

TECHNICAL SPECIAL PROVISIONS

FOR

**THE INSTALLATION AND MODIFICATION
OF TRAFFIC SIGNALS**

FOR THE

**CITYWIDE INTELLIGENT TRANSPORTATION SYSTEM (ITS)
UPGRADE PROJECT (CIP 975594)**

IN SAN RAMON, CALIFORNIA

**TECHNICAL SPECIAL PROVISIONS FOR
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PART 1 GENERAL.

1.00 GENERAL.

Work for this project shall consist of the modification of existing traffic signal systems and the installation of new traffic signal interconnect systems at the following locations:

1. Bollinger Canyon Road, between Dougherty Road and Albion Road

The work shall include, but not be limited to, the protection of existing utilities and appurtenances; the installation of new pull boxes, conduits, cables and conductors; fiber optics equipment such as fiber optics cables, switches, termination panels, small form-factor (SFP) transceivers; excavating and backfilling; clearing and grubbing; abandoning, removing and salvaging or discarding of existing traffic signal interconnect, pull boxes, conduits, switches, and other traffic signal equipment shown on the plans; replacement of striping damaged during construction; minor concrete work; traffic control; and all other work necessary and any other items of work not mentioned above that are required by the Plans and these Technical Special Provisions.

1.01 SPECIFICATIONS.

Electrical work for this project shall be constructed in accordance with the provisions of the State of California, Department of Transportation Standard Specifications dated 2022 (including latest revisions), the State of California, Department of Transportation, 2022 Standard Plans (including latest revisions), the current edition of the National Electrical Code, the City of San Ramon Standard Details and these Technical Special Provisions.

All references in the State Standard Specifications to METS (Materials and Equipment Testing Services) shall be changed to refer to:

**CITY OF SAN RAMON
SERVICE CENTER
5000 CROW CANYON ROAD
SAN RAMON, CA 94582**

**Attn: Traffic Signal Maintenance Division
(925) 973-2800**

Minimum notice of two (2) business days is required to schedule any deliveries to this location.

Electrical systems shall be modified / installed in accordance with the following standards, listed in order of priority:

1. These Technical Special Provisions
2. Approved Improvement Plans

3. City of San Ramon Standard Details
4. The State of California Standard Plans and Standard Specifications

1.02 BUSINESS LICENSE AND PERMITS.

The Contractor is responsible for obtaining a business license from the City of San Ramon - Building and Safety Services. The Contractor shall provide his/her Federal Employer ID Number, State Employer ID Number, Contractor's License Number, (a copy of pocket license issued by the State Contractor's License Board), and a Certificate of Insurance for Worker's Compensation with the City of San Ramon listed as a certificate holder.

The Contractor is also responsible for obtaining all necessary permits including a "No Fee" Building Permit for the electrical service installation from the City of San Ramon - Building and Safety Services and a "No Fee" Encroachment Permit from the City of San Ramon - Engineering Services. The Contractor shall be responsible for complying with all permit requirements including inspection.

1.03 CONTROL OF WORK.

Contractor shall maintain vehicular, bicycle, and pedestrian access at all times, including development and coordination of detours when necessary.

1.04 WORKMANSHIP.

All facilities shall be installed in a professional and workmanlike manner. Any portion of the signal system that is not installed in a professional manner shall be removed and reinstalled correctly, to the satisfaction of the Engineer. All costs involved in complying with this section shall be considered included in the contract price and no additional compensation will be allowed therefor.

1.05 MATERIALS SUBMITTALS.

State Specifications Section 86-1.01C (1), "General," is replaced with the following:

The Contractor shall provide information to the City documenting all equipment and materials proposed to be used in the completion of this project. Materials Submittals shall be in the form of manufacturer's cut sheets showing the brand name, specifications, model number, dimensions, components and any other information needed to fully describe the item proposed to be used. If more than one type or size is shown on the cut sheet, the proposed item shall be highlighted or identified so that a determination can be made if the item meets the specifications.

The Contractor shall submit electronic Materials Submittals to the Engineer for review and approval. All Materials Submittals shall be provided a minimum of seven (7) calendar days prior to equipment and material orders. Materials ordered and/or installed on the job site without prior City approval will be subject to removal at Contractor's sole expense if rejected by the City. Equipment and materials to be submitted for approval include, but are not limited to the following items:

1. Conduits and Conduit Fittings
2. Pull Boxes
3. Fiber Optic Cable System
 - a. Fiber Optic Cable
 - b. Fiber Optic Vault
 - c. Fiber Optic Splice Enclosures

- d. Fiber Termination Panels
 - e. Fiber Optic Connectors and Couplers
 - f. Ethernet Switches and Small-Form Factor Transceivers
4. Concrete Mix Design

1.06 CERTIFICATE OF COMPLIANCE.

The Contractor shall submit to the Engineer, Certificates of compliance from the Manufacturer in accordance with the provisions of State Specifications Section 6-2.03C, "Certificates of Compliance" for all items listed below, which may apply to this project, at the time they are delivered to the job site.

- 1. Fiber Optic Cable
- 2. Concrete Mix

1.07 APPROVED EQUAL.

Requests for a determination that an item meets the "approved equal" provision of these specifications shall be submitted, in writing, to the Engineer prior to ordering. The submittal shall include all technical specifications, catalog "cut sheets," a list of locations where the item has been used, and a sample of the item attached as an appendix.

1.08 PURCHASE ORDERS.

The Contractor shall, upon request, provide to the City copies of all purchase orders for equipment and materials ordered for this project. The Contractor may also be required to provide copies of any correspondence with suppliers concerning availability, delivery dates, anticipated delays and shipment notices within five days of each letter. References to cost may be omitted.

1.09 NOT USED.

1.10 OPERATION MANUALS.

The Contractor shall furnish two (2) maintenance and operation manuals for all new equipment including the fiber switches, splice closures, hub switches, and any other auxiliary equipment furnished. The operation manual and the maintenance manual may be combined into one manual. The individual or combined manuals shall be submitted at the time the equipment is delivered to the City for testing or, if ordered by the City, prior to ordering equipment. The manuals shall include, but are not limited to, the following items:

- a. Specifications
- b. Design characteristics
- c. General operation theory
- d. Function of all controls
- e. Trouble shooting procedure (diagnostic routine)
- f. Block circuit diagram
- g. Geographical layout of components
- h. Schematic diagrams
- i. List of replaceable component parts with stock numbers

1.11 WARRANTY AND GUARANTEE.

Except as specified below, the Contractor/Manufacturer shall guarantee the traffic signal interconnect and fiber system equipment, installed under these specifications, to the City

for a period of not less than twelve (12) months following the date of acceptance thereof. If any part (or parts) is found to be defective in material, workmanship, or for any other reason within the warranty period and it is determined by the City and an authorized manufacturer's representative that said part (or parts) cannot be repaired satisfactorily, the Contractor/Manufacturer shall provide a replacement part (or parts) of equal kind and/or type acceptable to the City. The twelve-month guarantee on the repaired or replaced parts shall again commence with the date of the reassembly of the system.

1.12 SCHEDULING OF WORK.

The 17th paragraph of State Specifications Section 87-1.03A, "General," regarding work above ground, is deleted.

Provide City with the opportunity to review and approve list prior to ordering as indicated in Section 1.05 of these Technical Special Provisions.

PART 2 MOBILIZATION.

2.00 GENERAL.

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to and from the project site; for the establishment of all offices, buildings, on-site sanitary facilities, developing construction water supply and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to commencement of work on the various work tasks on the project site. Furnishing and maintaining project field offices, facilities, facility control and cleanup, developing a construction staging area and plan, storage yard fencing, and storage lockers or other items of similar character, shall all be classified as mobilization.

Obtaining permits and licenses and paying all related fees, notification to the public, preparation and update of construction schedules, coordination and cooperation, attendance of project meetings, preparation of daily reports, contractor/subcontractor insurance and bonds, and maintaining record documents shall all be classified as mobilization.

A schedule of values shall be submitted, itemizing salient items, costs, and activities involved in each item. Items shall also include maintenance of such facilities and removal and cleanup costs.

Measurement will be made as a percentage of the costs incurred according to the schedule of values submitted, except that not more than 75% of the bid price shall be paid prior to the final estimate for payment being due, and the remaining 25% shall be paid upon completion of cleanup and removal with final payment.

2.01 CONSTRUCTION STAGING AREA.

No on-site storage is available. Attention is directed to Article 7.3 (B), "Offsite Staging Area and Field Office," of these General Conditions. Contractor shall arrange for his/her own storage and staging area at Contractor's expense.

Contractor shall prepare and submit a plan describing the construction staging area to the Engineer for approval. Contractor shall not permit any waste or damage to be done to the staging area and shall maintain the area in good condition, free of litter and debris. Upon completion of the work, the area shall be restored to its pre-construction or better condition,

including the repair of any damaged pavement, curbs, markings, or other public infrastructure components.

2.02 SANITARY RESTROOM FACILITIES.

Sanitary restroom facilities shall be furnished and maintained by the Contractor, and shall be mounted on a moveable trailer and moved to various locations throughout the project as necessary. The Contractor's proposed locations for restroom facilities shall be reviewed with the Engineer prior to delivery and placement of restroom facilities. Restroom facilities shall be removed from the jobsite at the end of the work day prior to every weekend and/or holiday.

2.03 ENVIRONMENTAL REQUIREMENTS.

Contractor shall comply with all air pollution, water quality, and other environmental control rules, regulations, ordinances and statutes that apply to the project and execution of the work performed pursuant to the Contract, including the requirements of the Contra Costa Clean Water Program (CCCWP) with respect to the Pollution Prevention Program. The major elements of this program are shown on the last Plan Sheet, "Construction Best Management Practices." "Attention is directed to Article 7.19 "Environmental Control," of these General Conditions.

Contractor shall implement construction site Best Management Practices (BMPs) for control of non-storm water and point discharges, erosion and sediment control.

A Construction Best Management Practices action plan, Water Pollution Control Program (WPCP) and Storm Drain Inlet protection plan shall be required for the project.

Contractor shall be required to implement temporary construction site best management practices in accordance with the Construction Site Best Management Practices (BMPs) Manual issued by the State of California, Department of Transportation. Temporary BMPs required for this Contract shall include, but are not limited to:

1. Stockpile Management: Implement BMPs, as appropriate, for soil stabilization and sediment control as applicable to stockpiles of various materials.
2. Mobile Operations: Implement BMPs, as appropriate, for control of equipment fueling and maintenance, concrete mixing and wash out, hauling and storage of materials. BMPs shall control all specific situations that mobile operations can create.
3. Wind Erosion Controls: Implement BMPs, as appropriate, for all disturbed soils on the project site that are subject to wind erosion when wind and dry conditions exist.
4. Tracking Controls: Implement BMPs, as appropriate, for control of sediments and debris from the construction site.
5. Non-Storm Water and Waste Management and Materials Pollution Controls: Implement BMPs, as appropriate, to control the discharge of materials other than storm water to the storm water collection system.

The Contractor shall inspect BMPs regularly. Improperly installed, damaged or ineffective BMPs shall be corrected immediately.

2.04 MEASUREMENT AND PAYMENT.

The lump sum price paid for "**Mobilization**" shall be considered as full compensation for mobilization as specified herein, including but not limited to notifications, project records and documents, obtaining all required permits, licenses, and paying all fees, developing construction schedules, moving on the site any equipment required for the operations,

coordination and cooperation, project meetings, developing construction water supply, developing a construction staging area, providing on-site sanitary facilities, offices, subcontractor insurance and bonds, Contractor insurance and bonds, environmental requirements, demobilization, and all other mobilization work, and no additional payment will be allowed therefor.

PART 3 STAGE CONSTRUCTION.

3.00 GENERAL.

Attention is directed to Article 5.2, "Schedule Requirements," of these General Conditions.

Contractor shall prosecute all work in a staged and sequential order, and as specified in these Contract Documents. Subsequent items of work in the stage construction location shall not commence until all the preceding items of work in that stage of work have been completed to the satisfaction of the Engineer.

Multiple items of work shall not be performed concurrently unless shown on the Contractor's Construction Schedule and approved by the Engineer.

Minor deviations from the requirements of this section may be allowed by the Engineer if, in the opinion of the Engineer, prosecution of the contract will be better served and the work expedited. Any request for such deviations by the Contractor shall not be adopted without the Engineer's written approval.

Contractor shall be responsible to verify with City staff if any other projects are expected to be active within, or near, the projects limits. Contractor shall coordinate and cooperate with concurrent projects to minimize conflict and disruption to the public.

Nothing in this section, or on the contract plans, shall be construed as to relieve the Contractor of his/her responsibility to comply with the requirements of Section 7-1.04, "Public Safety," of the State Standard Specifications.

Failure to comply with these requirements and provisions shall be sufficient cause for the Engineer to suspend the work in accordance with provisions of Article 13, "Suspension and Termination," of these General Conditions.

3.01 MEASUREMENT AND PAYMENT.

Payment for "**Stage Construction**" shall be considered as included in the contract prices bid for the various items of work shown on the Bid Schedule, which prices will be considered as full compensation for all labor, supervision, materials, equipment, tools and incidentals, and no additional compensation will be allowed therefor.

PART 4 MAINTAINING TRAFFIC.

4.00 GENERAL.

Attention is directed to Sections 7-1.03, "Public Convenience," 7-1.04, "Public Safety," and 12, "Temporary Traffic Control," of the State Standard Specifications. Nothing in these Contract Documents shall be construed as relieving the Contractor from the responsibilities for public safety.

Lane closures shall conform to the details shown in the most current edition of the "California Manual on Uniform Traffic Control Devices" (CAMUTCD), the provisions specified herein and Part 5 "Traffic Control System" of these Technical Special Provisions.

"Traffic Lane" shall be defined as that portion of the roadway for movement of a single line of vehicles.

"Lane Closure" shall be defined as the temporary closure of a portion or the full width of an existing traffic lane. The temporary shifting of an existing traffic lane to shoulders, parking areas, medians or other areas of the roadway shall be considered a lane closure.

Contractor shall schedule, stage and conduct all construction operations with regard to public convenience and in a manner to provide for the safe and expeditious movement of traffic.

Prior to commencing any activity within any public right-of-way, the Contractor shall implement traffic control measures in accordance with City-approved traffic control plans.

Portable Changeable Message Signs (CMS's) shall be installed, 1 in each direction, a minimum of 72 hours prior to any work on arterials and collectors, including the following:

- Bollinger Canyon Road

Portable CMS's shall be furnished, installed, maintained and relocated (as-needed) by the contractor, as long as required, to accommodate the contractor's schedule and work duration at each location. Portable CMS installation shall be thoroughly coordinated with the Engineer.

Contractor shall furnish and install temporary "No Parking" signs at least seventy-two (72) hours prior to the effective time of such restriction as needed to facilitate the work in public parking areas, in accordance with these Contract Documents.

Within work affecting business complexes and commercial areas, at least one (1) driveway shall be accessible at all times, and thoroughly coordinated with the Engineer.

Temporary driveways in excavation areas shall be provided with temporary compacted backfill materials with temporary asphalt surfacing as approved by the Engineer, or with permanent hot mix asphalt, to meet field conditions and enable sufficient support for vehicles using such temporary access.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way, including any section closed to public traffic.

Pedestrian access and emergency vehicles access shall be provided at all times through the construction areas. Crosswalks will require special handling. Contractor shall submit location specific pedestrian handling plans which address the safe passage of pedestrians through the construction site. Access shall meet ADA requirements with a hard, non-skid surface.

Qualified flaggers shall be utilized:

1. When it is necessary to change traffic controls frequently.
2. For stopping of through traffic for equipment movement.
3. For alternate directional use of a signal traffic lane.
4. To expedite the safe movement of traffic through or around work zones.
5. To expedite the safe movement of traffic through intersections.

Flaggers shall be properly positioned, attired and equipped to perform these functions.

Should permanent pavement markings become obliterated due to construction, the permanent markings should be restored as soon as practicable. If the Contractor is unable to restore permanent markings by the end of the shift, then temporary markings shall be provided prior to the Contractor leaving the job site. Temporary markings shall conform to the requirements of Part 6 of the most current edition of the "California Manual on Uniform Traffic Control Devices" (CAMUTCD).

Contractor shall temporarily cover any existing signs and signals which conflict with temporary signs, temporary pavement delineation, or traffic detours, as approved by the Engineer.

4.01 LANE CLOSURES.

A minimum of one (1) 11-foot traffic lane open for use by public traffic will be required at all times. In specific locations, if noted on the plans or approved by the Engineer, the width of through lane(s) may be reduced to ten (10) feet. The Contractor shall provide at least one flagman at each end at all times when the traveled way has been reduced to one traffic lane or when any one-way traffic control is implemented. A single flagman may be utilized when the length of one-way traffic control is short and, in the opinion of the Engineer, the criteria for a single flagman as defined in the CAMUTCD is met.

No night, weekend, or holiday work is allowed unless specified in these Contract Documents or approved by the Engineer. The full width of the traveled way shall be open for use by public traffic Saturdays, Sundays, holidays, at the end of each working period, and when construction activities are not actively in progress, unless specified in these Contract Documents.

Temporary full closure of streets is not permitted without advance written approval and submittal of detour plans for approval by the Engineer. Portable CMS shall be required for all full closures. Contractor shall show any proposed street closures on the traffic control plan required by Part 5, "Traffic Control System," of these Technical Special Provisions and shall provide all necessary detour signing, temporary pavement delineation, traffic control devices, and flagmen necessitated by the temporary road closure. The City reserves the right to reject any temporary full street closure proposed by the Contractor. No additional compensation will be allowed to the Contractor if a proposed full street closure is rejected by the City.

Lanes closed for the street work shall remain closed until applied pavement materials (HMA, striping and markings, etc.) have sufficiently cured to accommodate traffic without tracking, raveling, or the occurrence of other damage. The Contractor shall determine when pavement materials have sufficiently cured to accommodate traffic.

The Contractor shall furnish, install, maintain, and remove all markers, portable signs, cones, delineators, barricades, flashing arrow signs, crash cushions, or any other traffic control devices necessary to ensure the safe passage of traffic through the work zone.

4.02 HOURS FOR LANE CLOSURES.

All arterial and collector streets (**Bollinger Canyon Road**) shall be subject to the following:

- Lane closures shall be restricted to the hours of 9:00 A.M. to 3:30 P.M., Monday through Friday.

Working hours are specified in Article 5.2 (H), "Schedule Requirements," of these General Conditions.

Minor operations which do not require a lane closure shall be completed during the normal working hours specified in Article 5.2 (H), "Schedule Requirements," of these General Conditions.

The full width of traveled way shall be open for use by public traffic on Saturdays, Sundays, holidays, at the end of each working period, and when construction activities are not actively in progress.

Contractor's operations shall be so scheduled that traffic control can be discontinued and all lanes open to traffic no later than the stated time.

At the end of each work period, components of the traffic control systems which are not needed shall be removed from the traveled way and shoulder.

Minor deviations from lane closure requirements may be permitted upon written request seven (7) days in advance of lane closure. Such deviations shall not be adopted until the Engineer has given written approval. All other deviations will be made by contract change order.

Failure to comply with the requirements and provisions in this section shall be sufficient cause for the Engineer to suspend work in accordance with the provisions of Article 13, "Suspension and Termination," of these General Conditions.

4.03 MEASUREMENT AND PAYMENT.

Full compensation for furnishing all labor, supervision, materials, tools, equipment, site cleanup, traffic control, flagmen, flashing arrow signs, portable CMS, and incidentals necessary to maintain traffic and install and remove safety features and for complying with the requirements of this section shall be considered as included in the lump sum price paid for "**Traffic Control System**" and no additional compensation will be allowed therefor, except as noted below.

Traffic control required by work which is classified as extra work, as provided in Article 6.1, "Contract Modification" of these General Conditions, will be paid for as part of said extra work.

All other traffic control signs, including flashing arrow signs and all portable CMS, shall be included in the price paid for "Traffic Control System," and no additional compensation will be allowed therefor.

PART 5 TRAFFIC CONTROL SYSTEM.

5.00 GENERAL.

This work shall consist of implementing a Traffic Control System for closing traffic lanes in accordance with the details shown on any approved traffic control plan submittals for traffic control, the provisions of Section 12, "Temporary Traffic Control" of the State Standard Specifications, and the provisions of Part 4, "Maintaining Traffic," of these Technical Special Provisions.

The provisions in this section shall not relieve the Contractor from his/her responsibility to provide such additional devices or take such measures as may be necessary to comply

with the provisions in Section 7-1.04, "Public Safety," of the State Standard Specifications. Nothing in these Contract Documents shall be construed as to reduce the minimum standards specified in the current CAMUTCD published by Caltrans.

Each vehicle used to place, maintain, and remove components of the traffic control system on the roadway shall be equipped with a Type II flashing arrow sign that shall be used for placing, maintaining, or removing said components. The signs shall be controllable by the operator of the vehicle while the vehicle is in motion. The minimum size shall be 36 inches by 72 inches.

If any component in the traffic control system is displaced or ceases to operate or function as specified from any cause during the progress of the work, the Contractor shall immediately repair said component to its original condition or replace said component and shall restore the component to its original location.

Lane closures shall not be permitted unless work in the closed lane area is in progress. Lane closures shall not exceed 1/4 mile unless otherwise approved by the Engineer.

Failure to comply with these requirements and provisions shall be sufficient cause for the Engineer to suspend work in accordance with the provisions of Article 13, "Suspension and Termination," of these General Conditions.

5.01 TRAFFIC CONTROL PLAN.

Contractor shall submit all Traffic Control Plans (TCPs) for review and approval 5 working days in advance of the preconstruction conference. The Contractor shall allow 5 working days for the City's review for each resubmittal.

The City may permit certain minor operations, such as those involving a small work area including construction area signs and utility adjustments, to proceed with lane closure and traffic control requirements specified under the latest Caltrans Standard Plans T11, "Traffic Control System for Lane Closure on Multilane Conventional Highways," and T13, "Traffic Control System for Lane Closure on Two Lane Conventional Highways." The Contractor shall submit TCPs for minor operations which affect intersections and for pedestrian accommodations.

All TCPs shall be prepared and stamped by a registered civil or traffic engineer, and shall provide sufficient information and details to show typical lane closures, channelizing, and proposed detours or street closures, locations and usage of flagmen, typical construction zone signing, provisions for pedestrians, etc. TCP shall show in detail the proposed staging and sequencing of work together with the proposed traffic control system for each work task. The proposed traffic control system shall, in all respects, satisfy the requirements of these Contract Documents. The proposed TCP will be reviewed by the San Ramon Traffic Engineering Division and subsequently returned to the Engineer. The Engineer or designated San Ramon Inspector shall return it to the Contractor for any necessary revisions or corrections. Contractor shall revise and resubmit the TCP to the Engineer and this process shall be repeated until the proposed TCP is approved by the San Ramon Traffic Engineering Division. The Contractor will not be permitted to perform any lane closures or implement any part of the TCP until it has been approved by the San Ramon Traffic Engineering Division. It is the Contractor's responsibility to submit the TCP in a timely manner to obtain the required approvals prior to starting work.

If the Contractor is unable or fails to submit and/or receive an approval of his/her Traffic Control Plan(s) within ten (10) working days after the Pre-Construction Conference, the City may take the necessary steps to have the Traffic Control Plan(s) prepared by a registered civil or traffic engineer. All costs incurred by the City to prepare the

aforementioned Plans, including twenty (20) percent administrative markup, will be charged to the Contractor. Additionally, Contractor's failure to submit and/or obtain approval of his/her Traffic Control Plan(s) and/or is unable or fails to implement the Traffic Control Plan(s) provided by the City shall be sufficient cause for the Engineer to suspend work in accordance with the provisions of Article 13, "Suspensions and Termination," of these General Conditions. The days on which the suspension order is in effect shall be considered as working days. The increase of Contractor's operation cost due to implementation of the Traffic Control Plan(s) to be provided by the City shall not constitute a basis for claim by the Contractor for extra payment or damages, and no additional compensation therefor will be allowed.

5.02 TRAFFIC CONTROL SUPERVISOR.

The Traffic Control System shall be placed, maintained and removed under the direct supervision of a person who is certified by either the Institute of Transportation Engineers (ITE), the American Traffic Safety Services Association (ATSSA), the International Municipal Signal Association (IMSA), or the State of California. The Contractor shall designate in writing the person who shall have the responsibility for supervising the activities associated with the Traffic Control System. This designation, along with proof of certification, shall be provided to the Engineer for his/her approval two (2) working days in advance of any planned activity that requires traffic control. The person designated shall have the authority to stop the work if necessary. Failure of the designated person to be present at the jobsite when any part of the Traffic Control System is in place shall be considered a failure on the part of Contractor to perform a provision of the contract. The Engineer shall in accordance with Article 13, "Suspensions and Termination," of these General Conditions, suspend all work until such time as satisfactory arrangements have been made to have a certified person on the jobsite at all times when the Traffic Control System is in place.

5.03 USE OF FLAGGERS AT INTERSECTIONS

Use of flaggers shall be as specified in the Project Plans, the most current edition of the CAMUTCD, on the Caltrans Standard Plans Caltrans Standard Plans T11, "Traffic Control System for Lane Closure on Multilane Conventional Highways," and T13, "Traffic Control System for Lane Closure on Two Lane Conventional Highways." Contractor shall provide flaggers at all intersections affected in any way by the construction. Work within all intersections shall be staged in such a fashion as to maintain traffic flow at all times.

5.04 NOT USED.

5.05 REMOVAL OF SIGNS AND BARRICADES.

At the completion of construction operations, the Contractor shall remove barricades, signs, delineators, and other temporary measures from and immediately adjacent to the traveled way. The street shall be restored to its intended use, including the movement of public traffic, access to fronting properties and parking of vehicles. When permitted, such devices may be stored in the public right-of-way for a period not to exceed twenty-four (24) hours. Such storage is permitted provided the storage devices are stored in a neat and orderly manner and the storage does not interfere with the safe and orderly movement of traffic including vehicles, pedestrians and bicycles. Arrow boards shall not be stored in the public right-of-way.

5.06 MEASUREMENT AND PAYMENT.

The contract lump sum price paid for "**Traffic Control System**" shall include full compensation for furnishing all labor, supervision, materials, tools, equipment and incidentals and for doing all the work involved including, but not limited to, controlling traffic; furnishing and implementing the traffic control plans; resident and business notification; placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of all the components of the traffic control system including all lane closures, message signs, and detours necessary for any activities during the life of the project, all special and temporary signing necessary, and all other work as shown on the City approved TCPs, as specified in the State Standard Specifications, San Ramon Standards and these Contract Documents, and as directed by the Engineer and no additional compensation will be allowed therefor.

The full cost of furnishing all flagmen and guards under the provisions of these Contract Documents and Sections 7-1.03, "Public Convenience," and 7-1.04, "Public Safety," and 12-1, "General," of the State Standard Specifications will be borne by the Contractor and shall be considered included in the price paid for "Traffic Control System" and no additional compensation will be allowed therefor.

Progress payments for "Traffic Control System" shall be calculated as the percent completed of overlay, and inlay work, based on the contract dollar value of work completed compared to the total current total dollar value of overlay, and inlay work in the contract.

Traffic control system required by work which is classified as extra work, as provided in Article 6.1, "Contract Modification" of these General Conditions, will be paid for as part of said extra work.

PART 6 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES.

6.00 GENERAL.

Traffic control shall conform to the latest edition of the "California Manual on Uniform Traffic Control Devices" (CAMUTCD) published by Caltrans, and the Caltrans Standard Plans.

No deviation in traffic control from the references mentioned above will be allowed unless written permission is granted by the Engineer.

It is the responsibility of the Contractor performing work on or adjacent to a public thoroughfare to install and maintain such devices which are necessary to provide passage for the traveling public, including pedestrians and bicyclists, through the work, as well as for the safeguard of workers.

6.01 PUBLIC SAFETY.

Contractor shall provide for the safety of the traffic and the public in accordance with the provisions in Section 7-1.04, "Public Safety," of the State Standard Specifications and these Contract Documents.

6.02 TRAFFIC CONES.

If an emergency condition or unexpected delay occurs, during the hours of darkness, traffic cones shall be affixed with reflective cone sleeves. The reflective sheeting of sleeves on

the traffic cones shall be visible at 1,000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Reflective cone sleeves shall conform to the following:

1. Removable flexible reflective cone sleeves shall be fabricated from reflective sheeting, have a minimum height of thirteen (13) inches and shall be placed a maximum of three (3) inches from the top of the cone. The sleeves shall not be in place during daylight hours.
2. Permanently affixed semitransparent reflective cone sleeves shall be fabricated from semitransparent reflective sheeting, have a minimum height of thirteen (13) inches, and shall be placed a maximum of three (3) inches from the top of the cone. Traffic cones with semitransparent reflective cone sleeves may be used during daylight hours.
3. Permanently affixed double band reflective cone sleeves shall have two (2) white reflective bands. The top band shall be six (6) inches in height, placed a maximum of four (4) inches from the top of the cone. The lower band shall be four (4) inches in height, placed two (2) inches below the bottom of the top band. Traffic cones with double band reflective cone sleeves may be used during daylight hours.

The type of reflective cone sleeve used shall be at the option of the Contractor. Only one type of reflective cone sleeve shall be used on this project.

6.03 BARRICADES.

Type III barricades shall conform to the requirements specified in the Standard Specification for Type III barricades except as modified in these Contract Documents. Type III barricades shall be constructed of lightweight materials and shall have no rigid stay bracing for "A" frame designs.

Entire area of orange and white shall be retro-reflectorized with a material that has a smooth, sealed out surface that will display the same approximate size, shape and color day and night. The predominant color for other barricade components shall be white, except that unpainted galvanized metal or aluminum components may be used.

Type II reflective sheeting for stripes on barricade rail faces shall conform to the requirements of one of the materials specified on the latest listing of prequalified and tested signing and delineation materials and products maintained by the Department of Transportation, State of California.

Barricades shall be kept in good repair, and shall be cleaned or repainted as necessary to preserve their appearance.

Owner identification shall not be imprinted on the reflectorized face of any rail. It may be imprinted elsewhere, as on supports and on non-reflectorized rail faces.

Barricades used shall have a minimum of 270 square inches of retro-reflective area facing traffic.

If barricades are susceptible to overturning in the wind, sandbags may be placed on the lower parts of the frame or stays to provide the required ballast, but shall not be placed on top of any striped rail.

6.04 PORTABLE SIGNS.

Portable signs shall only be permitted for temporary lane closures. The Contractor shall temporarily cover the existing signs which conflict with temporary signs as required by the approved TCPs or as directed by the Engineer.

6.05 FLASHING ARROW SIGNS.

Flashing arrow signs shall conform to the requirements set forth in Section 12-3.30, "Flashing Arrow Signs," of the State Standard Specifications.

6.06 MEASUREMENT AND PAYMENT.

Full compensation for complying with the requirements of this section shall be considered as included in the lump sum price paid for "**Traffic Control System**" and no additional compensation will be allowed therefor.

PART 7 EXISTING HIGHWAY FACILITIES.

7.00 GENERAL.

The work performed in connection with various existing highway facilities shall conform to the provisions in Article 7.12, "Existing Utilities," of the General Conditions, Section 15, "Existing Facilities," of the State Standard Specifications, and these Contract Documents.

Nothing in these Contract Documents shall relieve the Contractor of the responsibilities as specified in Section 7-1.04, "Public Safety," of the State Standard Specifications.

At least two (2) working days in advance of any sawcutting, excavation, or any other work in the vicinity of any signalized intersection, the Contractor shall notify Underground Service Alert (USA). The Contractor shall coordinate with the City to have all traffic loop detectors and home run layouts marked in the field prior to any base work.

7.01 EXISTING UNDERGROUND FACILITIES.

At least two (2) working days in advance of any sawcutting or any excavation work, the Contractor shall notify Underground Service Alert (USA).

The Contractor's attention is directed to the existing storm drain, water, gas, electric, traffic signal, sanitary sewer, cable TV, fiber optic, and telephone lines within the limits of work. Prior to excavating near these existing facilities, the Contractor shall pothole the existing facilities and inform the Engineer of the actual depth of each line. The Contractor shall use caution while potholing these facilities and shall adjust the limits and/or depths of the various paving work shown on the Plans, as directed by the Engineer.

7.02 EXISTING TRAFFIC SIGNAL DETECTOR LOOPS.

Contractor shall coordinate with the City to have all traffic loop detectors and home run layouts marked in the field prior to any work.

Contractor shall protect in place existing traffic signal detector loop wires that are to remain as directed by the Engineer. The layout and limits of the work, and proposed traffic loop protection, shall be approved in advance by the Engineer.

If any part of any loop conductor (to remain in place), including the portion leading to the adjacent pull box, is damaged by the Contractor's operations, the entire detector loops shall be replaced at the Contractor's expense within 48 hours.

7.03 MEASUREMENT AND PAYMENT.

Payment for **"Existing Highway Facilities"** shall be considered as included in the contract prices bid for the various items of work shown on the Bid Schedule, which prices will be considered as full compensation for all labor, supervision, materials, equipment, tools and incidentals, and no additional compensation will be allowed therefor.

Full compensation for potholing, if needed, shall be considered as included in the prices paid for various contract items of work and no additional compensation will be allowed therefor.

PART 8 MATERIALS AND INSTALLATION.

8.01 NOT USED.

8.02 NOT USED.

8.03 CONDUIT.

8.03A GENERAL.

The fourth sentence in the ninth paragraph in State Specifications Section 87-1.03B(1), "General," is amended to read:

"If a standard coupling cannot be used for metal-type conduit, use a threaded union coupling, UL listed concrete tight split coupling or UL listed concrete tight set screw coupling."

Conduit installed underground shall be High Density Polyethylene (HDPE) Schedule 40 or approved equal.

After conductors have been installed, the ends of conduits terminating in pull boxes, controller cabinets and other above-grade enclosures shall be sealed with a sealing compound approved by the City.

The Contractor shall notify:

**"UNDERGROUND SERVICE ALERT" (USA)
1-800-227-2600 or 811**

At least two (2) working days prior to any excavation.

The Contractor shall be responsible for installing all new conduits shown on the drawings. Conduit runs shown on the plans to be located behind the curb or sidewalk may be installed in the street next to the lip of the gutter if approved by the City, or vice versa, provided there are no utility conflicts or risk of utility impacts.

Conduit installation may be by trenching and/or by jacking or drilling methods. The preferred method for the installation of conduits for street crossings is jacking or drilling.

After installation of conduit by trenching and/or jacking or drilling, Contractor shall restore the roadway surface to the nearest lane line (i.e., minimum of one lane width) by micro-surfacing, unless otherwise approved by the City Engineer. The Contractor must submit an estimate with detailed supporting documentation how the requested Allowance Draw value was determined to obtain an Allowance Draw Authorization. The Engineer will evaluate this request and advise the Contractor if the value and documentation are acceptable. The Engineer may require additional documentation or remove unwarranted items from the request; or, the Engineer may issue a Field Instruction to the Contractor to start work as soon as possible. The Contractor will then be required to submit daily work reports that are to be signed by the Engineer or their designate/Construction Manager to confirm equipment used in the course of this work, work hours of all tradesmen, and for all materials used daily. Contractor shall submit invoices to show actual costs incurred in fulfillment of each allowance. At project closeout, unused amounts remaining in each allowance may not be requested by the Contractor for payment.

Conduit installed by trenching within the street section shall be performed as follows:

- A. Installation of conduit by trenching shall conform to City of San Ramon Standard Details M-3a, M-3b, and M-3c. On arterial streets, the pavement replacement shall extend at least four feet (4') past the trench on both sides.
- B. Conduit shall be placed under existing pavement in a trench approximately two inches (2") wider than the outside diameter of the conduit to be installed. Trench width shall not exceed six inches (6"). The top of the installed conduit shall be a minimum of twelve inches (12") below finish grade.
- C. The outline of all areas of pavement to be removed shall be cut to a minimum depth of two inches (2") with an abrasive type saw or with a rock cutting excavator specifically designed for this purpose. Cuts shall be neat and true and there shall not be any shattered pavement outside of the area where pavement is removed.
- D. Conduit shall be placed in the bottom of the trench and the trench shall be filled to not less than two inches (2") below the surface of the pavement with a mixture of Portland cement, fly ash, aggregates, water and admixtures, proportioned to provide a non-segregating, self-consolidating, free-flowing material which will result in a hardened, dense, non-settling fill producing unconfined compressive 28 day strengths from 50 psi to a maximum of 150 psi, as per City Detail M-3c. Contractor shall submit the mix design one week minimum prior to intended use for review and approval. Alternatively, the contractor may provide the supplier and mix number if the fill mix has been approved within the previous 12 months. The top two inches (2") of trenches in roads surfaced with asphalt concrete shall be backfilled with asphalt concrete produced from commercial quality paving asphalt and aggregate.
- E. Spreading and compacting of asphalt concrete shall be performed by any method, which will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.
- F. During trenching operations, the Contractor shall provide a minimum of one (1), twelve-foot (12') wide traffic lane in each direction. The Contractor shall also provide for the safe passage of bicyclists and pedestrians through the construction site.
- G. Trenching operations shall be performed in such a manner that all trenching and backfilling will be completed by 3:00 P.M. each day. The Contractor shall provide for the free and unobstructed flow of vehicle, bicycle, and pedestrian traffic in the project area by 3:00 P.M. each workday.
- H. All vehicle, pedestrian, and bicycle lanes shall be open to traffic at the completion of the trenching operation.
- I. In lieu of the provisions in Section 12-1.03, "Flagging Costs," of the State Standard Specifications the entire cost of all flagging and traffic control required during the trenching operations shall be borne by the Contractor.

Conduit cover requirements shall be:

- 18 inches minimum under sidewalks
- 24 inches minimum under planter strip
- 36 inches minimum under pavement
- 42 inches minimum under arterial street pavement surface

The trench shall be back filled per City of San Ramon Standard M-3a.

Runs shall have no more than 180° of bends, unless authorized by the Engineer, and shall enter the pull box vertically within +/-45° with 36-inch bend radius.

If existing conduit is used for project fiber at locations where existing pull boxes are removed and replaced, the contractor shall modify the conduit sweeps to conform with the requirements of this section.

Conduit installed in non-paved areas shall be covered with conductive plastic underground warning tape six inches (6") above the conduit.

Where conduit is to be installed under pavement near existing underground facilities requiring special precautions (e.g., natural gas, petroleum, electrical, etc.) may be present, the conduit shall be placed by the trenching method, unless noted otherwise on the plans.

At locations where conduit is to be installed by jacking or drilling as provided in State Specifications Section 87-1.03B(5) "Conduit Installation," and if there will not be any delay to any vehicle traffic, the conduit may be installed by the trenching method if approved by the City. Prior to performing jacking or drilling, the Contractor shall:

- Perform a pre- and post- test (by camera), of all city sewers and storm drains within the bore path.
- Contractor shall notify USA, and shall not perform any conduit installation until all utilities have been marked and or cleared by the USA department.
- Provide USA tickets to the City for all utility responses, with utility contact information.
- Verify marked utilities by potholing and visual inspection to confirm depth and locations of utilities.
- A bore path profile shall be developed and submitted to the City Engineer for review and approval. The bore path profile shall include the utility location information gathered from the steps listed above.

Schedule 40 HDPE conduit shall be used throughout the project.

All new installed or existing conduits disturbed as a part of a project shall include the supply and installation of Mule Tape, three-quarter inch (3/4") by 2,500 pounds and one (1) pack traceable three (3) cell flexible innerduct.

The ends of conduits in pull boxes shall have Bell Bushings and be a minimum of two inches (2") above the surface of the rock, and between eight (8) and ten (10) inches below the top of the pull box.

8.03B MEASUREMENT AND PAYMENT

The Contractor shall bid a unit price per linear foot for "**Furnish and Install New 3" Conduit.**" Measurements shall be from center of pull box to center of pull box. Compensation shall include all labor, materials, tools, equipment, and incidentals, and for doing all work involved in constructing the conduit, complete in place, including but not

limited to, supplying conduit, asphalt concrete pavement replacement, excavation and backfill of trenches or boring pits, pavement/sidewalk/site restoration, removal and disposal of spoil material, and thermoplastic striping and marking replacement, as shown on the Plans, as specified in these Special Provisions, and no additional compensation will be allowed therefor.

The Contractor shall bid a unit price, per linear foot for **"Furnish and Install Tracer Wire and Pull Rope."** Compensation shall include all labor, materials, tools, equipment and incidentals and for doing all work involved in supplying and installing tracer wire and mule tape within existing and new conduit, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

8.04 PULL BOXES AND VAULTS.

8.04A PULL BOXES.

The Contractor shall be responsible for locating and marking the positions of all pull boxes. The Engineer shall review the locations before any installation work is performed.

City of San Ramon pull box sizes shall be: No. 6E for fiber optic and signal interconnect cable, and N48 "double lid" for fiber optic splice enclosures unless otherwise shown on the Drawings. The No. 6E pull box and N48 vault covers and bodies shall be polymer concrete and shall have an ANSI/SCTE-77 Tier 22 rating. Pull box and vault covers shall be slip resistant.

All 6E pull boxes shall employ a twelve-inch (12") extension. A minimum of twenty-four inches (24") of space shall be maintained between the lid of the 6E pull box and material at the bottom of the box.

Interconnect pull boxes shall have lids embossed with "FIBER OPTIC."

All new pull boxes shall be "PCC Type," unless noted otherwise on the plans or approved by the City. The sumps of all new pull boxes installed shall not be grouted. Pull box sumps shall be constructed from one-inch (1") minimum diameter clean/washed river run rock to a minimum depth of twelve inches (12"). Recesses for suspension of ballast will not be required. Where the sump of an existing pull box is disturbed by the Contractor's operations, the sump shall be removed and a new rock sump installed.

All pull boxes shall be raised to grade and leveled prior to the installation of any conductors, or mule tapes. Do not install pull boxes in curb ramps or driveways (including flares).

8.04B. FIBER OPTIC N48 SPLICE VAULT.

A fiber optic N48 Splice vault shall be required in front of each controller cabinet or at location as shown on project plans. The vault shall conform to Section 86-1.02C, "Pull Boxes," of the Standard Specifications. Covers shall be in two sections. Hold down bolts or cap screws and nuts shall be of brass, stainless steel or other non-corroding metal material. Each cover portion shall have inset lifting pull slots. Cover marking shall be "FIBER OPTIC" on each cover.

Non-PCC vaults and covers shall be of sufficient rigidity that when a 100-pound concentrated point force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it shall be possible to remove the cover without the use of tools. When a vertical force of 1500 pound is applied,

through a 0.5-inch x 3-inch x 6-inch steel plate, to a non-PCC cover in place on a splice vault, the cover shall not fail and shall not deflect more than 0.25 inches.

Fiber optic vaults shall be installed as detailed and as shown on the plans. Fiber optic vaults shall be installed at grade. Metallic or non-metallic cable racks shall be installed on the interior of both long sides of the fiber optic vaults. The racks shall be capable of supporting a load of 100-pound, minimum, per rack arm. Racks shall be supplied in lengths appropriate to the box in which they will be placed. All metallic cable racks shall be fabricated from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, "Miscellaneous Metal," of the Standard Specifications. Metallic cable racks shall be bonded and grounded.

For vaults not installed behind face of curb or within sidewalk areas, unless otherwise shown on the plans or as directed by the engineer, vaults shall be located outside the pavement with the lid centerline 5 feet from the edge of the pavement or back of the dike. Vaults may be moved farther from the roadway to accommodate buried objects, existing conduits, or similar items that prevent installation 5 feet from the pavement, but no part of the vault, concrete encasement ring, or backfill material shall be less than 18 inches from the edge of the pavement or back of the dike, to allow for future electrical conduit installations between the vault and roadway. The top of the vault lid shall match the final grade within 1 inch +/-0.5 inch.

Some locations along the roadway may have existing conduits, pipes, or drains parallel to the roadway and next to the shoulder, which may make it impossible to route conduits to the vault. At other locations, buried objects, steep drop-offs, or other objects may make installation of a vault outside the pavement impossible. At these locations or as directed by the engineer, vaults may be installed in the pavement of the shoulder. Vaults placed inside the pavement shall be installed with the centerline of the vault not more 3 feet from the edge of pavement or back of dike, and with the entire top of vault lid 0.1 inch +/- 0.05 inch below the surface of the pavement, when all pavement work specified in the job is completed.

Vaults located at bridges where exposed conduit must be used, such as at undercrossings, shall be located as close as possible to the end of the structure unless otherwise specified on the plans. If not specified otherwise in the plans, the location of vaults at bridge structures shall be between the first and second guardrail posts. Unless otherwise directed by the engineer, the top of the vault lid at these locations shall be located entirely behind the guardrail and shall conform to the final grade of the surrounding fill at the vault location. No part of the vault or vault lid shall be exposed or extend past the edge of the hinge point for the bridge, or otherwise deform the earth fill at the vault location.

Conduits shall enter the fiber optic vault through the sidewall at not more than 6 inches from the bottom of the vault. Conduits shall not enter through the bottom of the vault. Conduits shall not protrude more than 2 inches inside the pull box. Watertight sealing plugs as specified elsewhere in these Technical Special Provisions are required around all conduits not used.

Locking mechanism shall be provided for the cover consisting of four ¾-inch Penta head bolts.

8.04C MEASUREMENT AND PAYMENT.

"Furnish and Install N48 Pull Box" and **"Furnish and Install 6E Pull Box"** are Unit Price Items to be measured and paid by the number of pull boxes installed. Compensation shall include all labor, materials, tools, equipment, excavations, bedding, backfill, concrete

collars, cable racks, pavement removal and replacement, concrete sidewalk/curb/gutter removal and replacement and incidentals and for doing all work involved in installing the pull boxes and vaults, complete in place, as shown on the Plans, as specified in these Special Provisions and no additional compensation will be allowed therefor.

8.05 INTERCONNECT CABLES AND EQUIPMENT.

8.05A COPPER SIGNAL INTERCONNECT CABLE.

Existing copper signal interconnect cable in the project area to be removed and discarded or abandoned in place shall be replaced with new fiber optic cable per Section 8.05B of these Technical Special Provisions. New copper signal interconnect cable shall not be used, unless approved otherwise by the City.

8.05B FIBER OPTIC SIGNAL INTERCONNECT CABLE.

Fiber optic cable systems shall conform to the provisions in State Specifications Section 87-19, "Fiber Optic Cable Systems," except as noted in the plans and these Technical Special Provisions. All new signal interconnect cable (SIC) shall be fiber optic subject to the following requirements:

1. All fiber optic cable shall be single mode. Cable shall be Corning Altos, All Dielectric Gel-Free Cable, or approved equivalent.
2. Cable installed in runs between intersections shall be minimum 288 fiber count, unless otherwise noted on the plans.
3. Cable installed in runs between splice closures and termination equipment shall be minimum 12 fiber count, unless otherwise noted on the plans.
4. Splices are to be made in splice closures in the N48 fiber optic vault only.
5. A fiber termination panel shall be installed to terminate the 12 SMFO cable. In instances where there is insufficient rack capacity, a spider fan out kit shall be installed upon approval of City Engineer.
6. New fiber optic cable shall be connected to the City network and an as-built assignment table shall be submitted by the Contractor as part of the final punch list.

Cable shall be shipped from the factory with protective wrapping and with sealed ends. The cable shall include a waterproof tag with the results of factory OTDR attenuation test as well as:

Contract Number/Identification

Manufacturer's Name/Address

Manufacturer's Part Number

Type of Cable

Number of Loose Tubes and Fiber

Beginning and Ending Length Marks

Reel Number

Ship Date

Weight of Cable and Reel

Cable shall be of a continuous length on the reels.

Unless specified otherwise on the plans, the Contractor shall coil fiber optic cable slack as follows: 100 feet of 288-strand (trunk) slack and 50 feet of 12-strand (branch) slack in N48 pull boxes, 10 feet of 12-strand (branch) slack in "home run" pull boxes, 20 feet of 12-strand (branch) in base of controller cabinets, and 10 feet of 288-strand (trunk) in pass-through

6E pull boxes. Fiber optic cable shall have a footage marking every four (4) feet. This marking may be on the outside of the cover or on the inside insulation jacket.

8.05B.1 FIBER OPTIC INTERCONNECT EQUIPMENT.

Termination components for vaults and signal cabinets are listed in Table 8.1 below. The fiber optic cables shall be terminated and/or spliced with these components per the fiber assignment in the plans.

TABLE 8.1 Cabinet and Vault Fiber Termination Components

Description	Manufacturer	Model
Splice Closures	Corning (or approved equal)	SCF-6C22-01/02
Splice Closure Splice Tray	Corning (or approved equal)	SCF-ST-099
Splice Housing	Corning (or approved equal)	SPH-01P
12-Port Panels	Corning (or approved equal)	CCH-CP12-59
Splice Trays	Corning (or approved equal)	M67-048
6-Port Panels	Corning (or approved equal)	CCH-CP06-3C
Fiber Optic Splice Trays	Corning (or approved equal)	M67-110
Fiber Distribution Unit	Corning (or approved equal)	C-MIC-012
Fan Out Kit	Corning (or approved equal)	
Jumpers / Patch Cable	Corning (or approved equal)	LC connector type (6-foot min)
Connectors	Generic	LC
Connectors	Generic	Duplex SFP

8.05B.2 COMMUNICATION DATA NETWORK.

The communication protocol shall be Ethernet. New or modified signals shall receive the communication standard components in Table 8.2, at the locations noted in the plans.

Table 8.2 Data Communication Standards – Switches

Description	Manufacturer	Model
Edge Ethernet Switch	EtherWan	EX73934X-0VB
Hub Ethernet Switch	EtherWan	EG97023-2VZ
1G SFP Fiber Transceiver	Generic or FS	SFP1G-LX-31
10G SFP Fiber Transceiver	Generic or FS	SFP-10GLR-31-I
Hardened Ethernet Extender	EtherWan	ED3541
Cat 6 Patch Cable RJ45	Generic	
Power Connection	Generic	MDR-40-48
Mounting	Generic	Z-Bracket Din Rail Mounting Bracket

The Contractor shall prepare and submit Record Drawings of each splice closure installed, showing each fiber enclosed, fiber color, splices, and unconnected fibers. Record drawings shall be labeled to indicate the splice closure location.

8.05B.3 FIBER OPTIC TESTING.

General

The Contractor acknowledges that contractor-performed testing is a vital component of the work and required for acceptance of the fiber optic cables and all related assemblies.

The fiber optic testing shall be conducted at the following stages:

1. Upon cable delivery to the project site, but prior to installation - Cable Reel Test
2. After installation and before splicing - Cable Installation Acceptance Test
3. After completion of splices and terminations - Final Acceptance Test

All testing shall be performed in a manner that provides the time, space, set up, tools, and equipment for the Engineer or his designee to inspect and verify that all test setups and tests, including review of fiber connections, test equipment, device displays, and all related documentation. The tests shall quantitatively demonstrate that the fiber optic cable meets or exceeds the minimum requirements and specifications provided in these Technical Special Provisions and the contract plans.

All technicians testing cable shall be certified as an Advanced Fiber Optics Technician or Certified Fiber Optics Specialist by the Fiber Optic Association (FOA). Contractor shall submit to the Engineer for approval proof of FOA certification for each of the technicians performing testing.

Vehicles used for fiber testing shall have their engine turned off during testing.

The Contractor shall use clean, well maintained testing equipment. The testing equipment shall have been calibrated within one (1) year prior to conducting the tests.

All test measurements shall be measured at the wavelengths outlined under Section 86-1.02F(2)(e), "Fiber Optic Cable," of these Technical Special Provisions.

A 1,000-meter launch cable, or launch box tuned to the attenuation of a 1,000-meter launch cable, shall be used to overcome the dead zone of the OTDR inserted between the OTDR and the optical link.

The OTDR testing shall be done at a scale of at least 1 dB per division on the vertical scale.

Contractor shall perform tests to verify that ports and fibers installed by others have end points indicated in the Plans.

Fusion splice loss shall not exceed 0.3 dB maximum and mated connector loss shall not exceed 0.75 dB, as specified in TIA/EIA-758, "Customer Owned Outside Plant Telecommunication Cabling Standard," when measured in accordance with ANSI/TIA/EIA-455-8, "Measurement of Splice and Connector Loss and Reflectance Using an OTDR."

Short Fiber Cable Segments

A short fiber cable segment is defined as a cable measuring 1000 feet or less including all coiling and slack.

It is acknowledged that test results from short segments of fiber cable may require re-testing, and that there may be an issue where the OTDR results may appear inconsistent and do not meet the maximum attenuation limits required in these Technical Special Provisions even after the re-tests. In these cases, the Contractor shall prepare link attenuation calculations and perform power meter/light source tests on the subject fiber cable and submit to the Engineer for review. Should the power meter tests show that the actual loss is less than the theoretical maximum loss for the fiber cable (all strands), the power meter/light source test results will be used accepted instead of the OTDR tests.

There shall be no additional cost for the additional calculations and testing for short fiber cable testing including the power meter/light source tests and link attenuation calculations. The contractor shall bare the entire cost of the re-tests and calculations, and no additional compensation shall be allowed therefor.

Test Plan

The Contractor shall prepare and submit a Test Plan to the Engineer for review and approval that provides a detailed description of the tests that will be conducted, the steps required to conduct the testing, and the specific locations where the tests will be conducted.

The Test Plan shall cover all stages of the fiber testing and shall include the following at a minimum:

1. Stage of Test (i.e., Cable Reel, Cable Installation or Final Acceptance)
2. Contractor staff who will be conducting the tests
3. Test equipment to be used
4. The setup for the testing, including all equipment connections
5. The detailed process for the testing including, but not limited to:
 - a) recording/capturing of the test data;
 - b) file format and organization of the test data that will be submitted;
 - c) direction of the test (OTDR and power meter/light source); and
 - d) test data that will be collected and reported
6. Sample test printouts including all graphic and tables
7. A tabular and narrative summary of all the fiber optic segments that will be tested which shall include all start and end points noted by intersection name, facility name, stationing, or other means for the Engineer to be able to verify the location

Contractor shall submit a sample of the OTDR and power meter/light source data printouts to the Engineer for review and approval as part of the Test Plan.

If the Engineer rejects the submitted Test Plan, the Contractor shall submit a revised Test Plan within five (5) working days for review and approval by the Engineer. No testing shall be performed until Contractor's test plan has been approved by the Engineer.

Submittal of the test equipment user's manual does not constitute any part of the Test Plan, and should the Test Plan contain such documentation, it shall be rejected in its entirety.

The Contractor shall notify the Engineer of his intent to proceed with testing forty-eight (48) hours prior to commencement of each test. It is noted that regardless of the advance notification, there shall be no testing until the Test Plan is approved by the Engineer. In addition, the Contractor shall be able to commence testing a minimum of 48 hours after the Test Plan has been approved.

The approval of the formats for the test printouts shall be attained prior to conducting any testing. Any tests that are conducted prior to the Engineer's approval of the Test Plan and the test document format shall be considered as not acceptable and the Contractor shall re-test all fibers.

Link Attenuation Calculations

The Contractor shall prepare Link Attenuation Calculations for each fiber segment. The calculations shall be shown in a table clearly indicating the following:

- Fiber cable segment – note the two end points
- Length of the segment tested
- Direction – note which direction the calculation is being conducted for
- Splices – note the number and locations of the splices
- Connectors – note the number and locations of the connectors.

The results of the calculations will provide the theoretical attenuation limits for each segment. This will be used to compare the results of the power meter and light source testing.

The Contractor shall submit the Link Attenuation Calculations to the Engineer for review and approval prior to conducting any power meter/light source tests.

The approval of the Link Attenuation Calculations shall be attained prior to conducting any power meter/light source testing.

Any power meter/light source tests that are conducted prior to the Engineer's approval of the Link Attenuation Calculations shall be considered as not acceptable and the Contractor shall re-test all fibers.

Cable Reel Acceptance Test

The Contractor shall test fiber optic cables after delivery of the fiber optic cable to the project site but prior to field installation (Cable Reel Acceptance Test). This test is intended to verify that the fiber received from the supplier is in sound condition and without manufacturing defects.

The Cable Reel Acceptance Test shall be performed within ten (10) working days from the delivery of the fiber optic cable to the project site, or when the cable is received by the Contractor from the supplier, whichever is sooner.

The Contractor shall notify the Engineer of his intent to proceed with the cable reel testing forty-eight (48) hours prior to commencement of the test. However, no tests shall commence until the Engineer has approved the Test Plan that shall be submitted to the Engineer (refer to the "Test Plan" section elsewhere in these Technical Special Provisions).

Any fiber optic cable that does not meet the requirements described in State Specifications Section 87-19, "Fiber Optic Cable Systems" and any applicable and relevant section in these Technical Special Provisions shall be replaced at shall be at the sole cost of the Contractor, and no additional compensation shall be allowed therefor.

At the time of testing, the Contractor shall inspect the fiber optic cable and record any visible signs of defects.

The Contractor shall compare the test results to the manufacturer's specifications and note any discrepancies.

If the attenuation level measured from the tests conducted by the Contractor is 5% or more higher than the attenuation reported from the manufacturer's factory tests, or 5% or more higher than the maximum attenuation values of State Specifications Section 87-19, "Fiber Optic Cable Systems," the fiber cable reel will be considered as unacceptable at this stage regardless of the number of fibers that deviate from the manufacturer's test results.

The Contractor shall replace the unsatisfactory reels of cables at no additional expense to the project, and no additional compensation shall be allowed therefor.

The Contractor shall install heat shrink or other protective covering to the cable end to prevent the entry of moisture or other contaminants.

The Cable Reel Acceptance Test results including the manufacturer's factory test results shall be summarized and submitted to the Engineer for review and approval.

The test results shall be documented and submitted to the Engineer based on the requirements contained in section "Test Documentation" contained herein these Technical Special Provisions.

Cable Installation Acceptance Test

The installation of new fiber optic cable shall only occur once the fiber optic cable reel acceptance test has been reviewed and approved by the Engineer.

The Cable Installation Acceptance Test shall include OTDR tests conducted from both ends of the fiber optic cable.

The Installation Test shall be performed within ten (10) working days from the time the fiber optic cable is installed, and before splices are conducted or connectors installed on the fiber cable segment.

At the time of testing, the Contractor shall inspect the fiber optic cable and record any visible signs of damage.

Any fiber optic cable that does not meet the requirements described in State Specifications Section 87-19, "Fiber Optic Cable Systems" and any applicable and relevant section in these Technical Special Provisions shall be replaced at shall be at the sole cost of the Contractor, and no additional compensation shall be allowed therefor.

If the attenuation level measured from the tests conducted by the Contractor is 5% or more higher than the attenuation reported from the manufacturer's factory tests, *or* 5% or more higher than the maximum attenuation values of State Specifications Section 87-19, "Fiber Optic Cable Systems," the fiber cable reel will be considered as unacceptable at this stage regardless of the number of fibers that deviate from the manufacturer's test results.

The Contractor will be allowed one re-test to mitigate any failed test(s).

Should the results from any re-tests continue to yield test failures, the entire fiber cable shall be considered as unacceptable and shall be replaced by the Contractor, regardless of the number of fibers that have failed the test.

The Contractor shall replace the unacceptable fiber cables at no additional cost, and no additional compensation shall be allowed therefor.

In addition to the requirements outlined under the *Cable Reel Acceptance Test*, the Contractor shall note the differences in measurements taken from opposite directions.

Test results shall be summarized and submitted to the Engineer. If the cable installation test results are found unsatisfactory by the Engineer, the fiber optic cable segment will be judged as unacceptable. The Contractor shall replace the unsatisfactory segment of cable with new fiber, without additional splices, at no expense to the City. Conduct cable installation acceptance test for the new segment of cable to demonstrate proper installation.

All connectors that are necessary to conduct the post-installation testing shall be considered as part of the fiber optic testing costs, and no additional compensation shall be provided therefor.

The test results shall be documented and submitted to the Engineer based on the requirements contained in section "Test Documentation" contained herein these Technical Special Provisions.

Final Acceptance Test

After cable acceptance testing has been approved by the Engineer and after the splicing and connecting of the fiber cable per the contract plans is completed, the Contractor shall conduct the Final Acceptance Testing.

This test stage is intended to verify that the end-to-end fiber optic paths have been completed per the contract plans, and that all of the splices and connectors have been performed to the highest standard of care that meets all of the requirements in these Technical Special Provisions.

The Final Acceptance Test shall be performed within ten (10) working days from the completion of all the splices and connectors.

The end-to end Final Test shall consist of performing OTDR testing; including optical loss and reflection testing with a light source and power meter (LSPM) or optical loss test set (OLTS).

All fusion splices shall be tested in both directions and the average of the loss measured shall be used to determine the splice loss.

All mated connector pairs shall be tested in both directions and the average of the loss measured shall be used to determine the connector loss.

The tests shall document total end-to-end loss, splice and connector loss and back reflection, and overall reflectance levels.

Should the power meter tests show that the actual fiber loss is less than the theoretical maximum fiber loss for the fiber cable (for all strands), the fiber cable will be considered as acceptable.

If the attenuation level for a fiber strand measured from the tests conducted by the Contractor is 5% or more higher than the maximum attenuation values allowed as shown in State Specifications Section 87-19, "Fiber Optic Cable Systems," or the theoretical maximum as calculated from the Link Attenuation Calculations, the fiber strand shall be considered as an unacceptable fiber having failed the test.

The Contractor will be allowed one re-test to mitigate any failed test(s).

Should the results from any re-tests continue to yield test failures, the entire fiber cable shall be considered as unacceptable and shall be replaced by the Contractor, regardless of the number of fibers that have failed the test.

The Contractor shall replace the unacceptable fiber cables at no additional cost, and no additional compensation shall be allowed therefor.

All connectors that are necessary to conduct the end-to-end testing shall be considered as part of the fiber optic testing costs, and no additional compensation shall be provided therefor.

Acceptance Test Documentation

All tests shall be saved on Compact Disc (CD) or portable media stick (USB flash drive) and shall be submitted to the Engineer for review and approval. All electronic copies of the test results shall be submitted in portable document format (pdf).

A three-ring binder with hardcopies of the test results shall also be provided. All test result printouts (OTDR and Power Meter/Light Source) shall contain the following:

- Maximum specified loss at specified wavelengths
- Test location (e.g., intersection name or facility name)
- Date and Time of test
- Test crew (names)
- Test Equipment manufacturer and model
- Direction of the test
- Length of fiber segment tested
- Buffer tube and fiber color
- Attenuation result (in dB or dB/km)

OTDR Test Results

The OTDR test result printouts shall provide a graphical representation of the test of each fiber strand that clearly shows the following information at a minimum:

- The launch cable length
- The cable length
- Cable ID
- Fiber strand number or color
- Start location (where the OTDR is located)
- End or Far location
- Total End to End Loss (dB)
- Start point and end point for each OTDR trace
- Indications where losses or other events occur along the fiber

The start point and end point shall be used to determine the direction of the test. The graphical representation shall provide enough information for the Engineer to determine where splice and connector losses are located along the fiber segment. If this information is not readily apparent on the graphical representation, it will be rejected.

In addition to the test result printouts and graphical representations, the Contractor shall provide a summary table that documents the test results of each fiber strand that is tested on each fiber cable segment. The table shall indicate the fiber number or color, buffer tube (color), wavelength (in nm), and attenuation (in dB/km).

All printouts shall bear the signature or initials of the Contractor's representative who has reviewed the tests.

The Contractor shall place a check mark on all traces that satisfy the requirements identified herein.

The Contractor shall highlight any discrepancies that may exist in the test results. If more than 20% of the tests have any discrepancies, abnormalities or failures, the tests will be rejected and the Contractor shall be required to conduct a complete re-test and re-submit the documentation for the Engineer's review and approval.

Any subsequent re-testing, re-splicing, or revision of the test documentation shall be at the sole cost to the Contractor and no additional cost shall be allowed therefor.

Power Meter and Light Source Test Results

The Power Meter/Light Source test results shall be submitted with the following at a minimum:

- Contractor staff tester (name)
- Cable ID
- Start point (intersection or facility name)
- End point (intersection or facility name)
- Fiber number and color
- Fiber buffer tube
- Direction of test
- Length of cable tested (feet)
- Splice locations (name)
- Connector locations (name)
- Wavelength (nm)
- Theoretical loss limit (from Attenuation Calculations)
- Measured loss
- Headroom loss (theoretical loss minus actual loss)

The optical testing using a light source and power meter shall meet the following minimum requirements:

1. Optical fiber light source
 - Single mode fiber
 - Provide dual laser light sources with central wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
 - Output power of -10 dBm minimum.
2. Power Meter
 - Provide 850 nm, 1300nm, 1310 nm, and 1550 nm wavelength test capability.
 - Power measurement uncertainty of ± 0.25 dB.
3. Single Mode OTDR
 1. Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
 2. Event deadzones of 2 m maximum at 1310 nm and 2 m maximum at 1550 nm.
 3. Attenuation deadzones of 15 m maximum at 1310 nm and 15 m maximum at 1550 nm.
 4. Distance range not less than 10,000 m.
 5. Dynamic range at least 10 dB at 1310 nm and 1550 nm

The OTDR used for testing shall be provided with certification of its most recent calibration which shall be within twelve (12) months from the date of the testing.

The OTDR operator shall hold a current operators certificate for the equipment used. This certificate shall be provided to the Engineer prior to any use of the OTDR for testing, and shall represent not less than sixteen (16) hours of training from the equipment manufacturer.

The OTDR shall have a distance measurement accuracy of $\pm 0.01\%$ and meet the following minimum requirements.

8.05C SMALL FORM-FACTOR PLUGGABLE MODULE.

The Contractor shall furnish and install Small Form-Factor Pluggable (SFP) module for each fiber termination to the fiber optic switch as shown on the plans. The SFP module shall allow for optical interface between the LC/SC connector of the fiber optic patch cable to the managed/unmanaged fiber optic switch or media converter.

The SFP module shall adhere to the following functional requirements:

1. Transparent to data encoding/compatible with major data protocols
2. Interchangeable SFP for fiber type, distance, and connector.
3. No in-field optical adjustment required
4. IEEE 802.3 compliant
5. Can withstand -40° C to +75° C operating temperature
6. Lifetime warranty

The SFP module shall adhere to the following technical specifications:

- | | |
|-------------------------------|------------------------------|
| 1. Data Transfer Rate: | at least 1000 Mbps or 10Gbps |
| 2. Transmission Medium: | Single Mode |
| 3. Transmission Wavelength: | 1310 nm |
| 4. Receive Wavelength: | 1310 nm |
| 5. Maximum Path Length: | 15 km |
| 6. TX Power (dBm): | -8 |
| 7. RX Sensitivity (dBm): | ≤ -24 |
| 8. Optical Loss Budget (dBm): | 16 |
| 9. Number of Fibers: | 2 |
| 10. Receptacle Type: | LC |

8.05D NOT USED.

8.05E MEASUREMENT AND PAYMENT.

The Contractor shall bid a unit price, per linear foot for **“Furnish and Install 12-strand SMFO Cable”** and **“Furnish and Install 288-strand SMFO Cable.”** Compensation shall include all labor, materials, tools, equipment and incidentals and for doing all work involved in supplying and installing within existing and new conduit including all fiber optic cable (including slack within pull boxes), all testing, test documentation, and for providing all host equipment, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor. Removal, protection, and/or reinstallation of all other cables in existing conduit shall be incidental to the new cable installation and will not be measured or paid separately.

The Contractor shall bid a unit price per each for **“Furnish and Install 12-Port Fiber Termination Panel.”** Compensation shall include all labor, materials, tools, equipment and incidentals and for doing all work involved in supplying and installing, including termination panel, splice trays, connectors, mounting hardware, and accessories, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

“Make and Test Splices and Terminations” shall be measured and bid by each. The contract unit price shall include full compensation for supplying all labor, materials, tools, equipment, labeling, and for performing and coordinating the work involved with terminating cables, splicing, testing, and test documentation as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

“Furnish and Install Ethernet Switch (Edge)” is a Unit Price Item to be measured and paid by the number Ethernet switches installed. The unit price of Ethernet switches shall include full compensation to supply all labor, materials, tools, equipment, and incidentals required to install Ethernet switch, programming and configuration, patch cables, terminations and connectors, testing, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

"Furnish and Install SFP Transceiver" is a Unit Price Item to be measured and paid by the number SFP transceivers installed. The unit price of SFP transceivers shall include full compensation to supply all labor, materials, tools, equipment, and incidentals required to install SFP, patch cables, connectors, testing, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

"Furnish and Install Splice Closure" is a Unit Price Item to be measured and paid by the number splice closures installed. The unit price of splice closure shall include full compensation to supply all labor, materials, tools, equipment, and incidentals required to install underground splice closure, splice trays, connectors, hardware, accessories, and testing, complete in place, as shown on the Plans, as specified in the Special Provisions and as directed by the Engineer and no additional compensation will be allowed therefor.

8.06 NOT USED.

8.07 BONDING AND GROUNDING.

Bonding and grounding shall conform to Section 86-1.02F(2)(c)(ii), "Bonding Jumpers and Equipment Grounding Conductors," of the State Standard Specifications.

A bare No.10 copper tracer wire shall be run continuously in all interconnect conduits, running uninterrupted through and bonded to any rigid metal conduit.

8.08 NOT USED.

8.09 TESTING.

8.09A MATERIAL TESTING.

The first two paragraphs of State Specifications Section 86-1.01D(3), "Department Acceptance," is replaced with:

Within fourteen (14) calendar days of receipt of Contractor's submittals, the City shall have the right to request a sample of any materials used for the construction of the interconnect system. These include, but are not limited to, Ethernet cables, interconnect cable, Ethernet switches, fiber distribution units, and any other item deemed necessary to be tested or inspected for compliance to the specifications. The Contractor shall deliver those materials requested within twenty-one (21) calendar days of request. If the City does not receive the requested materials within the time specified, those materials requested shall be deemed to be unsatisfactory, and rejected.

The testing facility is currently located at:

CITY OF SAN RAMON
SERVICE CENTER
5000 Crow Canyon Road
San Ramon, CA. 94583
(925) 973-2800

If unsatisfactory performance of the equipment develops, the equipment shall be replaced or repaired by the Manufacturer and the test shall be repeated until satisfactory operation is obtained.

If any of the material or equipment is rejected for failure to comply with the requirements of these Technical Special Provisions, the Contractor shall be responsible for replacing all rejected equipment or materials. The Contractor shall pay all of the costs involved in re-testing the replacement equipment or materials.

8.09B INSPECTION AND TURN ON.

The first sentence after the Electrical Material Sampling table of the State Specifications Section 87-1.01D(2) "Quality Control" is replaced with:

Upon the completion of the traffic signal interconnect installation, the Contractor shall request a final inspection from the City. Upon completion of the inspection and correction of all deficiencies found, the Contractor shall request an activation date from the City. The activation of new traffic signal interconnect shall be performed on a Tuesday, Wednesday, or Thursday, if not a holiday. The Contractor shall arrange to have a fiber optic and/or networking technician present at the project site at the time the equipment is activated.

8.09C FUNCTIONAL TESTING.

The last two paragraphs of State Specifications Section 86-1.01D(2) "Quality Control" is replaced with:

Upon activation, a functional test of the traffic signal interconnect system shall be performed consisting of not less than fourteen (14) continuous days of operation. If unsatisfactory performance of the system develops, the conditions shall be reported to the Contractor and the Contractor shall have seventy-two (72) hours to initiate the necessary repairs and shall vigorously pursue the repairs until they are complete. When the Contractor notifies the City that the repairs are complete, the test shall be repeated until the fourteen (14) days of continuous, satisfactory operation are obtained. The Contractor shall be responsible for all of the costs involved in the repair of the equipment, including re-testing if necessary.

In the event that the Contractor is unable to respond to a problem that develops during the functional test, or for any reason is unable to correct the problem in a timely fashion, as determined by the City, the City may have its own maintenance personnel work on the problem. Any such work performed by the City shall not invalidate the guarantee provided for in these Technical Special Provisions, and shall be at the Contractor's expense.

After successful completion of the fourteen (14) day test, the City may relieve the Contractor of maintenance for the interconnect system. Maintenance by the City will not relieve the Contractor from repairing any deficiencies found prior to the acceptance of the traffic signal by the City.

The Contractor at his expense shall repair any damage to the new facilities prior to final acceptance by the City.

PART 9 NOT USED.

PART 10 NOT USED.

PART 11 DETECTORS.

11.01 VEHICLE DETECTORS.

If existing vehicle detector loops shall become damaged due to construction activities, Contractor shall replace the loops in kind, and at no cost, as indicated in this section within 72 hours.

All loops shall be "Type E Loop Detector Configuration," per San Ramon Standard Detail T-5a, with the exception of the circular stop bar loops. The stop bar loops shall be installed per Detail "Type E Modified Loop Detector Configuration" as shown on the San Ramon Standard Detail T-5a. Additional loops behind the stop bar loop shall be spaced at 16 feet center to center, unless otherwise specified. All loops shall be sawcut. The sides of the slot shall be vertical with a maximum width of 5/8 inch.

Loops shall be installed as directed by the engineer and per San Ramon Standard Detail T-5b.

PART 12 NOT USED.

PART 13 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT.

All existing traffic signal equipment to be reused as part of this project shall be removed, protected, and reinstalled as shown on the plans. All traffic signal equipment to be salvaged will be removed and delivered to:

CITY OF SAN RAMON
SERVICE CENTER
5000 CROW CANYON ROAD
SAN RAMON, CA 94582

Existing signal equipment to be removed and not salvaged or reused shall become the property of the Contractor.

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