Individual pairs shall be tested for continuity within the system. All cable installed shall be tested in the presence of the Engineer. Any individual pair which is found to be electrically discontinuous within the system must be repaired before final acceptance is given by the City.

Cable testing shall conform to the following:

1. Each pair shall be tested for loop resistance and result recorded
2. Branching cable to be tested from one end to each outer branch and result recorded for each individual pair
3. A 500V megger shall be used to obtain megger reading of each pair to ground and result recorded
4. All recorded results shall be submitted to the Engineer before final acceptance is given.

4.6 VIDEO VEHICLE DETECTION SYSTEM

4.6.1. DESCRIPTION. This work shall consist of furnishing and installing video vehicle detection system(s) at the locations indicated in the Plans and as directed by the Engineer.

The work under this Section shall be performed in accordance with these provisions, the Plans, and the Standard Specifications.

4.6.2. SYSTEM REQUIREMENTS. The video vehicle detection system shall include the camera with zoom lens and the

integrated machine vision processor in one compact unit, with internal heater and integrated adjustable sunshield, all mounting hardware (video detector camera mounting bracket or video detector camera pole mount extension bracket), the communications interface panel, the detector port master, video detector cable, all associated equipment or miscellaneous fittings (cabinet wiring), and all labor, materials, and equipment required to complete the installation and make the video detection system fully operational. All of the video detection system components shall be current production equipment produced by the same manufacturer (for system operation compatibility purposes) unless otherwise noted herein or approved in advance by the Engineer.

The video vehicle detection system shall be an Econolite Autoscope Encore or previously approved equal.

4.6.3. SUBMITTALS.

(a) Fabrication Drawings. The Contractor shall submit Fabrication Drawings.

(b) Documentation Requirements. Three (3) advance copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer. The Engineer will verify the manufacturer's equipment manual as part of the test and integration process. The equipment manual incorporating the Engineer's corrections and comments shall be integrated by the Contractor into the operations and maintenance manual. The manual shall, as a minimum, include the following:

(1) Complete and accurate schematic diagrams.

(2) Complete installation and operation procedures.

(3) Complete performance specifications (functions, electrical, mechanical, and environmental) of the unit.

(4) Complete accurate troubleshooting, diagnostic, and maintenance procedures.

4.6.4. CONSTRUCTION REQUIREMENTS. All work associated with Video Vehicle Detection System shall be completed prior to activation of the video detection system.

The Contractor shall make the necessary changes to the signal equipment to integrate the video vehicle detection system into the signal control operation. The Contractor shall be responsible for furnishing all training, labor, materials, cables, connectors, tools, equipment, shipping, and incidental items necessary to complete the installation and make the video vehicle detection system fully operational.

Installation of the video vehicle detection system shall include the installation of any and all associated equipment, including, but not limited to, the following:

(a) Video Detector Camera Assembly with Integrated Machine Vision Processor (MVP). The Contractor shall furnish one

(1) Integrated Machine Vision Processor module per approach and all associated enclosures and incidental work necessary to complete the installation and make the video vehicle detection system fully operational. This will also require providing the Integrated Machine Vision Processor Comm Server configuration software, all miscellaneous hardware, connectors, and documentation.

(b) Video Detector Communications Interface Panel (CIP). The Contractor shall furnish one (1) Video Detector Communications Interface Panel per cabinet and incidental work necessary to complete the installation and make the video vehicle detection system fully operational.

(c) Video Detector Port Master. The Contractor shall furnish one (1) Video Detector Port Master per cabinet and incidental work necessary to complete the installation and make the video vehicle detection system fully operational.

(d) Video Detector Cable. The Contractor shall furnish the specified cable type, all connectors, sealing tape, and incidental work necessary to compete the installation of the Video Detector Cable between the Video Detector Camera Assembly with Integrated Machine Vision Processor and the Video Detector Communications Interface Panel in the traffic control cabinet, and make the video vehicle detection system fully operational.

(e) Video Detector Camera Mounting Bracket. The Contractor shall furnish one (1) Video Detector Camera

Mounting Bracket per Video Detector Camera and all associated equipment, labor, materials, tools, and incidental work necessary to attach the camera mounting bracket to a mast arm or camera extension bracket, complete the installation, and make the video vehicle detection system fully operational.

Video Detection System Hardware

	Qty	Hardware
Per Approach as specified	1	MVP camera
	1	Mounting brackets (model AMBKTM11S) std 10”
	FT	3 conductor, 18AWG Polyethylene Jacketed-CSA rated conduit rated power cable. Length to be determined homerun from controller cabinet to each camera with 10’ slack in each pullbox.
Per Intersection	1	Terra Interface Panel
	1	Cat5e network patch cable RJ45 Male to RJ45 Male Cat5 Length 3’
	1	Terra Access Panel
	1	ASTCBL10 – Terra Interface Panel cable
	1	SDLC cable (model ACBLP0E05 P/N 33550G5) for TS2 connection to the controller
	1	NTSC Monitor with BNC interfaces for signal cabinet
		Five (5) years System warranty from of date of acceptance

When Video Detection System is to be used in a NEMA TS1 cabinet, the following additional equipment shall be supplied.

	Qty	Hardware
Per Intersection	1	Model 33457G57 for logic inputs (33x)
	1	ASTCBL12 – Terra Interface Panel cable and I/O for 24 outputs in place of ASTCBL10 – Terra Interface Panel cable

Installation

Camera shall be placed to minimize occlusions of left turn lanes. Occlusions can be minimized by installing the camera on the signal mast arm, in line with the lane striping between the left turn lane and the through lanes. Cameras installed on signal mast arm shall use a manufacturer supplied (City

pre-approved) 28” extended camera mount. At intersections where the left and through movements go together as standard operation and left turn movements are not protected, the camera can be mounted on a luminaire arm with standard camera mounting bracket.

Camera shall be aimed so that the area of detection is in the top half of the video image. Typically the farthest away detector shall be at the top of the image, and at least four (4) cars shall be visible behind the stop line, in the top half of the video image. No horizon shall be allowed in the video image.

Video detection system installed in traffic signal cabinets with network switches installed or scheduled to be installed shall use NEMA TS2 connections to controller. Contractor shall connect SDLC (model ACBLP0E05 P/N 33550G5 or approved equal) to connect TIP and the traffic signal controller. Contractor shall work with the Econolite Representative and the City of Santa Clara staff to insure that all channels are programmed and detection calls are being inputted into the controller.

Video detection system installed in traffic signal cabinets without network switches installed shall use NEMA TS1 and logic level connections to controller. Contractor shall wire in MVP Wiring Harness (model 33457G57 or approved equal) into traffic signal controller cabinet. Contractor shall work with the video detection camera system manufacturer’s representative and the City of Santa Clara staff to insure that all channels are programmed and detection calls are being inputted into the controller.

The Contractor shall install the Camera/Integrated machine Vision Processor System (MVP) to achieve the desired field of detection as shown on the Plans or as directed by the Engineer. All equipment shall be installed and wired in a neat and orderly manner in conformance with the manufacturer’s instructions. The camera shall be affixed to the support structure in accordance with the manufacturer’s instructions to provide the optimal field of detection.

Video detection camera locations shown on the Plans are for illustration purposes only.

The Contractor shall perform a site survey with a representative of the manufacturer of the video vehicle detection system at all project locations. The purpose of the survey shall be to optimize the performance of the video

vehicle detection equipment when it is installed at the various overhead and side-fired mounting locations and ensure that it will meet the accuracy requirements specified herein. The results of this survey shall be submitted to the Engineer in a report which lists all locations with any recommended location shifts, sensor mounting adjustments, camera angle lens adjustments, and desired detection zone locations. The cost of the site survey, including the use of a bucket truck or other method to obtain an elevated vantage point, shall be included in the cost for each intersection's respective video vehicle detection system pay item.

Cable to be installed in conduit shall be pulled with a minimum of dragging on the ground or pavement. This shall be accomplished by means of reels mounted on jacks or approved devices conveniently located for unreeling cable directly into the conduit. Powdered soapstone, talc, or other approved lubricants shall be used when inserting cable into the conduit. Cable shall be pulled through conduit by means of a cable or cables. Wiring within junction boxes and cabinets shall be neatly arranged.

When conductors and cables are pulled into conduits, all ends of conductors and cables shall be taped to exclude moisture, and shall be so kept until they are attached to the Camera/Integrated Machine Vision Processor (MVP) and the Video Detector Communications Interface Panel (CIP) in the traffic controller cabinet.

Conductors entering the traffic controller cabinet shall be neatly dressed and laced along the base and back of the traffic cabinet to the Video Detector Communications Interface Panel. Spare conductors (if any) shall be tied together with their ends taped. At least five feet (5') of slack shall be left for each conductor in the traffic controller cabinet at the Video Detector Communications Interface Panel.

Routing of the Video Detector Cable shall provide a drip loop for protection of the camera and connector.

4.7 SIGNAL FACES AND SIGNAL HEADS

Signal faces, signal heads, and auxiliary equipment as shown on the plans, and the installation thereof, shall be manufactured by Econolite Product Inc., Eagle Traffic Control Systems, or approved equal, and shall conform to the specifications in Sections 86-4.01 Vehicle Signal Faces, 86-4.01C Visors, 86-4.01D Light Emitting Diode Signal Module, 86-4.01E Backplates, 86-4.02 Programmed Visibility Vehicle Signal Faces, 86-4.03 Pedestrian Signal Faces,

86-4.03I Light Emitting Diode Pedestrian Signal Modules, and 86-4.04 Signal Mounting Assemblies of the Standard Specifications and this Section 02086. Vehicle signal heads shall be twelve inch (12") diameter and shall be IntelliLED Hi-Flux tinted lens, incandescent appearance, type LED's manufactured by Dialight Corporation or a City-approved equal meeting ITE specs. Vehicle signal housings shall be either die-cast or permanent mold-cast aluminum conforming to ANSI Standard D-10.1. Signal door fasteners shall be wing nuts with screw threads. Visors shall be of the full circle variety. Finish of signal heads and back plates shall be flat black.

Rubber gaskets are to be installed inside of head at top with metal flat washer between gasket and chase nipple.

Mast arm wiring for each signal head is to be brought into nearest at grade pull box for splicing/connection. No parallel electrical connections between heads.

Signal heads are to be installed vertically level in all directions except with special permission from the Traffic Engineer.

4.8 SIGNAL STANDARDS AND POSTS

Signal standards as shown on the plans, and the installation thereof, shall conform to the specifications in Section 86-2.04, Standards, Poles, Steel Pedestals and Posts, of the Standard Specifications and this Section 02086. Foundations for signal standards and posts shall conform to Section 86-2.03, Foundation, of the Standard Specifications, the Standard Plans, and this Section 02086. Excavation and backfilling for foundation shall conform to Section 86-2.01, Excavation and Backfilling, of the Standard Specifications. Final location shall be approved by the Engineer.

4.9 PEDESTRIAN SIGNALS AND PUSHBUTTONS

4.9.1. PEDESTRIAN PUSHBUTTONS

Pedestrian pushbuttons shall be Type B color black with large button model ADA compliant "Bulldog" type manufactured by Polara Engineering Inc., or a City-approved equal.

4.9.2. AUDIBLE PEDESTRIAN SIGNALS

Audible pedestrian signals shall be Novax DS-100 Series or approved equal. The audible pedestrian signals shall be installed per manufacturer specifications at locations noted

on plan. The audible pedestrian signals shall be installed to emit "cuckoo" or "peep peep" as noted on plans.

4.9.3. PEDESTRIAN SIGNAL

Pedestrian signal shall be uniform appearance countdown signal manufactured by Dialight Corporation model 430-6479-001X or approved equal.

4.10 CONDUIT

Conduit shall conform to all applicable specifications in Section 86-2.05, Conduit, of the Standard Specifications and this Section 02086. All new conduits on this project shall be galvanized schedule 40 steel or schedule 80 HDPE unless otherwise specified in the Plans. All conduits inside pull boxes shall be bonded together with approved NEC methods. Insulating bonding bushings will be required on metal conduit. Each conduit terminating in a pull box shall be grouted to the pull box prior to conductor installation. After conductors have been installed, the ends of conduits terminating in controller cabinets shall be sealed with an approved type of sealing compound. All conduits shall have mule tape made of durable, non-rotting fiber, installed and tied securely in each pull box.

Conduit runs in roadway sections, where drilling or jacking is not specified, shall be in a trench approximately two inches (2”) wider than the outside diameter of the conduit(s). Trench width shall not exceed eight inches (8”) and a minimum depth of cover of eighteen inches (18"). The outline of all areas of pavement to be removed shall be cut 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 two inches (2”) above the bottom of the trench on blocks made of material suitable for the purpose. The trench shall be backfilled on the same Working Day with either controlled density fill or commercial quality Portland Cement Concrete containing no less than 564 pounds of Portland cement per cubic yard of concrete. Backfilling shall be to the finished grade. Calcium chloride admixture shall not be used in concrete that will be in contact with metal conduit. The top two inches (2”) of trench shall be removed and backfilled with commercially produced asphaltic concrete within a period of 5 Working Days. Trench in Roadway should be per the Standard Details.

Conduit runs in other areas shall be provided with a minimum of eighteen inches (18”) coverage from finished grade. A minimum two inches (2”) of sand shall encase each conduit run.

Existing conduits to be re-used shall be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air. Conduit to be abandoned shall have all wiring removed then it shall be capped at each end.

Conduits between signal cabinet, AC power enclosure, and their respective first pull box shall be sealed on both ends with approved duct seal.

5.0 SALVAGE MATERIAL

All salvaged material shall be placed on pallets or as otherwise directed by the Engineer and returned to the City Corporation Yard, 1705 Martin Avenue, Santa Clara, CA 95050. Material shall be handled with care and be returned to the City in good condition.

6.0 SERVICE

Service shall conform to the specifications in Section 86-2.11, Service, of the State Specifications and the City Electrical Code. All applicable permits shall be obtained prior to construction.

The Contractor shall contact the City Building Department (1-408-615-2400) for a minimum of two electrical inspections: 1) The first inspection shall be scheduled so that the City Building Inspector may observe the installation of conduits. 2) Second inspection shall be scheduled after installation of cabinet and breaker enclosure, conduits, conductors, and splices. All electrical inspections shall be scheduled at least two working days prior to time of requested inspection.

7.0 COMMUNICATIONS BOXES

Communications Pull Box, cover and extension shall be made of reinforced monolithic polymer concrete material. The minimum dimensions for communications pull box shall be thirty inches by forty-eight inches by twenty- four inches (30” x 48” x 24”). Reinforced polymer concrete Pull Box shall have two (2) piece detachable covers that have skid-resistant surfaces. The cover shall have lift slots to aid in the removal of the lid.

Contractor shall install communications pull boxes unless otherwise directed by the Engineer. Pull boxes shall be installed at the locations shown on the plans; the locations may be changed to suit field conditions with permission from the Engineer. The bottoms of pull boxes shall be bedded in crushed rock and shall be grouted according to Section 86-2.06C, Installation and Use, of the Standard Specifications. Pull box extensions may be installed as determined necessary in the field with permission from the Engineer.

Conduits shall enter through the side of pull boxes from the direction of the run unless otherwise specified on plans. Conduit shall be sloped slightly toward the top of box to facilitate the pulling of cable. Each conduit terminating in a pull box shall be grouted to the pull box prior to cable installation.

8.0 TS2 – TYPE 1 CONTROLLER CABINET EQUIPMENT LIST AND DRAWINGS

GENERAL
Equipment list and drawings of electrical and material shall conform to the specifications in Section 86-1.04, Equipment List and Drawings, of the Standard Specifications and this Section 02086.

The supplier shall furnish a maintenance manual for all supplied equipment, including but not limited to, the following:

(a) Vehicle detector sensor control units and amplifiers.
(b) Malfunction Management Unit (MMU)

The maintenance manual shall be submitted at the time the cabinet(s) 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) Function of all controls
(c) Trouble shooting procedure (Diagnostic routine)
(d) Block circuit diagram
(e) Geographical layout of components
(f) Schematic diagrams
(g) List of replaceable component parts with stock numbers and list of industry standard replacements

In addition to the five (5) sets of cabinet schematic wiring diagrams as specified in the second paragraph of Section 86-1.04, Equipment List and Drawings, of the Standard Specifications, the supplier shall furnish one reproducible wash-off- mylar or erasable vellum for each cabinet, which shall be easily readable, of each cabinet schematic wiring diagram. The supplier shall also provide a CD or DVD with an electronic AutoCAD 2009.dwg version of the cabinet drawing. All wiring on the drawings shall be double ended.

8.1 TS2 CABINET ASSEMBLY

8.1.1 This specification describes the minimum acceptable requirements for a TS2 cabinet assembly to house a TS2 Type 1 solid state fully-actuated controller unit. The manufacturer of the cabinet assembly shall have a minimum of two (2) years of cabinet manufacturing experience with TS2 Type 1 cabinets. The assembly shall include the cabinet, flasher, card rack(s), a MMU, five (5) BIU's, external power

supply, six (6) flash transfer relays, Twelve (12) Reno A&E E/2 single width four channel detector amplifiers, Actelis ML688 copper over Ethernet unit, Actelis ML530 fiber switch. Cabinet assemblies shall be configuration 4 (16 position). The assembly shall include sixteen (16) load switches.

8.1.2 The cabinet assembly shall be tested and operated as a complete working unit prior to submittal to the City. This test shall consist of full operation under a full signal load for a minimum of two (2) hours.

8.2 Cabinet Design Requirements

8.2.1 The cabinet shall be constructed using unpainted sheet aluminum with a minimum thickness of 3.2 mm (0.125”). No wood, wood fiber products, or other flammable material shall be used in the cabinet. All welds shall be by GMAW process and shall be neat and of uniform consistency. No external rivets shall be present on the door or cabinet assembly. The surface of the aluminum shall be finished with Anodic coating as per Section 86-3.04A, Cabinet Construction, of the Standard Specifications. Coating shall have uniform appearance.

8.2.2 The profile of the cabinet shall be size 6 as defined by TS2 Clause 7.3 of the NEMA Standard Publication TS2 latest revision, as specified in the Plans. The load bay shall be configuration 4 (16 position) as defined by TS2 Clause 5.3, or as specified in the Plans.

Cabinet Option	Size of Cabinet	Backpanel Config	Size of Load Bay
Option 4	Base Mount TS2 Size 6	Configuration 4	16 position load bay

8.2.3 Vertical shelf support channels shall be provided to permit adjustment of shelf location in the field. The channels shall have a single continuous slot to allow shelves to be placed at any height within the cabinet. Channels with fixed notches or holes are not acceptable.

8.2.4 Each cabinet shall be equipped with an extra set of unistrut channels or a keyhole panel on either side of the front section of the cabinet to permit the purchaser to mount additional equipment as necessary.

8.2.5 Shelves shall be at least 330 mm (13”) deep and be located in the cabinet to provide a 12.5 mm (0.5”) clearance between the back of the shelf and the back of the cabinet. A 38mm (1.5”) document drawer shall be provided in the cabinet, mounted directly beneath the controller support shelf. The drawer shall have a hinged top cover and shall be capable of storing documents and miscellaneous equipment. Provide a drawer with telescoping drawer guides to allow full extension from the shelf to provide storage space for cabinet documentation and standard laptop This drawer shall support up to 22.5 kg (50 lbs) in weight when fully extended. The drawer shall open

and close smoothly. Drawer dimensions shall make maximum use of available depth offered by the controller shelf and be a minimum of 600 mm (23.6”) wide. Provide a top for the storage compartment that has a non-slip plastic laminate attached covering 90% of the surface area.

8.2.6 Two shelves shall be provided in the cabinet and shall be at minimum 305 mm (12”) apart in height. There shall be sufficient shelf space to accommodate a controller unit 330 mm (13”) high, an MMU, two 8 position card racks and external power supply. An additional space at least 305 mm (12”) high, 325 mm (12.8”) wide, and 305 mm (12”) deep shall be provided. The controller unit, MMU, card racks, and power supply shall be placed on the shelves in such a manner that sufficient ventilation is provided to all components. Labels showing the proper placement of each component shall be provided along the shelves to ensure proper placement. Labels shall be permanent engraved and riveted to the shelf.

8.2.7 The cabinet shall be vented and cooled by 2 thermostatically controlled fans. The fans shall be a commercially available model with a capacity of at least 2.83 m^3/min. (100 ft^3/min.). The thermostats shall have an adjustable range of 32°C to 65°C (90°F to 150°F) . A press-to-test switch shall be provided to test the operation of the fans.

8.2.8 The cabinet shall be provided with a unique five digit serial number which shall be stamped directly on the cabinet or engraved on a metal or metalized mylar plate, epoxied or riveted with aluminum rivets to the cabinet. The digits shall be at least 5 mm (0.2”) in height and located on the upper right sidewall of the cabinet near the front.

8.3 Cabinet Door

8.3.1 The cabinet shall be provided with one door in front that will provide access to the cabinet. The door shall be provided with three stainless steel hinges with non-removable stainless steel pins, or a full-length stainless steel piano hinge with a stainless steel pin, spot welded at the top of the hinge. The hinges shall be mounted so that it is not possible to remove them from the door or cabinet without first opening the door. The bottom of the door opening shall extend at least to the bottom level of the back panel. The door and hinges shall be braced to withstand a 74 kg per vertical meter of door height load applied to the outer edge of the door standing open. There shall be no permanent deformation or impairment of any of the door or the cabinet body when the load is removed.

8.3.2 The cabinet door shall be fitted with a Corbin #2 lock and a stainless steel handle with a 16 mm (0.630”) minimum diameter shaft or the equivalent cross-sectional area for a square shaft, and a three point latch. The lock and latch design shall be such that the handle cannot be released until the lock is released. Two keys shall be provided for each cabinet. A gasket shall be provided to act as a permanent dust and weather resistant seal at the controller cabinet door facing. The gasket material shall be of a nonabsorbent material and shall maintain

its resiliency after long term exposure to the outdoor environment. The gasket shall have a minimum thickness of 6.25 mm (0.25”). The gasket shall be located in a channel provided on the cabinet or on the door(s). An “L” bracket is acceptable in lieu of this channel if the gasket is fitted snugly against the bracket to insure a uniform dust and weather resistant seal around the entire door facing. Any other method is subject to prior approval by the Traffic Engineer during inspection of the sample order.

8.3.3 A locking auxiliary police door shall be provided in the door of the cabinet to provide access to a panel that shall contain a signal shutdown switch, and a signal flash switch, The police door shall be gasketed to prevent entry of moisture or dust and the lock shall be provided with two brass keys. The Police panel door latch shall be accessible from inside the cabinet.

8.3.4 A manual-automatic switch shall be mounted on the inside of the cabinet door and a manual advance push-button switch on a six foot (6’) retractable cord shall be supplied. The manual advance control of the controller unit shall override any external control (external logic, etc.) in effect when the manual-automatic switch is in the manual position. Each actuation of the manual advance push-button switch shall advance the controller to the next interval. Manual control shall not override any calls for preemption. The cord and button shall be coiled and stored on the inside of the cabinet door by a minimum one inch (1”) wide grommet mounting hook and loop tensioning buckle cable tie strap permanently mounted on the inside of the cabinet door.

8.3.5 The intake for the air vent system shall be filtered with an industry standard sized disposable pleated panel or 4 ply woven polypropylene air filter. The minimum filter dimensions shall be 406.4 mm (16”) wide by 304.8 mm (12”) high by 25 mm (1”) thick. The filter shall be securely mounted so that any air entering the cabinet must pass through the filter. The filter shall be easily removable without the use of tools. The cabinet opening for intake of air shall be large enough to use the entire filter. The air intake and exhaust vent shall be screened to prevent entry of insects. The screen shall have an opening no larger than 8.1 mm^2 (0.0125 in^2). The total free air opening of the exhaust vent shall be large enough to prevent excessive backpressure on the fan.

8.4 Wiring

8.4.1 All wiring within the cabinet shall be neat and routed such that opening and closing the door or raising or lowering the back panel will not twist or crimp the wiring. All wiring harnesses shall be either braided, sheathed in nylon mesh sleeving, or made of PVC or polyethylene insulated jacketed cable. Wiring shall be mounted to the cabinet using fastener mounted cable and wire holders. Wiring leading to the cabinet door shall be sheathed in nylon mesh sleeving or be PVC jacketed cable only. All SDLC cabling shall be Belden #7203A or

equivalent.

8.4.2 Size

A. All conductors between the main power circuit breakers and the signal power bus shall be a minimum size 10 AWG stranded copper. All conductors carrying individual signal lamp current shall be a minimum size 16 AWG stranded copper. All AC service lines shall be of sufficient size to carry the maximum current of the circuit or circuits they are provided for. Minimum cabinet conductor wire size shall be 22 AWG stranded copper. All wiring and insulation shall be rated for 600 V or greater.

B. Conductors for AC common shall be white. Conductors for equipment grounding shall be green. All other conductors shall be a color coded different than the foregoing.

C. No P.C. boards will be allowed on the back panel of the cabinet. All wiring must be done from the BIUs to the Load Switches using standard 19-gauge wiring.

8.4.3 A barrier terminal block with a minimum of three compression fitting terminals designed to accept up to a #4 AWG stranded wire shall be provided for connection of the AC power lines. The block shall be rated at 50 Amperes.

8.4.4 All terminals shall be permanently identified in accordance with the cabinet wiring diagram using an anodized silk screening process on the aluminum panel. Where through-panel solder lugs or other suitable connectors are used, both sides of the panel shall have the terminals properly identified. Identification shall be placed as close to the terminal strip as possible.

A. Each controller input and output function shall be distinctly identified with no obstructions, at each terminal point in the cabinet, with both a number and the function designation. The same identification must be used consistently on the cabinet wiring diagrams.

B. Each load switch socket shall be identified by phase number, overlap number, and pedestrian phase number as applicable. No cabinet equipment, including the load switches themselves, may obstruct these identifications.

C. Each flash transfer base and power relay base shall be properly identified with no possible obstructions.

D. Each harness within the cabinet shall be distinctly identified by function on the connector end.

E. The flasher socket shall be distinctly identified with no possible obstruction.

F. All other sockets needed within the cabinet to fulfill the minimum requirements of the Invitation to Bid, or attachments thereof, shall be distinctly identified.

8.4.5 The controller unit harness (A plug) shall be long enough to reach any point 400 mm (16”) above the timer shelf. The MMU harness and any required auxiliary harness shall reach 600 mm (24”) from the MMU shelf.

8.4.6 An unused, spare terminal block providing ten terminals shall be provided. This block shall be double 8-32 X 5/16" binder head screw design with shorting bars. These terminal strips shall be located on the lower third of either side of the cabinet.

8.4.7 Copper ground buses shall be provided for both the power supply neutral (common) and chassis ground. Each bus bar must provide a minimum of ten unused terminals with 8-32 X 5/16" or larger screws with compression fitting style terminals. The AC neutral and chassis ground buses shall be jumpered together with a minimum #10 AWG wire.

8.4.8 A 20 Ampere and a 50 Ampere thermal type circuit breaker shall be mounted and wired in the cabinet. The 20 ampere breaker shall protect the base light, trouble light, ground fault circuit interruption (GFCI) receptacle, modem duplex receptacle, and fans. The 50 ampere breaker shall protect the signal load circuits, controller circuits, MMU, flasher, and card rack detector power supply. The breakers shall be Square "D" QUO 150 Series only.

8.4.9 The circuit breakers shall be equipped with solderless connectors and installed on the right side wall (facing the cabinet) or lower right hand side of the back panel inside the cabinet. The breakers shall be easily accessible. The breakers shall be positioned so that the

rating markings are visible.

8.4.10 A GFCI type duplex receptacle shall be mounted and wired in the lower right side wall of the cabinet. An additional non-GFI duplex receptacle (for use with communications modems) shall be mounted and wired in the upper left side of the cabinet behind the preempt/interconnect panel. These receptacles shall be wired on the load side of the 20 Amp circuit breaker. A six (6) outlet (minimum) plug strip shall be mounted on an aluminum panel and the panel mounted to the shelf din rails. The housing of the plug strip shall be aluminum. The receptacles on the plug strip shall be oriented at 90 degrees to the length of the plug strip and the spacing of the receptacles shall allow wall transformers to be plugged into adjacent receptacles without blocking the adjacent receptacles.

8.4.11 The above breakers are in addition to any auxiliary fuses which may be furnished with the controller to protect component parts, such as transformers, etc.

8.4.12 The load side of the main circuit breaker shall be protected by a two stage lightning surge suppresser, equivalent to the EDCO APC340 (with LED indication along with a set dry contacts for alarm capabilities to indicate proper operation).

8.4.13 The suppresser ground connection shall be connected to the cabinet by means of a short, heavy copper ground strap. The strap shall be bonded to the cabinet.

8.4.14 The suppresser shall be connected to the line filter as recommended by the manufacturer. Number 10 AWG or larger wire shall be used for connections to the suppresser, line filter and load switch bus.

8.4.15 A fluorescent light, with switch and a rapid start, -18□C (0□F) ballast, shall be installed in the cabinet. This light shall be turned on when the cabinet door is opened, and turn off when the cabinet door is closed. A MOV or other such transient suppression device shall be placed across the AC power input to the light. The switch shall also provide a set of door open alarm contacts.

8.4.16 A radio frequency interference (RFI) suppresser shall be provided and installed on the load side of the signal circuit breaker and shall be protected by the surge protector. This filter shall be rated at 50 amperes and shall provide a minimum attenuation of 50 decibels over the frequency range of 200 Kilohertz to 75 Megahertz.

8.4.17 Transient suppression devices shall be placed on the coil side of all relays in the cabinet. DC relay coils shall have, as a minimum, a reversed biased diode across the coil. AC relays shall have MOV's

or equivalent suppression across their coils. RC networks are acceptable. One suppression device shall be supplied for each relay.

8.4.18 Except where soldered, all wires shall be provided with lugs or other approved terminal fittings for attachment to binding posts. Insulation parts and wire insulation shall be insulated for a minimum of 600 volts.

8.4.19 The outgoing traffic control signal circuits shall be of the same polarity as the line side of the power source.

8.4.20 A switch shall be provided on the inside face of the cabinet door that shall be labeled Test-Normal. When the switch is in the Normal position, call for flashing operation shall remove the power from the controller unit. When the switch is in the Test position, the call for flashing operation shall permit the controller unit to continue to run so that its operation can be observed.

8.4.21 A switch shall be provided near the Test-Normal switch to cause the controller unit, and any auxiliary equipment, to stop timing. It shall be labeled "STOP TIMING".

8.4.22 The cabinet shall be wired so that activation of the MMU will cause the controller unit, and any auxiliary equipment, to stop timing.

8.4.23 Conflict and manual flash shall be wired for all red.

8.4.24 The cabinet shall be designed and equipped with enough transfer relays for the purchaser to change any “Main Street” indications (phase movements 2, 6, and/or 1, 5) to amber for the conflict and/or manual flash operation on the face of the back panel or a side panel, using only simple tools.

8.4.25 Transfer relays shall be the Model 430, 8 pin plug-in type manufactured by Reno A+E, Model TR-200 or approved equal. The relays shall have contacts a minimum of 3/8" diameter in size and shall be rated at a minimum of 30 Amps 102 / 240 VAC, 20 Amps 28 VDC.

8.4.26 The red enable and remote reset from the MMU shall be terminated on the face of the back panel.

8.4.27 A 75 Amp, solid state relay shall be wired between the RFI filter output and the load switch power bus. The relay shall be controlled by the signal shutdown switch and the flash switch. The relay shall be mounted to a heat sink designed to allow maximum current flow at 74□C (165□F) without damaging the relay.

8.4.28 All exposed AC wiring points, including the RFI filter, surge suppresser, and solid state relay shall be covered with a clear non-conductive plastic cover to prevent accidental contact. Unless otherwise noted in this specification, wiring at terminal strips is exempt from this requirement.

8.4.29 An input point shall be provided on the backpanel to allow external reset of the MMU.

8.4.30 The load switch outputs shall be brought out through posted 10-32 X 5/16" binder head screw terminals. Field wiring for the signal heads shall be connected at this terminal strip.

8.5 DETECTOR PANEL AND CARD RACK

8.5.1 The cabinet shall have a loop detector panel mounted on the left side of the cabinet. This panel shall provide for all connections between loops at the street and the detector amplifiers as described in the following sections.

8.6 DETECTOR CARD RACKS

8.6.1 Two card racks shall be provided for cabinet configuration four (16 position backpanel). The first card rack shall accommodate up to a total of eight (8) four (4) channel single space TS2 detector units. The second card rack shall provide an additional, up to 32 channels, of alternate technology detection for up to a total of 64 channels of detection. Each card rack shall include a single position for (1) BIU unit and (8) positions for detectors. The first rack shall have two additional integrated position slots for two (2) 2-channel Preemption phase discriminator cards labeled “EV1” and “EV2”. An auxiliary card rack may be used for the preemption if previously approved by the City Traffic Engineer.

8.6.2 The detector card rack shall have a rigid frame and shall be fabricated from aluminum and shall have slots set in a modular fashion such that the PCB edge connectors shall plug into the rear while sliding between top and bottom card guides for each module. Mounting flanges shall be provided and be turned outward for ease of access. The detector card rack shall be bolted to a cabinet shelf. It shall be possible to unbolt the rack using simple tools.

8.6.3 All wiring to the rack shall be labeled and neatly run to other parts of the cabinet and detector termination panel.

8.6.4 The slots shall be numbered 1 to 8 left to right when viewed from the front of the rack. A flange shall be provided on the top and the bottom of the rack to label each individual channel.

8.6.5 The Detector DC Supply shall be bussed to a common point and wired to the Intersection Detector Panel.

8.6.6 The Chassis Ground shall be bussed to a common point and wired to the Detector Panel.

8.6.7 The Logic Ground shall be bussed to a common point and wired to the Detector Panel.

8.6.8 The Data Address for the detector channels shall be according to TS2.

8.7 DETECTOR PANEL

8.7.1 The Detector Panel shall provide all connections between the detector loops and the detector amplifiers.

8.7.2 The panel shall be constructed of 3.2 mm (0.125 “) aluminum.

8.7.3 The panel shall contain a 76 mm (3”) horizontal slot in each corner to accommodate 6.3 mm (1/4”) mounting bolts.

8.7.4 All inputs from the loops shall be brought through posted 10-32 X 5/16 inch binder screw terminals or 8-32 X 5/16 inch binder screw terminals.

8.7.5 Each loop pair shall be protected by lightning surge suppressor. The suppressers must be mounted behind the panel using feed through screw terminals to attach the suppressors.

8.7.6 Each detector will have a test switch such that when the switch is closed, a call is placed upon that detector input. The test switch will have three positions; no effect, permanently on, and momentarily on.

8.7.7 The detector panel shall provide connection points for a minimum of 32 loop detectors.

CONNECTION POINT	**NO. OF CONNECTION POINTS**
EXTERNAL 24V POWER SUPPLY	1
LOOP INPUTS	64, 2 FOR EACH OF 32 LOOPS
LOGIC GROUND	1
SPARES	6
CHASSIS GROUND BUS	1 BUS

8.7.8 A chassis ground bus bar shall be provided on the panel and connected to the cabinet by an insulated braided copper ground strap. The strap shall be bonded to the cabinet.

8.8 PREEMPT / COMMUNICATION PANEL

8.8.1 A preempt / communication panel shall be provided that contains all interface circuits and wiring for preemption and communication functions. The panel shall be located on the left side of the cabinet interior.

8.8.2 Three input relay circuits, with 120 VAC coil and contacts rated for the application, shall be provided on the preempt panel. These circuits shall be used to isolate the incoming preempt commands from the controller unit logic circuitry. The circuits shall be programmable to operate with either a normally open or normally closed relay contact by jumpers on a terminal strip. A barrier strip protected from accidental contact by service personnel shall be supplied to connect the external input. It shall be possible to use either a neutral or hot 120 VAC input. Relays used shall be plug-in Potter Brumfield K10P series / Magnecraft W-78 series or interchangeable equivalent. The relays shall be mounted in relay sockets.

8.8.3 Adequate protection of the input relay circuits as well as the preemptor circuitry shall be provided to eliminate damage or false preemption commands caused by line transients or lightning surges. The devices shall have a minimum rating of 20 Joules.

8.8.4 Three momentary test switches, one for each preempt circuit, shall be provided on the preempt panel. The operator shall not be exposed to hazardous voltages during operation of the test switches.

8.8.5 All necessary interconnection cables and mounting hardware shall be provided.

8.8.6 There shall be a switch on the preempt/communication panel, which shall release the local controller to operate in an isolated, full-actuated manner, when necessary for maintenance purposes. The switch positions shall be labeled “SYSTEM” and “FREE”.

8.8.7 Terminal connections for 8 twisted pair communication lines and one telephone line shall also be provided. The protection will consist of series 25 ohm resistors, 15 volt transorbs, and other devices, which allow protection including primary overvoltage protection, resettable overcurrent protection, secondary clamping voltage protection, and fast transient filtering. The secondary overvoltage stage shall allow peak voltages of no more than 250 volts. The fast transient filtering

stage shall provide no less than 40 dB/decade of attenuation to transients above the required pass band. The protection shall be provided in an integrated closure with eight (8) input/output terminations and ground connection.

8.9 POWER SUPPLY

8.9.1 The power supply shall be a shelf mounted, enclosed, 24 VDC power supply in accordance to Clause 5.3.5 of the NEMA Standards Publication TS2 latest revision.

8.9.2 One power supply cable per power supply shall be furnished and installed in each cabinet. The wires shall be terminated to bus bars, terminals on the front of the backpanel, detector panels, or connector as appropriate. The connections shall be with forked spade lugs or otherwise as needed. Each individual wire shall be cut to the length required to reach the point at which it is to be connected. Model shall be Reno A+E, TS-2 Cabinet Power Supply, or approved equal.

8.10 TWO CIRCUIT SOLID STATE FLASHER

8.10.1 The solid state, two circuit flasher shall meet the electrical and physical characteristics described in Clause 6.3 of the NEMA Standards Publication TS2 latest revision. The flasher shall be Type III (dual circuit rated at 15 Amps per circuit) unit and so constructed that each component may be readily replaced if needed.

8.10.2 The two circuit flasher shall be of solid state design and contain no electro-mechanical devices. Model shall be Reno A+E, Model FL-200, or approved equivalent.

8.11 LOAD SWITCH

8.11.1 The solid state load switches shall meet the requirements set forth in Clause 6.2 of the NEMA Standards Publication TS2 latest revision, and shall be "Triple-Signal Load Switch" I/O, dual indicating type. Model shall be Reno A+E, Model LS-200, or approved equivalent.

8.11.2 Two indicator lights (LED) for each circuit shall be provided in each load switch. The input indicator LED shall be on when a "Low Voltage Active" input to the load switch is present. The output indicator LED shall be on when the internal loadswitch triac triggers and AC output for the respective channel as the input indicator. Load switches shall be rated at 20 amps @ 70°C. All pedestrian yellows shall be wired to terminal block.

8.12 MALFUNCTION MANAGEMENT UNIT (MMU)

8.12.1 The MMU shall meet all requirements set forth in Section 4 of the NEMA Standards Publication TS2 latest revision, Type 16 style. In addition to the DB-15 port 1 (SDLC) connector defined in §4.3.1, the MMU shall have a DB-9 port 2 (RS-232) connector located adjacent to the port 1 connector and Ethernet Port to allow high speed external data transfer. Model shall be Reno A+E MMU- 1600GE or approved equal.

8.12.2 The MMU shall be fully compatibility with the cabinet SDLC.

8.12.3 The MMU shall have three (3) output indicators for all 16 phases to indicate Red/Yellow/Green outputs.

8.12.4 The MMU shall have the ability to log event conflicting event history, power disturbances, and real-time RMS AC line voltage values in an internal non-volatile memory. This information shall be capable of being extracted via port 2 by both of the following methods:

a) Downloading via Procom or similar, generic, RS-232 compatible terminal software

b) Downloaded directly into ATMS software.

8.12.5 Minimum data reporting requirements available remotely from the MMU shall be:

a) Trace (real-time status) reports of all current front panel indications

b) History/event logs of recent faults

c) User defined Programming card and front panel switch positions of the MMU

8.13 BUS INTERFACE UNIT (BIU) NETWORK CARDS

8.13.1 The cabinet shall be equipped with a total of five (5) BIU cards, two (2) BIU cards for the load bay, plus three (3) BIU cards for the detector racks. The BIU shall meet, as a minimum, all applicable sections of the NEMA Standards Publication TS2 latest revision.

8.13.2 The BIU shall be rack-mountable and solid-state. The BIU unit shall be constructed with discrete component circuitry in order to allow repair and maintenance of the unit by use of standard tools. The BIU shall utilize machine tooled integrated circuit (IC) sockets for all IC's of 14 pins or greater, for ease of repair.

8.13.3 The BIU shall be proven to the satisfaction of the City Traffic Engineer to provide full compatibility with the cabinet SDLC data circuits. Model shall be Reno A+E, Model BIU/2, or approved equal.

8.14 PEDESTRIAN INPUTS

8.14.1 Pedestrian inputs shall be isolated from the controller input circuits by means of pedestrian isolators. Isolation shall be provided by a pedestrian isolation card or by pedestrian isolation units incorporated into the cabinet. Pedestrian isolation shall be approved by the City Traffic Engineer.

8.15 CABINET COMMUNICATIONS

8.15.1 The cabinet shall be supplied with an Actelis ML530 Fiber Switch, or other equal approved by the City Traffic Engineer.

8.15.2 The switch shall be mounted on slide mount brackets attached to the underside of the controller shelf or at another location approved by the City Traffic Engineer. The brackets will provide a slide mount that will lock the unit in place in the stored position and allow easy removal of the switch without the use of tools.

8.15.3 Four (4) - HESCO/RLS model HE624D Data Line Surge Suppressor with base sockets shall be provided and mounted on a aluminum plate. The plate shall be mounted on the upper left side of the cabinet and will be located to provide easy access to the terminals.

8.15.4 Fiber switch shall be hardened, dual single mode LC, 10/1000 optic ports, 4 managed 10/100 ethernet ports, hardened power supply, dim rail mount, Actelis model ML530, or other approved equal by the City Traffic Engineer.

8.15.5 All cables, conductors and auxiliary equipment required to provide connections within the cabinet from the MMU, Controller, and Video systems to the Actelis unit and CISCO switch will be provided by the cabinet supplier.

8.16 TESTING

8.16.1 Contractor shall provide all submittals to the City to determine that equipment to be tested will meet Project's specifications. Acceptance testing shall not be performed until all submittals are first approved by the City. Complete testing shall include visual inspection, electrical testing, and testing of all required controller assembly functions. A Contractor representative and City staff shall randomly be present at the testing facilities to observe testing.

8.16.2 Testing of fully wired cabinet(s) and auxiliary equipment as specified in Section 86-3, Controllers, of the Standard Specifications shall be the responsibility of the Contractor. This responsibility includes, but not limited to, all associated costs from entering into an agreement with a City-approved third-party testing facility for testing, and

coordination for pick-up and delivery of the cabinet(s) and auxiliary equipment, to and from the testing facility and installation at the job site.

Testing shall be performed by a City-approved third-party testing facility. Contractor shall choose any of the following City-approved third-party testing facilities but contact Traffic Engineering Division at 1-408-615-3000 for the latest listing.

- Aegis ITS, 1810 Oakland Road, Suite E, San Jose CA 95131, (408) 577-1802
- Cal West Lighting & Signal, 530 Marburg Way, San Jose, CA 95133, (408) 923-1313

8.16.3 Testing shall start with a point-to-point circuit test for all hardwired cabinet circuits. Following the point-to-point testing, each controller assembly shall be tested continuously under signal load for a minimum of twenty-one (21) days. A copy of the City's standard Traffic Signal Cabinet Inspection/Test Report for each unit shall be submitted to the Traffic Engineer upon completion of testing. The Twenty-Eight (28) days Traffic Signal Cabinet Testing shall include, but not limited to, seven (7) days Point-to-Point Wire Testing, fourteen (14) consecutive days Burn Testing, and seven (7) days Site Functional Testing.

8.17 TEST FAILURE

If a unit fails its test, the testing staff shall report the failure to the Silicon Valley Power Senior City Electrician, the Project Inspector, and the Contractor within 48 hours of the finding. The conditions of failure shall be corrected, or if it is determined that major repair is required, the unit shall be replaced by the Contractor within 5 working days from notification. The Twenty-Eight (28) days testing period shall be suspended and the clock is restarted should the cabinets be found to be defective and/or in non-compliance with City's specifications at any time during the test period.

8.18 ADDITIONAL INCLUDED ITEMS

Each cabinet shall also include the following items:

a) Four (4) Anchor bolts

b) Sixteen (16) Load Bay Jumpers

9.0 2070-2NZ CONTROLLER SPECIFICATIONS FOR TS2

The controller shall be Model 2070L NEMA TS2 – Type 1 with Apogee Version 65 NTCIP based Intersection Control Software by Naztec, and conforming to the following specifications:

The controller shall be Model 2070L NEMA TS2 – Type 1 ATC traffic controller per Section 86-3, Controller Assemblies, of the Standard Specifications, shall conform to the latest Transportation Electrical Equipment Specifications (TEES), and shall be listed on the California Department of Transportation's Qualified Products List (QPL). The controller shall be equipped with the following modules:

2070-1B	8Mb-CPU with Ethernet Port
2070-2B	I/O Module for NEMA Cabinets
2070-2NZ	TS2 I/O Side Mount Module
2070-3B	8x40 Line Display
2070-4B	Power Supply
2070-7A	Dual Serial Port Card

- **2070-1B**

The 2070-1B shall be 8Mb and equipped with an Ethernet port. The controller software operating on the 2070-1B shall be capable of utilizing the Ethernet port for data transfers. The operating system shall allow the user FTP and Telnet access via the Ethernet port.

- **2070-2B**

The 2070-2B shall provide for NEMA I/O to interface for TS1 or TS2 operation. The 2B module shall provide a C12S serial communications port and SP3 operation. The SP3 shall have a disable switch.

- **2070-2NZ**

The 2070-2NZ module shall provide a front connection for the Port 1 SDLC port, the Type-1 connector, and two serial ports (C21S and C22S) from the 2070-7A serial card. The 2NZ shall provide Port 1 SDLC communications via the C12S and C13S ports. The 2NZ module shall be constructed of matching aluminum design to the 2070 chassis, and mount on the right side of the controller via the rack ear slots and provide access to all critical TS2 ports through the front of the controller.

- **2070-7A**

The 2070-7A shall conform to TEES specifications. The 2070-7A shall be optically isolated and capable of asynchronous serial communication for ports C215 and C225. On-board jumpers shall be provided to allow either DCE or DTE operation for each port.

- **Operating System**

The 2070 controller shall operate on the 2070-1B using Microware OS9 v3.2 or higher.

- **Intersection Software**

The controller software shall include the latest version of “Apogee” v65-Local NTCIP-based Intersection Control Software by Naztec Inc. The firmware shall come factory installed on the controller hardware.

- **Testing**

Prior to delivery, each controller assembly shall be configured and tested by the supplier. The controller shall be “plug and play” ready for the City’s existing cabinets.

- **Installation and Training**

A factory certified representative for the manufacturer shall be on-site during signal turn-on for support.

The supplier shall provide a maximum of two hours of technical training for City staff within four weeks after controller delivery.

- **Warranty**

The controller assembly shall be warranted by the manufacturer against mechanical and electrical defects for a period of 1 year.

The supplier shall correct any defects in design, workmanship or material during the warranty period at no cost to the City. All cost of labor, parts and transportation shall be borne by the supplier for the duration of the warranty period.

The vendor shall provide all standard revisions to any equipment furnished under this Section 02086, at no cost to the City.

10.0 FIBER OPTIC CABLE

Contractor shall furnish and install a 288 strand single mode fiber optic cable as shown on the plans unless otherwise indicated.

10.1 GENERAL

This item shall govern for the furnishing and installation of fiber optic cable in designated locations as shown on the plans and as detailed in accordance with this Section 02086.

10.2 REQUIREMENTS

Fiber optic cables shall be supplied in the configurations shown on the plans and specified in this Section 02086.

Each fiber optic cable shall be suitable for both underground conduit/duct placement and indoor application. The fiber optic cable shall be fire rated. Additionally, there will be ancillary drop and connecting (patching) optical fiber cables procured under this Section 02086, which are more precisely described elsewhere in this Section 02086.

All materials furnished, assembled, fabricated or installed under this item shall be new, corrosion resistant and in strict accordance with the details shown and specified in the Contract Documents. 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 this Section 02086.

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 cable for this project shall be all-dielectric, dry water-blocking material, duct type, with loose buffer tubes, and shall conform to these Specifications.

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 glass/cable on this project shall be from the same qualified manufacturer regularly engaged in the production of optical fiber material.

The optical fibers shall be contained within buffer tubes. The buffer tubes shall be stranded around an all-dielectric central member. Aramid yarn and/or fiberglass shall be used as a primary strength member, and a medium or high-density polyethylene outside jacket shall provide overall protection.

The cable shall be qualified as compliant with Chapter XVII, of Title 7, Part 1755.900 of the Code of Federal Regulations, “RUS Specification for Filled Fiber Optic Cables.”

10.3 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.

10.4 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 0.1 inch in height and must be permanent and weatherproof.

10.5 QUALITY CONTROL

The manufacture 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.

10.6 GENERAL CONSIDERATIONS

Fiber Optic Outside Plant Cable
Fiber optic outside plant cable (FOOP) shall be dielectric, non-gel filled or water-blocking material, duct type, with loose buffer tubes. Cables with singlemode fibers shall contain 288 singlemode (SM) dual-window (1310 nm and 1550 nm) fibers. Optical fibers shall be contained within loose buffer tubes. Loose buffer tubes shall be stranded around a dielectric central member. Aramid yarn or fiberglass shall be used as a primary strength member, and a polyethylene outside jacket shall provide protection.

Fiber optic cable shall be from the same manufacturer who is regularly engaged in the production of fiber optic cables.

Cables shall be compliant with 7 CFR 1755.900 (RUS Bulletin 1753F- 601), "RUS Specification for Filled Fiber Optic Cables."

Fiber Characteristics

Optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. Fibers in buffer tubes shall be usable fibers, and shall be sufficiently free of surface imperfections and occlusions to meet optical, mechanical, and environmental requirements of these specifications. Required fiber grade shall reflect the maximum individual fiber attenuation to guarantee required performance of fiber in cables.

Coating shall be dual layered, UV cured acrylate, mechanically or chemically strippable without damaging fibers.

Cable shall comply with optical and mechanical requirements over an operating temperature range of -40°C to +70°C. Cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." Change in attenuation at extreme operational temperatures (-40°C to +70°C) for singlemode fiber shall not be greater than 0.20 dB/km, with 80 percent of measured values no greater than 0.10 dB/km. Singlemode fiber measurement shall be made at 1550 nm.

Singlemode fibers within finished cables shall meet the following requirements:

Fiber Characteristics Table	
Parameters	Singlemode
Type	Step Index
Core diameter	9 µm (nominal)
Cladding diameter	125 µm ±0.7 µm
Core to Cladding Concentricity Error	≤ 0.5 µm
Cladding Non-Circularity	≤ 0.7 %
Coating Diameter	242 µm ±7 µm
Coating/Cladding Concentricity Error	≤ 12 µm
Coating Non-Circularity	≤ 0.5 %
Proof Test	Entire length subjected to tensile proof stress> 0.7 GPA (100 kpsi); 1% strain equivalent
Tensile Strength: Dynamic tensile strength (0.5 meter gauge length)	Aged* and unaged: median>3.8 GPa (550 kpsi)

	*Aging @85°C, 85% RH, 30 Days
Attenuation: (-40□C to +70□C) 1310 nm 1383 nm 1460 nm 1550 nm 1625 nm	 0.33 – 0.35 dB/km 0.32 – 0.35 dB/km 0.25 dB/km 0.19 – 0.21 dB/km 0.20 – 0.23 dB/km
Attenuation at the Water Peak	≤ 2.1 dB/km @ 1383 ±3 nm
Bandwidth:	
@1,300 nm (MM)/1310 nm (SM)	N/A
Chromatic Dispersion: 1285 – 1330 nm 1550 nm 1625 nm Zero Dispersion Wavelength (λ0) Zero Dispersion Slope (S_0) @ λ_0	 ≤ |3| ps/(nm x km) ≤ 18.0 ps/(nm x km) ≤ 22.0 ps/(nm x km) 1300 – 1322 nm < 0.090 ps/(nm^2 x km)
Cut-Off Wavelength(λccf)	≤ 1260 nm
Numerical Aperture (measured in Accordance with EIA-455-47)	0.12
Mode Field Diameter 1310 nm 1550 nm	 8.8 – 9.6 µm 9.6 – 10.6 µm

In certain underground locations, Low Water Peak fiber cable can be installed to provide additional optimized use in the 1385 nm region.

Color Coding

In buffer tubes containing multiple fibers, length of fiber shall be distinguishable from others in the same tube by means of color-coding according to the following:

1. Blue (BL)	7. Red (RD)
2. Orange (OR)	8. Black (BK)
3. Green (GR)	9. Yellow (YL)
4. Brown (BR)	10. Violet (VL)
5. Slate (SL)	11. Rose (RS)
6. White (WT)	12. Aqua (AQ)

Buffer tubes containing fibers shall be color-coded with distinct and recognizable colors according to the table listed above for fibers.

Colors shall be in accordance with the Munsell color shades (ASTM d 1535-01) and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

Color formulations shall be compatible with fiber coatings and buffer tube filling compounds, and be heat stable. Colors shall not fade or smear or be susceptible to migration and shall not affect transmission characteristics of optical fibers and shall not cause fibers to stick together.

Cable Construction
Fiber optic cable shall consist of, but not limited to, the following components:

1. Buffer tubes
2. Central member
3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

Buffer Tubes
Clearance shall be provided in loose buffer tubes between fibers and insides of tubes to allow for expansion without constraining fibers. Fibers shall be loose or suspended within tubes and shall not adhere to insides of buffer tubes. Buffer tubes shall contain a maximum of 12 fibers.

Loose buffer tubes shall be extruded from material having a coefficient of friction sufficiently low to allow free movement of fibers. Material shall be tough and abrasion resistant to provide mechanical and environmental protection of fibers and permit safe intentional "scoring" and breakout without damaging or degrading internal fibers.

Buffer tube filling compound shall be a homogeneous hydrocarbon-based gel with anti-oxidant additives used to prevent water intrusion and migration. Filling compound shall be non-toxic and dermatologically safe to exposed skin, chemically and mechanically compatible with cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. Filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process that will prevent stress on fibers when the cable jacket is placed under strain.

Central Member
The central member functions as an anti-buckling element and shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. A

symmetrical linear overcoat of polyethylene may be applied to central members to achieve optimum diameter to ensure proper spacing between buffer tubes during stranding.

Filler Rods
Fillers may be included in cables to maintain symmetry of cable cross- sections. Filler rods shall be solid medium or high-density polyethylene. The diameter of filler rods shall be the same as the outer diameter of buffer tubes.

Stranding
Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning so cables meet mechanical, environmental and performance specifications. A polyester binding shall be applied over stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure buffer tubes to central members without crushing buffer tubes. Binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound) and dielectric with low shrinkage.

Core and Cable Flooding
Cable core interstices shall contain a water blocking material to prevent water ingress and migration. Water blocking material shall be a polyolefin based compound, which fills the cable core interstices, or an absorbent polymer, which fills voids and swells to block ingress of water. Flooding compound or material shall be homogeneous, non-hygroscopic, electrically non-conductive, non-nutritive to fungus, nontoxic, dermatologically safe, and compatible with other cable components.

Tensile Strength Member
Tensile strength shall be provided by high tensile strength Aramid yarns or fiberglass helically stranded evenly around cable cores and shall not adhere to other cable components.

Ripcord
Cables shall contain at least one ripcord under the jacket for easy sheath removal.

Outer Jacket
Jackets shall be free of holes, splits, and blisters and shall be medium or high-density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal jacket thickness of 1 mm ±0.076 mm. Jacketing material shall be applied directly over tensile strength members and water blocking materials and shall not adhere to Aramid strength materials. Polyethylene shall contain carbon

black to provide ultraviolet light protection and shall not promote fungus growth.

Jackets or sheaths shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. Actual cable lengths shall be within -0/+1 percent of length markings. Markings shall be a contrasting color to cable jackets. Heights of markings shall be 2.5 mm±0.2 mm.

General Cable Performance Specifications

F/O cable shall withstand water penetration when tested with one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through open cable ends. Testing shall be in accordance with EIA-455-82 (FOTP- 82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in accordance with EIA/TIA-455-81 (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. Cables shall exhibit no flow (drip or leak) at 70°C as defined in the test method.

Crush resistance of finished F/O cables shall be 220 N/cm applied uniformly over the length of cables without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for fibers shall be ≤0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. Cables shall not exhibit measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA- 455-41 (FOTP-41), except that loads shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

Cables shall withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for fibers shall be ≤0.20 dB at 1550 nm (singlemode) at the completion of testing. Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure. Testing shall be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with sheave diameters a maximum of 20 times the outside diameter of cables. Cables shall be tested in accordance with Test Conditions I and II of (FOTP-104).

Cables shall withstand 20 impact cycles, with a total impact energy of 5.9 N•m. Impact testing shall be conducted in accordance with TIA/EIA- 455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables

and Cable Assemblies". The average increase in attenuation for fibers shall be <0.20 dB at 1550 nm for singlemode fiber. Cables shall not exhibit evidence of cracking or splitting.

Finished cable shall withstand a tensile load of 2700 N without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). Testing shall be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test". Load shall be applied for 30 minutes in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

Packaging and Shipping Requirements
Documentation of compliance to specifications shall be provided to the Engineer prior to ordering materials.

Attention is directed to "Fiber Optic Testing", of these special provisions.

Completed cables shall be packaged for shipment on reels. Cables shall be wrapped in weather and temperature resistant covering. Ends of cables shall be sealed to prevent ingress of moisture.

Ends of cables shall be securely fastened to reels to prevent cables from coming loose during transit. Four meters of cable on ends of cables shall be accessible for testing.

Cable reels shall have durable, weatherproof labels or tags showing the manufacturer's name, cable type, the actual length of cable on reels, the Contractor's name, the contract number, and the reel number. A shipping record shall be included in a weatherproof envelope showing the above information, including the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and other pertinent information.

Minimum hub diameter of reels shall be at least 30 times the diameter of the cable. F/O cable shall be in one continuous length per reel with no factory splices in fibers. Reels shall be marked to indicate the direction reels should be rolled to prevent loosening of cables.

Installation procedures and technical support information shall be furnished at the time of delivery.

10.7 LABELING

General
The Contractor shall label fiber optic cabling in a permanent consistent manner. Tags shall be of a material designed for long

term permanent labeling of fiber optic cables. Metal tags shall be stainless steel with embossed lettering. Non-metal label materials shall be approved by the Engineer and marked with permanent ink. Labels shall be affixed to cables per the manufacturer's recommendations and shall not be affixed in a manner, which will cause damage to fibers. Handwritten labels will not be allowed.

10.8 CABLE INSTALLATION

Cable installation shall be in conformance with the procedures specified by the cable manufacturer. The Contractor shall submit the manufacturer's recommended procedures for pulling fiber optic cable at least 20 Working Days prior to installing cable. Mechanical aids may be used provided that a tension measuring device, and break-away swivel are placed in tension to the end of cables. Tension in cables shall not exceed 2225 N or the manufacturer's recommended pulling tension, whichever is less.

During cable installation, the bend radius shall be a minimum of 20 times the outside diameter. Cable grips for installing fiber optic cables shall have a ball bearing swivel to prevent cables from twisting during installation.

F/O cable shall be installed using a cable pulling lubricant recommended by the F/O cable manufacturer and a pull rope conforming to the provisions in Section 4.10, "Conduit" of these special provisions. Personnel shall be stationed at splice vaults and pull boxes through which cables are pulled to lubricate and prevent kinking or other damage.

F/O cable shall be installed without splices except where allowed on the plans and shall be limited to one cable splice every 6 km if splice locations are not shown on the plans. Mid-span access splices or FDU terminations shall involve fibers being spliced as shown on the plans. Cable splices shall be located in splice closures installed in splice vaults or in No. 6(E) pull boxes. Slack shall be provided for F/O cables at the following splice enclosures:

Splice Enclosure Type	Minimum Slack (feet)
Splice Vault (N48)	**75**
Splice Vault (N48) with slice closure	**150**

The slack shall be divided equally on each side of splice closures.

10.9 SPLICING

Field splices shall be done in splice vaults, cabinets, and in splice trays housed in splice closures. Splices in cabinets shall be done in splice trays housed in FDU's.

Fiber splices shall be fusion type unless otherwise specified. Mean splice loss shall not exceed 0.07 dB per splice and shall be obtained by measuring loss through splices in both directions and averaging the resultant values.

Splices shall be protected with a metal reinforced thermal shrink sleeve. The mid-span access method shall be used to access individual fibers in cables for splicing to other cables. Cable manufacturers recommended procedures and approved tools shall be used for mid-span access. Only fibers to be spliced shall be cut. Buffer tubes and individual fibers not being used in mid-span access shall not be modified or damaged.

Individual fibers shall be looped one full turn within splice trays to avoid micro bending. A 45 mm minimum bend radius shall be maintained during installation and after final assembly in optical fiber splice trays. Bare fibers shall be individually restrained in splice trays. Optical fibers in buffer tubes and placement of bare optical fibers in splice trays shall not produce tensile force on optical fibers.

The Contractor will be allowed to splice a total of 30 percent of fibers to repair damage done during mid-span access splicing without penalty. The Engineer will assess a fine of $300.00 for each additional and unplanned splice. A single fiber may not have more than 3 unplanned splices within the 6km limitation. If a fiber requires more than 3 unplanned splices, the entire length of F/O cable shall be replaced at the Contractor's expense.

10.10 SPLICE CLOSURES

F/O field splices shall be enclosed in splice closures, complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. Splice closures shall be suitable for direct burial or pull box applications. Manufacturer’s installation instructions shall be supplied to the Engineer prior to installation of splice closures. Location of splice closures shall be where a splice is required as shown on the plans, where designated by the Engineer, or described in these special provisions.

Splice closures shall conform to the following specifications:

A. Non-filled thermoplastic case.

B. Rodent proof, water proof, re-enterable and moisture proof.

C. Cable entry ports shall accommodate 10-mm to 25-mm diameter cables.

D. Multiple grounding straps.

E. Accommodate a minimum of 24 splice trays.

F. Suitable for "butt" or "through" cable entry configurations.

G. Place no stress on finished splices within splice trays.

The Contractor shall verify the quality of splices prior to sealing splice closures. Splice closures shall not be sealed until link testing is performed and is approved by the Engineer.

10.11 SPLICE TRAYS

Each splice tray shall accommodate a minimum of 12 fusion splices and shall allow a minimum bend radius of 45 mm. Individual fibers shall be looped one full turn within splice trays to allow for future splicing. Stress shall not be applied on fibers when located in final position. Buffer tubes shall be secured near entrances of splice trays. Splice tray covers may be transparent.

Splice trays shall conform to the following:

A. Accommodate up to 12 fusion splices.

B. Place no stress on completed splices within the tray.

C. Stackable with a snap-on hinge cover.

D. Buffer tubes securable with channel straps.

E. Accommodate a fusion splice with the addition of an alternative splice holder.

F. Be labeled after splicing is completed.

Only one splice tray may be secured by a bolt through the center of the tray in fiber termination units. Multiple trays shall be securely held in place per the manufacturer's recommendation.

10.12 PASSIVE CABLE ASSEMBLIES AND COMPONENTS

Fiber optic cable assemblies and components shall be compatible components, manufactured by a company regularly engaged in the production of material for the fiber optic industry. Components or assemblies shall be best quality, non-corroding, with a minimum design life of 20 years. The cable assemblies and components manufacturer shall be ISO 9001 registered.

10.13 FIBER OPTIC CABLE TERMINATIONS

10.13.1 GENERAL

Cables shall continue within conduit to the designated cable termination point. Components shall be the size and type required for the specified fiber. Fiber optic cable terminations may take place in several locations such as data node(s), video nodes, hubs, traffic signal (Adaptive Traffic Control Signal), and CCTV camera location(s).

10.13.2 CABLE TERMINATION

At the FDU, the cable jacket of outside plant cable, shall be removed exposing the Aramid yarn, filler rods, and buffer tubes. The exposed length of buffer tubes shall be at least the length recommended by the FDU manufacturer, which allows the tubes to be secured to the splice trays. Buffer tubes shall be secured to splice trays in which they are to be spliced. The remainder of the tubes shall be removed to expose sufficient length of fibers to properly install on splice trays, conforming to the requirements in "Splicing," of these special provisions.

When applicable, moisture-blocking gel shall be removed from exposed buffer tubes and fibers. The transition from the buffer tube to the bundle of jacketed fibers shall be treated by an accepted procedure for sleeve tubing, shrink tube and silicone blocking of the transition to prevent future gel leak. Manufacturer directions shall be followed to ensure gel will not flow from ends of buffer tubes throughout the specified temperature range. Individual fibers shall be stripped and prepared for splicing.

Factory terminated pigtails shall be spliced and placed in splice trays.

Fibers inside fiber optic cables entering Fiber Distribution Units (FDU) shall be terminated and labeled. Attention is directed to "Fiber Distribution Unit" of these special provisions.

10.13.3 DISTRIBUTION INTERCONNECT PACKAGE

Distribution involves connecting fibers to locations shown on the plans. The distribution interconnect package consists of FDUs with connector panels, couplers, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package shall

be assembled and tested by a company regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" of these special provisions. Distribution components shall be products of same manufacturers, regularly engaged in the production of these components with quality assurance programs.

10.13.4 FIBER OPTIC CABLE ASSEMBLIES AND PIGTAILS

Cables for cable assemblies shall be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected.

Pigtails shall be of simplex (one fiber) construction, in 900-μm tight buffer form, surrounded by Aramid yarn for strength, with a PVC jacket with manufacturer's identification information, and a nominal outer jacket diameter of 3 mm. Singlemode simplex cable jackets shall be yellow. Pigtails shall be factory terminated and tested and at least one meter in length.

Jumpers may be of simplex or duplex design. Duplex jumpers shall be duplex round cable construction and shall not have zipcord (Siamese) construction. Jumpers shall be at least 2 m in length.

Outer jackets of duplex jumpers shall be yellow. The 2 inner simplex jackets shall be contrasting colors to provide easy visual identification for polarity.

Connectors shall be ceramic ferrule ST or SC type for SMFO. Indoor or outdoor ST connector body housings shall be nickel- plated zinc or glass reinforced polymer construction. Indoor or outdoor SC connector body housings shall be glass reinforced polymer.

Associated couplers shall be the same material as connector housings.

Connectors shall be the 2.5 mm connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre- radiused tip.

All connectors shall have an operating temperature range from -40°C to +70°C. Insertion loss shall not exceed 0.4 dB for singlemode and return reflection loss on singlemode connectors shall be at least -35 dB. Connection durability shall be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). Terminations

shall provide a minimum 222 N pull out strength. Factory test results shall be documented and submitted to the Engineer prior to installing connectors. Singlemode connectors shall have a yellow color on the body and boot.

Field terminations shall be limited to splicing of adjoining cable ends and cables to ST or SC pigtails.

Connectors shall be factory-installed and tested.

Unmated connectors shall have protective caps installed.

10.14 FIBER OPTIC TESTING

10.14.1 GENERAL

Testing shall include tests on elements of passive fiber optic components at the factory, after delivery to the project site but prior to installation, and after installation but prior to connection to other portions of the systems. The Contractor shall provide personnel, equipment, instrumentation, and materials necessary to perform testing. The Engineer shall be notified at least two (2) Working Days prior to field tests. Notification shall include the exact location or portion of system to be tested.

Documentation of test results shall be provided to the Engineer within five (5) Working Days after testing.

A minimum of 15 working days prior to arrival of cable at the site, the Contractor shall provide detailed test procedures for field testing for the Engineer's review and approval. Procedures shall include tests involved and how tests are to be conducted. Test procedures shall include the model, manufacturer, configuration, calibration, and alignment procedures for proposed test equipment.

10.14.2 FACTORY TESTING

Documentation of compliance with fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the original equipment manufacturer. Before shipment, but while on shipping reels, 100 percent of fibers shall be tested for attenuation. Copies of the results shall be maintained on file by the manufacturer

with a file identification number for a minimum of 7 years, attached to cable reels in waterproof pouches, and submitted to the Contractor and to the Engineer.

10.14.3 ARRIVAL ON SITE

Cables and reels shall be physically inspected on delivery and 100 percent of fibers shall be attenuation tested to confirm that cable meets requirements. Failure of a fiber in the cable shall be cause for rejection of the entire reel. Test results shall be recorded, dated, compared and filed with copies accompanying shipping reels in weatherproof envelopes. Attenuation deviations from shipping records of greater than 5 percent shall be brought to the attention of the Engineer. Cables shall not be installed until completion of testing and written approval of the Engineer. Copies of traces and test results shall be submitted to the Engineer. If test results are unsatisfactory, the reel of F/O cable shall be considered unacceptable and records corresponding to that reel of cable shall be marked accordingly. Unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. New reels of cable shall be tested to demonstrate acceptability. Copies of test results shall be submitted to the Engineer.

10.14.4 AFTER CABLE INSTALLATION

Index matching gel will not be allowed in connectors during testing. After fiber optic cable has been pulled, but before breakout and termination, 100 percent of fibers shall be tested with an OTDR for attenuation. Test results shall be recorded, dated, compared, and filed with previous copies of these tests. Copies of traces and test results shall be submitted to the Engineer. If OTDR test results are unsatisfactory, the F/O cable segment of cable will be rejected. Unsatisfactory segments of cable shall be replaced with new segments, without additional splices, at the Contractor's expense. New cable segments shall be tested to demonstrate acceptability. Copies of test results shall be submitted to the Engineer.

10.14.5 SYSTEM CABLE VERIFICATION AT COMPLETION

A. Power Meter and Light Source
At the conclusion of OTDR testing, 100 percent of fiber links shall be tested end-to-end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for

OTDR tests. Tests shall be conducted in one direction as directed by the Engineer. The Insertion Loss (1C) shall be calculated. Test results shall be recorded, compared, and filed with the other recordings of the same links. Test results shall be submitted to the Engineer. These values shall be recorded and provided in summary table and submitted to the Engineer for review and approval within five (5) Working Days of completing the test.

B. OTDR Testing

After passive cabling systems have been installed and are ready for activation, 100 percent of fibers shall be tested with OTDR for attenuation at wavelengths of 1310 nm and 1550 nm. OTDR testing shall be performed in both directions (bi-directional) on fibers. Test results shall be generated from software of test equipment, recorded, dated, compared and filed with previous copies. A hard copy printout and an electronic copy on a CD of traces and test results shall be submitted to the Engineer. The average of the 2 losses shall be calculated and recorded in the Cable Verification Worksheet in Appendix D. The OTDR shall be capable of recording and displaying anomalies of at least 0.02 dB. Connector losses shall be displayed on OTDR traces.

C. Test Failures

If link loss, measured from the power meter and light source, exceeds the calculated link loss or the actual location of fiber ends does not agree with the expected location of fiber ends, fiber optic links will not be accepted. Unsatisfactory segments of cable or splices shall be replaced with new segments of cables or splices at the Contractor's expense. OTDR testing, power meter and light source testing, and Cable Verification Worksheet shall be completed for repaired links to determine acceptability. Copies of test results shall be submitted to the Engineer. Removal and replacement of segments of cable shall be considered as removal and replacement of a single contiguous length of cable connecting 2 splices and 2 connectors. Removal of a section containing a failure will not be allowed.

Passive Component Package Testing and Documentation

Components in the passive component package (FDUs, pigtails, jumpers, couplers, and splice trays) shall be from a manufacturer who is ISO 9001 registered.

Pigtails or jumpers shall be tested for insertion attenuation loss using optical power meters and light sources. Singlemode terminations shall be tested for return reflection loss. Values shall meet loss requirements specified and shall be recorded on tags attached to pigtails or jumpers.

After an assembly is complete, the manufacturer shall visually verify that tagging of loss values is complete. The manufacturer shall conduct an "end-to-end" optical power meter/light source test from pigtail ends to end of terminating points assuring continuity and overall attenuation loss values are acceptable.

Final test results shall be recorded with previous individual component values on forms assigned to individual FDU. Completed forms shall be dated and signed by the Manufacturer's Quality Control supervisor. One copy of the form shall be attached in a plastic envelope to the assembled FDU. Copies shall be provided separately to the Contractor and the Engineer, and shall be maintained on file by the manufacturer or supplier.

Assembled and completed FDU units shall be protectively packaged for shipment to the Contractor for installation.

Fiber Optic System Performance Margin Design Criteria

Installed system performance margin shall be at least 6 dB for links. If the design system performance margin is less than 6 dB, the Engineer shall be notified of the Contractor's plan to meet this requirement.

Active Component Testing

Transmitters and receivers shall be tested with power meters and light sources to record transmitter average output power (dBm) and receiver sensitivity (dBm).

All new fiber optic cable shall be fixed with identification bands in pull boxes and near termination points. Identification bands shall indicate that the cable is "INTERCONNECT" and the direction in which the cable is traveling (North-South or East- West).

11.0 TRAFFIC SIGNAL PRE TURN-ON REVIEW

The following steps should be followed for a typical traffic signal pre turn-on review:

A. Contractor completes all items relating to the operation of the signal. Striping and pavement markings must be complete. Contractor notifies Public Works Inspector once power equipment and wires are installed.

B. Contractor requests final electric permit inspection of service equipment. Once approved, Building Inspection will issue turn on request to Finance Department.

C. Contractor requests a pre-turn-on inspection through the Public Works Inspector. A one-week advance notice is required to schedule this inspection.

The pre turn-on inspection is not a final inspection. The Electric Technician will only inspect the signal for completeness. Contractor shall complete items as necessary and reschedule another pre-turn-on inspection through the Public Works Inspector.

D. Contractor requests a flashing pre-turn-on of the signal through the Public Works Inspector only after the Electric Technician finds the results of the pre-turn-on satisfactory. Contractor will flash the signal while the Electric Technician verifies the operation. Electric Technician also verifies cabinet wiring and auxiliary equipment in the traffic signal cabinet and the Tesco power cabinet. Depending on the workload of the Electric Technician, the inspection will take place within one week of the request. Deficient items will be noted and a list of deficient items will be supplied to the Contractor.

E. Contractor shall complete deficient items and request another flashing pre-turn-on through the Public Works Inspector. If an additional inspection is required due to non-compliance with the previous deficiency list, the Contractor will be charged the actual cost for the inspection.

F. If the flashing pre-turn-on is successful, the Contractor requests a final turn- on through the Public Works Inspector. Depending on the workload of the Electric Technician, Traffic Engineering, and the cabinet and video equipment manufacturers representatives, the turn-on will take place within one week of the request.

Signal turn-on shall only be performed on Tuesday, Wednesday, or Thursday. Turn-on shall start at 9:30 A.M. and shall be completed by 1:00 P.M.

G. After the final turn-on request and prior to the turn-on day, the following items will be performed:

1. Electric Technician installs the traffic signal controller, camera controller, detector amplifiers (if required) and the intersection is “run dark” for seven days prior to turn-on. Traffic Engineering will verify operation of detector and communications lines and equipment. Contractor shall repair any deficiencies found prior to turn-on.

2. Contractor to schedule cabinet manufacturer to be present on turn-on day.

3. Contractor will schedule the camera manufacturer to be present during the turn-on day.

12.0 TRAFFIC SIGNAL TURN-ON

The following items will be performed on the day of the turn-on:

A. Public Works Inspector and Traffic Engineering will walk the intersection and check all the signal heads and pedestrian heads for proper alignment including PV visors. Contractor will correct as required.

B. Electric Technician connects the traffic signal controller, camera controller, detector amplifiers (if required). Installs load switches, relays and any auxiliary equipment. Electric Technician will assist the camera manufacturer as necessary with the cable connections to the camera controller. Cabinet manufacturer will inspect the installation of items in the cabinet.

C. Traffic Engineering will check for the proper location of the cameras with the camera manufacturer. Contractor will provide the bucket truck and personnel to relocate the cameras as necessary to the requirements of Traffic Engineering.

D. Traffic Engineering will install the program card in the controller and verify against timing sheet.

E. Traffic Engineering and Electric Technician/Contractor/Cabinet manufacturer will place the signal in normal operation and Contractor will cover any stop signs.

F. Traffic Engineering and Electric Technician will verify operation of the signal and make any necessary changes to the timing. After the operation of the signal has been verified, the Public Works Inspector will notify Contractor to remove any existing stop signs.

The Engineer reserves the right to suspend the counting of working days, during the traffic signal turn-on, if unexpected or undue delays are encountered.

G. Contractor requests final inspection. Electric Technician, Traffic Engineering, and Public Works Inspector will inspect the traffic signal construction and prepare a deficiency list (compiled by the Public Works Inspector) to be delivered to the Contractor. Contractor will correct the work.

H. Once corrected, Contractor will request another inspection (if needed) through the Public Works Inspector. If a second inspection is required due to non-compliance with the previous deficiency list, the Contractor will be charged the actual cost for the second inspection.

Signal turn on shall be performed on Tuesday, Wednesday, or Thursday. Turn on shall start at 9:30 A.M. and shall be completed by 2:30 P.M.

13.0 WARRANTY

Contractor shall warrant all material and workmanship to be free from defects for a period of one year after acceptance. In the event that evidence of failure develops within one year, Contractor shall replace the faulty components at no cost to the City. A guaranty for this purpose is included as Document 00630, Guaranty.

14.0 PAYMENT

Any item of work not shown on the Bid but is required by the Contract Documents shall be considered as incidental and full compensation for same shall be considered included in the payment for the bid item(s) shown on the Bid.

Detector Loop Test Results

Intersection Location:									
Contract No.: CE XX-XX-XX									
Contractor:									
Phase #	**Lane #***	**Type****	**Loc.*****	**Meg**	**"L"**	**“R”**	**"Q"**	**By**	**Date**
* Lane Closest To Center of Roadway is #1 Lane (1,2,3, etc.) ** P=Presence Detector, A= Advance Detector									
***Head Loop (closest to stop bar)=A (A,B,C,D)									
Meg = Megohms, “L” = Inductance,“R” = Resistance, “Q” = Quality Factor									

END OF SECTION

EXHIBIT B
SCHEDULE OF FEES

1. MAXIMUM COMPENSATION

1.1 The maximum compensation payable to Contractor during the Term shall not exceed the amount in Section 6 of this Agreement.

1.2 The City does not guarantee a minimum compensation under this Agreement.

2. FEE SCHEDULE

2.1 Appendix B-1 sets forth the detailed fee schedule for annual maintenance services at its corresponding intersections.

2.2 Appendix B-2 sets forth the detailed fee schedule for as-needed services pursuant to Exhibit A, Scope of Services.

3. ADDITONAL AS-NEEDED SERVICES

In the event the City requires additional traffic signal maintenance, repair, and support services, Contractor shall provide a written quotation that includes all costs to complete the additional work requested. Contractor shall obtain prior written approval from the City before starting work.

Description	Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
Hourly Lead Signal Technician (straight time)	**$235.00**	**$242.00**	**$250.00**	**$258.00**	**$265.00**
Hourly Signal Technician (straight time)	**$225.00**	**$232.00**	**$240.00**	**$248.00**	**$255.00**
Hourly General Labor (straight time)	**$140.00**	**$145.00**	**$150.00**	**$155.00**	**$160.00**
Hourly Fiber Optic Technician (straight time)	**$225.00**	**$232.00**	**$240.00**	**$248.00**	**$255.00**
Hourly Lead Signal Technician (over time)	**$335.00**	**$345.00**	**$355.00**	**$365.00**	**$375.00**

Description	Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
Hourly Signal Technician (over time)	**$325.00**	**$335.00**	**$345.00**	**$355.00**	**$365.00**
Hourly General Labor (over time)	**$185.00**	**$190.00**	**$195.00**	**$200.00**	**$207.00**
Hourly Fiber Optic Technician (over time)	**$315.00**	**$325.00**	**$332.00**	**$345.00**	**$355.00**

Materials Mark Up on Actual Costs	10%

4. OPTION PERIODS

Pursuant to Section 2.B. of the Agreement, after the initial five-year term, the City reserves the right to exercise two (2) one-year period extensions for a total of seven (7) years. Pricing shall remain fixed during the initial five-year term, after which the Contractor may request rate adjustments no more than once annually. In the event the City elects to exercise the options after the initial term, any proposed rate adjustments must be substantiated by the Contractor to the satisfaction of the City that a price increase is warranted and must be supported by the appropriate price index e.g. PPI, CPI, etc. Price adjustments are subject to the City's approval.

5. INVOICING

5.1 The Contractor shall invoice the City on a monthly basis for all services provided by the Contractor during the preceding month on an invoice and in the format approved by the City and subject to verification and approval by the City. The invoice must reflect labor rates and classification in accordance with California Department of Industrial Relations prevailing wage rates, equipment rates within the Caltrans Equipment Rental Rates Book, and material costs supported by vendor invoices. The markups used for labor, equipment, and materials shall be in accordance with the City's Standard Specifications.

5.2 Invoice shall include, at a minimum, the following:

5.2.1 Service date

5.2.2 Line item of services provided

5.2.3 Unit cost of each line item

5.2.4 Quantity/number of hours for each line item

5.2.5 Total cost of each line item

5.3 The City will pay Contractor within thirty (30) days of City's receipt of an approved invoice.

Appendix B-1
Annual Maintenance Services

This Appendix B-1 sets forth the detailed fee schedule for annual maintenance services at its corresponding intersections.

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
1	Signal	Calvert Drive/I-280	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
2	Signal	Agilent Tech	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
3	Signal	Lawrence Expy W	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
4	Signal	Lawrence Expy E	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
5	Signal	Cabot Ave/Loma Linda Dr	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
6	Signal	Cronin Dr	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
7	Signal	Woodhams Rd	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
8	Signal	Saratoga Ave	Keystone Ave	$135.00	$140.00	$145.00	$150.00	$155.00
9	Signal	Cypress Ave	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
10	Signal	Saratoga Ave	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
11	Signal	Kiely Blvd	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
12	Signal	Woodhams Rd	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
13	Signal	Pomeroy Ave	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
14	Signal	Kiely Blvd	Forbes Ave	$135.00	$140.00	$145.00	$150.00	$155.00
15	Signal	Saratoga Ave	Los Padres Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
16	Signal	Kaiser Dr	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
17	Signal	Bing Dr	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
18	Signal	Pomeroy Ave	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
19	Signal	Peppertree Ln	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
20	Signal	Kiely Blvd	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
21	Signal	Central Library	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
22	Signal	Las Palmas	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
23	Signal	Saratoga Ave	Newhall St	$135.00	$140.00	$145.00	$150.00	$155.00
24	Signal	Winchester Blvd	Newhall St	$135.00	$140.00	$145.00	$150.00	$155.00
25	Signal	Washington St	Newhall St	$135.00	$140.00	$145.00	$150.00	$155.00
26	Signal	Washington St	Poplar St	$135.00	$140.00	$145.00	$150.00	$155.00
27	Signal	Monroe St	Bellomy St	$135.00	$140.00	$145.00	$150.00	$155.00
28	Signal	Winchester Blvd	Bellomy St	$135.00	$140.00	$145.00	$150.00	$155.00
29	Signal	Winchester Blvd	Market St	$135.00	$140.00	$145.00	$150.00	$155.00
30	Signal	Scott Blvd	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
31	Signal	Los Padres Blvd	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
32	Signal	Kiely Blvd	Kaiser Dr	$135.00	$140.00	$145.00	$150.00	$155.00
33	Signal	Pomeroy Ave	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
34	Signal	Kiely Blvd	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
35	Signal	Scott Blvd	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
36	Signal	Monroe St	Market St	$135.00	$140.00	$145.00	$150.00	$155.00
37	Signal	Lafayette St	Bellomy St	$135.00	$140.00	$145.00	$150.00	$155.00
38	Signal	The Alameda/Park Ave	Bellomy St	$135.00	$140.00	$145.00	$150.00	$155.00
39	Signal	Lafayette St	Market St	$135.00	$140.00	$145.00	$150.00	$155.00
40	Signal	Lafayette St	Santa Clara St	$135.00	$140.00	$145.00	$150.00	$155.00
41	Signal	Lafayette St	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
42	Signal	Monroe St	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
43	Signal	Lincoln St	Homestead Rd	$135.00	$140.00	$145.00	$150.00	$155.00
44	Signal	Lincoln St	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
45	Signal	Monroe St	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
46	Signal	Lafayette St	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
47	Signal	Coleman Ave	Brokaw Rd	$135.00	$140.00	$145.00	$150.00	$155.00
48	Signal	Lafayette St	Lewis St	$135.00	$140.00	$145.00	$150.00	$155.00
49	Signal	Lafayette St	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
50	Signal	Monroe St	Lewis St	$135.00	$140.00	$145.00	$150.00	$155.00
51	Signal	Monroe St	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
52	Signal	Lincoln St	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
53	Signal	Scott Blvd	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
54	Signal	Los Padres Blvd	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
55	Signal	Bowers Ave	Warburton Ave	$135.00	$140.00	$145.00	$150.00	$155.00
56	Signal	Scott Blvd	Warburton Ave	$135.00	$140.00	$145.00	$150.00	$155.00
57	Signal	Scott Blvd	Royal Dr	$135.00	$140.00	$145.00	$150.00	$155.00
58	Signal	Bowers Ave	Barkley Ave	$135.00	$140.00	$145.00	$150.00	$155.00
59	Signal	Bowers Ave	Cabrillo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
60	Signal	Scott Blvd	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
61	Signal	Lafayette St	Memorex Dr	$135.00	$140.00	$145.00	$150.00	$155.00
62	Signal	Los Padres Blvd	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
63	Signal	Bowers Ave	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
64	Signal	Monticello Way	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
65	Signal	Calabazas Blvd	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
66	Signal	Bowers Ave	Chromite Dr	$135.00	$140.00	$145.00	$150.00	$155.00
67	Signal	Scott Blvd	Martin Ave	$135.00	$140.00	$145.00	$150.00	$155.00
68	Signal	Lafayette St	Martin Ave	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
69	Signal	De La Cruz Blvd	Martin Ave	$135.00	$140.00	$145.00	$150.00	$155.00
70	Signal	De La Cruz Blvd	Airport Tech Park	$135.00	$140.00	$145.00	$150.00	$155.00
71	Signal	Lafayette St	Walsh Ave	$135.00	$140.00	$145.00	$150.00	$155.00
72	Signal	Nvidia	Walsh Ave	$135.00	$140.00	$145.00	$150.00	$155.00
73	Signal	Bowers Ave	Mead Ave	$135.00	$140.00	$145.00	$150.00	$155.00
74	Signal	Corvin Dr	Kifer Rd	$135.00	$140.00	$145.00	$150.00	$155.00
75	Signal	Bowers Ave	Walsh Ave	$135.00	$140.00	$145.00	$150.00	$155.00
76	Signal	Scott Blvd	Space Park Dr	$135.00	$140.00	$145.00	$150.00	$155.00
77	Signal	Jay St	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
78	Signal	Olcott St	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
79	Signal	Octavius	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
80	Signal	Bowers Ave	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
81	Signal	Lakeside Dr	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
82	Signal	Lafayette St	Laurelwood Rd	$135.00	$140.00	$145.00	$150.00	$155.00
83	Signal	De La Cruz Blvd	Laurelwood Rd	$135.00	$140.00	$145.00	$150.00	$155.00
84	Signal	Bowers Ave	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
85	Signal	Bowers Ave	101 South	$135.00	$140.00	$145.00	$150.00	$155.00
86	Signal	Lafayette St	Aldo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
87	Signal	De La Cruz Blvd	Aldo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
88	Signal	Lafayette St	Laurie Ave	$135.00	$140.00	$145.00	$150.00	$155.00
89	Signal	Great America Pkwy	101 North	$135.00	$140.00	$145.00	$150.00	$155.00
90	Signal	Lafayette St	Norman Ave	$135.00	$140.00	$145.00	$150.00	$155.00
91	Signal	Lafayette St	Clyde Ave	$135.00	$140.00	$145.00	$150.00	$155.00
92	Signal	Lafayette St	Montague North	$135.00	$140.00	$145.00	$150.00	$155.00
93	Signal	Lafayette St	Montague South	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
94	Signal	De La Cruz Blvd	Greenwood Dr	$135.00	$140.00	$145.00	$150.00	$155.00
95	Signal	Burton Dr	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
96	Signal	Juliet Ln	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
97	Signal	Agnew Rd	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
98	Signal	San Tomas Aq Trail	Agnew Rd	$135.00	$140.00	$145.00	$150.00	$155.00
99	Signal	Freedom Circle	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
100	Signal	Marriot	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
101	Signal	Great America Pkwy	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
102	Signal	Mission College Circle	Mission College Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
103	Signal	Lafayette St	Palm Dr	$135.00	$140.00	$145.00	$150.00	$155.00
104	Signal	Harrigan Dr	Agnew Rd	$135.00	$140.00	$145.00	$150.00	$155.00
105	Signal	Sun Fire Way	Agnew Rd	$135.00	$140.00	$145.00	$150.00	$155.00
106	Signal	Lafayette St	Agnew Rd	$135.00	$140.00	$145.00	$150.00	$155.00
107	Signal	Lick Mill Blvd	Moreland Way	$135.00	$140.00	$145.00	$150.00	$155.00
108	Signal	Great America Pkwy	Patrick Henry Dr	$135.00	$140.00	$145.00	$150.00	$155.00
109	Signal	Lafayette St	Hope Dr	$135.00	$140.00	$145.00	$150.00	$155.00
110	Signal	Lafayette St	Eisenhower Dr	$135.00	$140.00	$145.00	$150.00	$155.00
111	Signal	Lick Mill Blvd	Hope Dr	$135.00	$140.00	$145.00	$150.00	$155.00
112	Signal	Lafayette St	Hogan Dr	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
113	Signal	Great America Pkwy	Old Glory Ln	$135.00	$140.00	$145.00	$150.00	$155.00
114	Signal	Stern Ave	Stevens Creek Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
115	Signal	Lafayette St	Calle De Primavera	$135.00	$140.00	$145.00	$150.00	$155.00
116	Signal	Lick Mill Blvd	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
117	Signal	Calle De Sol	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
118	Signal	Centennial Blvd	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
119	Signal	Convention Center	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
120	Signal	Great America Pkwy	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
121	Signal	Old Ironsides Dr	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
122	Signal	Patrick Henry Dr	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
123	Signal	Great America Pkwy	Bunker Hill Ln	$135.00	$140.00	$145.00	$150.00	$155.00
124	Signal	Lafayette St	Calle De Luna	$135.00	$140.00	$145.00	$150.00	$155.00
125	Signal	Great America Pkwy	Old Mtn/Alviso Rd	$135.00	$140.00	$145.00	$150.00	$155.00
126	Signal	Betsy Ross Drive	Old Mtn/Alviso Rd	$135.00	$140.00	$145.00	$150.00	$155.00
127	Signal	Great America Pkwy	Great America Way	$135.00	$140.00	$145.00	$150.00	$155.00
128	Signal	Ped Crossing	Tasman Dr	$135.00	$140.00	$145.00	$150.00	$155.00
129	Signal	De La Cruz Blvd	Reed St	$135.00	$140.00	$145.00	$150.00	$155.00
130	Signal	San Tomas Aq Trail	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
131	Signal	Lakeside Dr	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
132	Signal	Oakmead Village Dr	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
133	Signal	Garrett Dr	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
134	Signal	Scott Blvd	Anna Dr	$135.00	$140.00	$145.00	$150.00	$155.00
135	Signal	McCormick	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
136	Signal	Montgomery Dr	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
137	Signal	Montgomery Dr	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
138	Signal	Scott Blvd	Walsh Ave	$135.00	$140.00	$145.00	$150.00	$155.00
139	Signal	Ped Crossing	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
140	Signal	Coronado P (Alley B)	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
141	Signal	Lafayette St	Reed St	$135.00	$140.00	$145.00	$150.00	$155.00
142	Signal	Nobili Ave	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
143	Signal	Calvert Drive	Calvert Ct	$135.00	$140.00	$145.00	$150.00	$155.00
144	Signal	Monroe St	Chromite Dr	$135.00	$140.00	$145.00	$150.00	$155.00
145	Signal	Cronin Dr	Pruneridge Ave	$135.00	$140.00	$145.00	$150.00	$155.00
146	Signal	Brokaw Rd	Wondo Wy	$135.00	$140.00	$145.00	$150.00	$155.00
147	HAWK	Lafayette St	Lexington St	$135.00	$140.00	$145.00	$150.00	$155.00
148	HAWK	Lafayette St	Franklin St	$135.00	$140.00	$145.00	$150.00	$155.00
149	HAWK	Moraga St	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
150	HAWK	Meadowbrook Dr	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
151	HAWK	Glade Dr	Monroe St	$135.00	$140.00	$145.00	$150.00	$155.00
152	HAWK	Alpine Ave	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
153	HAWK	Buchanan Dr	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
154	HAWK	Morse Ln	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
155	HAWK	Harrison St	El Camino Real	$135.00	$140.00	$145.00	$150.00	$155.00
156	HAWK	Coronado Dr	Scott Blvd	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
157	HAWK	Lick Mill Blvd	East River	$135.00	$140.00	$145.00	$150.00	$155.00
158	HAWK	Sonoma Pl	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
159	HAWK	Washington St	Linden Dr	$135.00	$140.00	$145.00	$150.00	$155.00
160	HAWK	Washington St	Manchester Dr	$135.00	$140.00	$145.00	$150.00	$155.00
161	HAWK	Kiely Blvd	Malabar	$135.00	$140.00	$145.00	$150.00	$155.00
162	HAWK	Scott Blvd	Harrison St	$135.00	$140.00	$145.00	$150.00	$155.00
163	Reversible	Lewis St	e/o Lafayette St	$135.00	$140.00	$145.00	$150.00	$155.00
164	Reversible	Lafayette St	n/o Harrison St	$135.00	$140.00	$145.00	$150.00	$155.00
165	Reversible	Lafayette St	n/o Fremont St	$135.00	$140.00	$145.00	$150.00	$155.00
166	Reversible	Lafayette St	s/o Fremont St	$135.00	$140.00	$145.00	$150.00	$155.00
167	Reversible	Lafayette St	n/o Franklin St	$135.00	$140.00	$145.00	$150.00	$155.00
168	Reversible	Lafayette St	s/o Franklin St	$135.00	$140.00	$145.00	$150.00	$155.00
169	Beacon	Monroe St	Marchese Way	$135.00	$140.00	$145.00	$150.00	$155.00
170	Beacon	Fallon Ave	Saratoga Ave	$135.00	$140.00	$145.00	$150.00	$155.00
171	Beacon	Monroe St	s/o Chromite Dr	$135.00	$140.00	$145.00	$150.00	$155.00
172	Beacon	Monroe St	s/o Calabazas Ave	$135.00	$140.00	$145.00	$150.00	$155.00
173	Beacon	The Alameda	Benton St	$135.00	$140.00	$145.00	$150.00	$155.00
174	Beacon	Saratoga Ave	e/o Cypress Ave	$135.00	$140.00	$145.00	$150.00	$155.00
175	Beacon	Saratoga Ave	w/o Los Padres Blvd	$135.00	$140.00	$145.00	$150.00	$155.00
176	Beacon	Bowers Ave	n/o Chromie Dr	$135.00	$140.00	$145.00	$150.00	$155.00
177	Beacon	Bowers Ave	n/o Bonnie Dr	$135.00	$140.00	$145.00	$150.00	$155.00
178	Beacon	Lick Mill Blvd	East River Pkwy	$135.00	$140.00	$145.00	$150.00	$155.00
179	Beacon	Lick Mill Blvd	Fitzpatrick Way	$135.00	$140.00	$145.00	$150.00	$155.00
180	RRFB	Octavius Dr	Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00

Item #	Type	Site Description		Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
		North/South Street	East/West Street					
181	RRFB	Octavius Dr	s/o Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
182	RRFB	Montogomery Dr	s/o Augustine Dr	$135.00	$140.00	$145.00	$150.00	$155.00
183	RRFB	Juliet Ln	n/o Laureldwood Rd	$135.00	$140.00	$145.00	$150.00	$155.00
184	Beacon	Halford Ave	Burnley Way	$135.00	$140.00	$145.00	$150.00	$155.00
185	RRFB	Los Padres Blvd	Royal Dr	$135.00	$140.00	$145.00	$150.00	$155.00
186	RRFB	Townsend Ave	Cabrillo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
187	Beacon	Lafayette St	Reeve St	$135.00	$140.00	$145.00	$150.00	$155.00
188	RRFB	e/o Hoover Dr	Cabrillo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
189	RRFB	Morrison Ave	Cabrillo Ave	$135.00	$140.00	$145.00	$150.00	$155.00
190	RRFB	Pomeroy Ave	Humbolt Ave	$135.00	$140.00	$145.00	$150.00	$155.00
191	RRFB	Pomeroy Ave	Lochinvar Ave	$135.00	$140.00	$145.00	$150.00	$155.00
192	RRFB	The Alameda	n/o Mission St	$135.00	$140.00	$145.00	$150.00	$155.00
193		Underground Service Alerts Request (Hourly)		$116.00	$120.00	$125.00	$130.00	$135.00

Appendix B-2
As-Needed Services

This Appendix B-2 sets forth the detailed fee schedule for as-needed services pursuant to Exhibit A, Scope of Services.

Item No.	Service Description	UOM	Unit Cost Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Unit Cost Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Unit Cost Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Unit Cost Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Unit Cost Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
1	Remove safety light	Each	$40.00	$41.00	$41.00	$41.00	$41.00
2	Remove existing MAS signal	Each	$40.00	$41.00	$41.00	$41.00	$41.00
3	Remove existing SV/TV/SP signal	Each	$40.00	$41.00	$41.00	$41.00	$41.00
4	Furnish and install LED safety light	Each	$670.00	$700.00	$700.00	$700.00	$700.00
5	Furnish and install RRFB signal	Each	$4,740.00	$4,800.00	$4,800.00	$4,800.00	$4,800.00
6	Furnish and install 3-section vehicle signal	Each	$800.00	$840.00	$845.00	$845.00	$845.00
7	Furnish and install 5-section vehicle signal	Each	$1,250.00	$1,300.00	$1,300.00	$1,300.00	$1,300.00
8	Furnish and install 16x18 pedestrian signal	Each	$800.00	$840.00	$840.00	$840.00	$840.00
9	Furnish and install MAS/MAT framework	Each	$220.00	$225.00	$225.00	$225.00	$225.00
10	Furnish and install SV/TV/SP-1-T framework	Each	$510.00	$525.00	$525.00	$525.00	$525.00
11	Furnish and install SV/TV/SP-2-T framework	Each	$565.00	$575.00	$580.00	$580.00	$580.00
12	Furnish and install SV/TV-3-T framework	Each	$950.00	$965.00	$965.00	$965.00	$965.00
13	Furnish and install Traffic Controller Unit	Each	$10,150.00	$10,250.00	$11,000.00	$11,000.00	$11,000.00

Item No.	Service Description	UOM	Unit Cost Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Unit Cost Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Unit Cost Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Unit Cost Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Unit Cost Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
14	Furnish, install, and test 12-SM Fiber Optic Cable	LF	$3.00	$3.10	$3.10	$3.10	$3.10
15	Furnish, install, and test 48-SM Fiber Optic Cable	LF	$3.30	$3.40	$3.40	$3.40	$3.40
16	Fiber Optic Fusion Splice	Each	$70.00	$72.00	$72.00	$72.00	$72.00
17	Remove and replace video detection camera	Each	$8,000.00	$8,240.00	$8,240.00	$8,240.00	$8,240.00
18	Remove and replace PTZ camera	Each	$4,500.00	$4,550.00	$4,550.00	$4,600.00	$4,600.00
19	Furnish and install video detection camera with wiring to cabinet	Each	$8,000.00	$8,240.00	$8,240.00	$8,240.00	$8,240.00
20	Furnish and install PTZ camera with wiring to cabinet	Each	$4,500.00	$4,550.00	$4,600.00	$4,600.00	$4,600.00
21	Remove existing push button	Each	$40.00	$41.00	$41.00	$41.00	$41.00
22	Furnish and install push button	Each	$335.00	$340.00	$345.00	$345.00	$345.00
23	Furnish and install APS system complete (8 PPB)	Each	$13,700.00	$14,120.00	$14,120.00	$14,120.00	$14,120.00
24	Remove existing pull box	Each	$800.00	$825.00	$825.00	$825.00	$825.00
25	Remove and replace #6 pull box cover	Each	$150.00	$155.00	$155.00	$155.00	$155.00
26	Furnish and install #6 pull box complete	Each	$900.00	$900.00	$900.00	$900.00	$900.00
27	Furnish and install #6E pull box complete	Each	$1,200.00	$1,200.00	$1,200.00	$1,200.00	$1,200.00
28	Install Type D loop – Mobilize for qty 1-4	Each Loop	$1,100.00	$1,135.00	$1,170.00	$1,200.00	$1,240.00

Item No.	Service Description	UOM	Unit Cost Initial Term Year 1 of 5 07/01/2026 – 06/30/2027	Unit Cost Initial Term Year 2 of 5 07/01/2027 – 06/30/2028	Unit Cost Initial Term Year 3 of 5 07/01/2028 – 06/30/2029	Unit Cost Initial Term Year 4 of 5 07/01/2029 – 06/30/2030	Unit Cost Initial Term Year 5 of 5 07/01/2030 – 06/30/2031
29	Install Type E loop – Mobilize for qty 1-9	Each Loop	$900.00	$930.00	$955.00	$985.00	$1,015.00
30	Install Type E loop – Mobilize for qty 10+	Each Loop	$800.00	$825.00	$850.00	$875.00	$900.00

EXHIBIT C
INSURANCE REQUIREMENTS

Without limiting the Contractor's indemnification of the City, and prior to commencing any of the Services required under this Agreement, the Contractor shall provide and maintain in full force and effect, at its sole cost and expense, the following insurance policies with at least the indicated coverages, provisions and endorsements:

A. COMMERCIAL GENERAL LIABILITY INSURANCE

1. Commercial General Liability Insurance policy which provides coverage at least as broad as Insurance Services Office form CG 00 01. Policy limits are subject to review, but shall in no event be less than, the following:

   $1,000,000 Each Occurrence
   $2,000,000 General Aggregate
   $2,000,000 Products/Completed Operations Aggregate
   $1,000,000 Personal Injury

2. Exact structure and layering of the coverage shall be left to the discretion of Contractor; however, any excess or umbrella policies used to meet the required limits shall be at least as broad as the underlying coverage and shall otherwise follow form.

3. The following provisions shall apply to the Commercial Liability policy as well as any umbrella policy maintained by the Contractor to comply with the insurance requirements of this Agreement:

   a. Coverage shall be on a "pay on behalf" basis with defense costs payable in addition to policy limits;

   b. There shall be no cross liability exclusion which precludes coverage for claims or suits by one insured against another; and

   c. Coverage shall apply separately to each insured against whom a claim is made or a suit is brought, except with respect to the limits of liability.

B. BUSINESS AUTOMOBILE LIABILITY INSURANCE

Business automobile liability insurance policy which provides coverage at least as broad as ISO form CA 00 01 with policy limits a minimum limit of not less than one million dollars ($1,000,000) each accident using, or providing coverage at least as broad as, Insurance Services Office form CA 00 01. Liability coverage shall apply to all owned, non-owned and hired autos.

In the event that the Work being performed under this Agreement involves transporting of hazardous or regulated substances, hazardous or regulated wastes and/or hazardous or regulated materials, Contractor and/or its subcontractors involved in such activities shall provide coverage with a limit of two million dollars ($2,000,000) per accident covering transportation of such materials by the addition to the Business Auto Coverage Policy of Environmental Impairment Endorsement MCS90 or Insurance Services Office endorsement form CA 99 48, which amends the pollution exclusion in the standard Business Automobile Policy to cover pollutants that are in or upon, being transported or towed by, being loaded onto, or being unloaded from a covered auto.

C. WORKERS' COMPENSATION

1. Workers' Compensation Insurance Policy as required by statute and employer's liability with limits of at least one million dollars ($1,000,000) policy limit Bodily Injury by disease, one million dollars ($1,000,000) each accident/Bodily Injury and one million dollars ($1,000,000) each employee Bodily Injury by disease.

2. The indemnification and hold harmless obligations of Contractor included in this Agreement shall not be limited in any way by any limitation on the amount or type of damage, compensation or benefit payable by or for Contractor or any subcontractor under any Workers' Compensation Act(s), Disability Benefits Act(s) or other employee benefits act(s).

3. This policy must include a Waiver of Subrogation in favor of the City of Santa Clara, its City Council, commissions, officers, employees, volunteers and agents.

D. COMPLIANCE WITH REQUIREMENTS

All of the following clauses and/or endorsements, or similar provisions, must be part of each commercial general liability policy, and each umbrella or excess policy.

1. Additional Insureds. City of Santa Clara, its City Council, commissions, officers, employees, volunteers and agents are hereby added as additional insureds in respect to liability arising out of Contractor's work for City, using Insurance Services Office (ISO) Endorsement CG 20 10 11 85 or the combination of CG 20 10 03 97 and CG 20 37 10 01, or its equivalent.

2. Primary and non-contributing. Each insurance policy provided by Contractor shall contain language or be endorsed to contain wording making it primary insurance as respects to, and not requiring contribution from, any other insurance which the Indemnities may possess, including any self-insurance or self-insured retention they may have. Any other

insurance Indemnities may possess shall be considered excess insurance only and shall not be called upon to contribute with Contractor's insurance.

3. Cancellation.

   a. Each insurance policy shall contain language or be endorsed to reflect that no cancellation or modification of the coverage provided due to non-payment of premiums shall be effective until written notice has been given to City at least ten (10) days prior to the effective date of such modification or cancellation. In the event of non-renewal, written notice shall be given at least ten (10) days prior to the effective date of non-renewal.

   b. Each insurance policy shall contain language or be endorsed to reflect that no cancellation or modification of the coverage provided for any cause save and except non-payment of premiums shall be effective until written notice has been given to City at least thirty (30) days prior to the effective date of such modification or cancellation. In the event of non-renewal, written notice shall be given at least thirty (30) days prior to the effective date of non-renewal.

4. Other Endorsements. Other endorsements may be required for policies other than the commercial general liability policy if specified in the description of required insurance set forth in Sections A through D of this Exhibit C, above.

E. ADDITIONAL INSURANCE RELATED PROVISIONS

Contractor and City agree as follows:

1. Contractor agrees to ensure that subcontractors, and any other party involved with the Services who is brought onto or involved in the performance of the Services by Contractor, provide the same minimum insurance coverage required of Contractor, except as with respect to limits. Contractor agrees to monitor and review all such coverage and assumes all responsibility for ensuring that such coverage is provided in conformity with the requirements of this Agreement. Contractor agrees that upon request by City, all agreements with, and insurance compliance documents provided by, such subcontractors and others engaged in the project will be submitted to City for review.

2. Contractor agrees to be responsible for ensuring that no contract used by any party involved in any way with the project reserves the right to charge City or Contractor for the cost of additional insurance coverage required by this Agreement. Any such provisions are to be deleted with reference to City. It is not the intent of City to reimburse any third party for the cost of

complying with these requirements. There shall be no recourse against City for payment of premiums or other amounts with respect thereto.

3. The City reserves the right to withhold payments from the Contractor in the event of material noncompliance with the insurance requirements set forth in this Agreement.

F. EVIDENCE OF COVERAGE

Prior to commencement of any Services under this Agreement, Contractor, and each and every subcontractor (of every tier) shall, at its sole cost and expense, provide and maintain not less than the minimum insurance coverage with the endorsements and deductibles indicated in this Agreement. Such insurance coverage shall be maintained with insurers, and under forms of policies, satisfactory to City and as described in this Agreement. Contractor shall file with the City all certificates and endorsements for the required insurance policies for City's approval as to adequacy of the insurance protection.

G. EVIDENCE OF COMPLIANCE

Contractor or its insurance broker shall provide the required proof of insurance compliance, consisting of Insurance Services Office (ISO) endorsement forms or their equivalent and the ACORD form 25-S certificate of insurance (or its equivalent), evidencing all required coverage shall be delivered to City, or its representative as set forth below, at or prior to execution of this Agreement. Upon City's request, Contractor shall submit to City copies of the actual insurance policies or renewals or replacements. Unless otherwise required by the terms of this Agreement, all certificates, endorsements, coverage verifications and other items required to be delivered to City pursuant to this Agreement shall be emailed to:

ctsantaclara@ebix.com

Or mailed to:

EBIX Inc.
City of Santa Clara – Department of Public Works
P.O. Box 100085 – S2
Duluth, GA 30096

Telephone number: 951-766-2280
Fax number: 770-325-0409

H. QUALIFYING INSURERS

All of the insurance companies providing insurance for Contractor shall have, and provide written proof of, an A. M. Best rating of at least A minus 6 (A- VI) or shall

be an insurance company of equal financial stability that is approved by the City or its insurance compliance representatives.

EXHIBIT D
LABOR COMPLIANCE ADDENDUM

This Agreement is subject to the requirements of California Labor Code section 1720 et seq. requiring the payment of prevailing wages, the training of apprentices, and compliance with other applicable requirements.

I. Prevailing Wage Requirements

1. Contractor shall be obligated to pay not less than the General Prevailing Wage Rate, which can be found at www.dir.ca.gov and are on file with the City Clerk's office, which shall be available to any interested party upon request. Contractor is also required to have a copy of the applicable wage determination posted and/or available at each job site.

2. Specifically, contractors are reminded of the need for compliance with Labor Code Section 1774-1775 (the payment of prevailing wages and documentation of such), Section 1776 (the keeping and submission of accurate certified payrolls) and 1777.5 in the employment of apprentices on public works projects. Further, overtime must be paid for work in excess of 8 hours per day or 40 hours per week pursuant to Labor Code Section 1811-1813.

3. Special prevailing wage rates generally apply to work performed on weekends, holidays and for certain shift work. Depending on the location of the project and the amount of travel incurred by workers on the project, certain travel and subsistence payments may also be required. Contractors and subcontractors are on notice that information about such special rates, holidays, premium pay, shift work and travel and subsistence requirements can be found at www.dir.ca.gov .

4. Only bona fide apprentices actively enrolled in a California Division of Apprenticeship Standards approved program may be employed on the project as an apprentice and receive the applicable apprenticeship prevailing wage rates. Apprentices who are not properly supervised and employed in the appropriate ratio shall be paid the full journeyman wages for the classification of work performed.

5. As a condition to receiving progress payments, final payment and payment of retention on any and all projects on which the payment of prevailing wages is required, Contractor agrees to present to City, along with its request for payment, all applicable and necessary certified payrolls (for itself and all applicable subcontractors) for the time period covering such payment request. The term "certified payroll" shall include all required documentation to comply with the mandates set forth in Labor Code Section 1720 *et seq*, as well as any additional documentation requested by the City or its designee including, but not limited to: certified

payroll, fringe benefit statements and backup documentation such as monthly benefit statements, employee timecards, copies of wage statements and cancelled checks, proof of training contributions (CAC2 if applicable), and apprenticeship forms such as DAS-140 and DAS-142.

6. In addition to submitting the certified payrolls and related documentation to City, Contractor and all subcontractors shall be required to submit certified payroll and related documents electronically to the California Department of Industrial Relations. Failure to submit payrolls to the DIR when mandated by the project parameters shall also result in the withholding of progress, retention and/or final payment.

7. No contractor or subcontractor may be listed on a bid proposal for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

8. No contractor or subcontractor may be awarded a contract for public work on a public works project, unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5. Contractors MUST be a registered “public works contractor” with the DIR AT THE TIME OF BID. Where the prime contract is less than $15,000 for maintenance work or less than $25,000 for construction alternation, demolition or repair work, registration is not required.

9. All contractors/subcontractors and related construction services subject to prevailing wage, including but not limited to: trucking, surveying and inspection work must be registered with the Department of Industrial Relations as a “public works contractor”. Those you fail to register and maintain their status as a public works contractor shall not be permitted to perform work on the project.

10. Should any contractor or subcontractors not be a registered public works contractor and perform work on the project, Contractor agrees to fully indemnify the City for any fines assessed by the California Department of Industrial Relations against the City for such violation, including all staff costs and attorney’s fee relating to such fine.

11. This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

J. Audit Rights

All records or documents required to be kept pursuant to this Agreement to verify compliance with this Addendum shall be made available for audit at no cost to City, at any time during regular business hours, upon written request by the City Attorney, City Auditor, City Manager, or a designated representative of any of these officers. Copies of such records or documents shall be provided to City for audit at City Hall when it is

practical to do so. Otherwise, unless an alternative is mutually agreed upon, the records or documents shall be made available at Contractor's address indicated for receipt of notices in this Agreement.

K. Enforcement

1. City shall withhold any portion of a payment; including the entire payment amount, until certified payroll forms and related documentation are properly submitted, reviewed and found to be in full compliance. In the event that certified payroll forms do not comply with the requirements of Labor Code Section 1720 et seq., City may continue to hold sufficient funds to cover estimated wages and penalties under the Agreement.

2. Based on State funding sources, this project may be subject to special labor compliance requirements of Proposition 84.

3. The City is not obligated to make any payment due to Contractor until Contractor has performed all of its obligations under these provisions. This provision means that City can withhold all or part of a payment to Contractor until all required documentation is submitted. Any payment by the City despite Contractor's failure to fully perform its obligations under these provisions shall not be deemed to be a waiver of any other term or condition contained in this Agreement or a waiver of the right to withhold payment for any subsequent breach of this Addendum.

City or the California Department of Industrial Relations may impose penalties upon contractors and subcontractors for failure to comply with prevailing wage requirements. These penalties are up to $200 per day per worker for each wage violation identified; $100 per day per worker for failure to provide the required paperwork and documentation requested within a 10-day window; and $25 per day per worker for any overtime violation.

EXHIBIT E
NOTICE OF EXERCISE OF OPTION TO EXTEND AGREEMENT

AGREEMENT TITLE:	
CONTRACTOR:	
DATE:	

Pursuant to Section __ of the Agreement referenced above, the City of Santa Clara hereby exercises its option to extend the term under the following provisions:

OPTION NO.	# of #

NEW OPTION TERM

Begin Date	
End Date	

☐ **CHANGES IN RATE OF COMPENSATION**

Percentage change in CPI upon which adjustment is based:	

Pursuant to Section __ of Exhibit B (Schedule of Fees) of the Agreement the rates of compensation are hereby adjusted as follows:
(use attachment if necessary)

MAXIMUM COMPENSATION for New Option Term:	

For the option term exercised by this Notice, City shall pay Contractor an amount not to exceed the amount set forth above for Contractor's services and reimbursable expenses, if any. The undersigned signing on behalf of the City of Santa Clara hereby certifies that an unexpended appropriation is available for the term exercised by this Notice, and that funds are available as of the date of this signature.

Dated:

Approved as to Form:

GLEN R. GOOGINS
City Attorney

JŌVAN D. GROGAN
City Manager
City of Santa Clara
1500 Warburton Avenue
Santa Clara, CA 95050
Telephone: (408) 615-2210
Fax: (408) 241-6771