THIS PRINT COVERS CALENDAR ITEM NO. :

SAN FRANCISCO
MUNICIPAL TRANSPORTATION AGENCY

DIVISION: Sustainable Streets

BRIEF DESCRIPTION:

Authorizing the Director of Transportation to execute Contract No. SFMTA-2016-49 (Contract), for the administration of the City's Red Light Camera Automated Photo Enforcement Program (Program), between the SFMTA and American Traffic Solutions, Inc. (Contractor) for a contract amount not to exceed $5,000,000, and an initial contract term of one-year and nine-months, with an option to extend the term for up to an additional two years at the City's sole discretion.

SUMMARY:

- The City's Program has been in operation since 1996.
- The Program's existing Red Light Camera Automated Photo Enforcement System uses technology and equipment that has become outdated.
- In April 2015, the SFMTA issued a request for proposals to provide the design for an upgraded, replacement system that uses state-of-the-art system equipment, and assist the SFMTA in the administration of the Program after the replacement system is operational (collectively, Services).
- The SFMTA competitively selected the Contractor to provide the Services in two phases.
- Phase I Services included construction design services to design the replacement system, as well as administrative preparation work needed to lay the foundation for Phase II; the Contractor completed Phase I in July 2017.
- Phase II Services include construction consultation services for the replacement system, leasing to the SFMTA and maintenance of the system equipment for the replacement system, and assistance to the SFMTA with the administration of the Program once the replacement system is operational; the Contractor will perform Phase II Services under the Contract.
- The Contract is funded by the SFMTA's annual Operating Budget.

ENCLOSURES:

1. SFMTAB Resolution
2. Contract

APPROVALS: **DATE**

DIRECTOR _____ 8/13/2018

SECRETARY _____ 8/13/2018

ASSIGNED SFMTAB CALENDAR DATE: August 21, 2018

PURPOSE

Authorizing the Director of Transportation to execute Contract No. SFMTA-2016-49 for the administration of the City's Red Light Camera Automated Photo Enforcement Program between the SFMTA and American Traffic Solutions, Inc. for a contract amount not to exceed $5,000,000, and an initial contract term of one-year and nine-months, with an option to extend the term for up to an additional two years at the City's sole discretion.

STRATEGIC PLAN GOALS AND TRANSIT FIRST POLICY PRINCIPLES

The SFMTA will further the following goal of the Strategic Plan through execution of the Contract.

Goal 1: Create a safer transportation experience for everyone.

Objective 1.1: Achieve Vision Zero by eliminating all traffic deaths.

The SFMTA will further the following Transit First Policy Principle through execution of the Contract.

1. To ensure quality of life and economic health in San Francisco, the primary objective of the transportation system must be the safe and efficient movement of people and goods.

DESCRIPTION

Red Light Camera Automated Photo Enforcement Program

In 1996, the City and County of San Francisco was one of the first cities in the United States to implement a program to enforce red-light running using automated cameras at street intersections. Since then, the City has operated its Red Light Camera Automated Photo Enforcement Program (Program) to photograph and issue citations to vehicles that illegally enter red-light camera-enforced intersections after the start of the red-signal phase. At the height of the Program in 2013, there were 47 enforced approaches at 26 intersections. There are currently 32 enforced approaches at 20 intersections.

The Program has proven to be a valuable tool in reducing red-light related collisions by up to 40% at enforced intersections. In addition, the Program has generated a "spill-over" effect of reducing red light collisions at neighboring intersections, which may not be red-light camera enforced.

Replacement of Existing Red Light Camera Automated Photo Enforcement System

The Program's existing Red Light Camera Automated Photo Enforcement System uses

technology and equipment that is outdated and will likely become obsolete soon. On April 14, 2015, the SFMTA issued a request for proposals to design an upgraded, replacement system that uses state-of-the-art system equipment, and assist the SFMTA in the administration of the Program after the replacement system is operational. The SFMTA competitively selected the Contractor as the successful proposer.

To account for an expected lapse in Contactor's services – necessary for the City to build out under a separate contract the Contractor's design for the replacement system – the SFMTA split the Contractor's services in two phases.

Phase I

The Contractor performed Phase I under Contract No. SFMTA-2015-13, which the Director of Transportation executed on May 1, 2016. Phase I consisted of construction design services to design the replacement system, as well as administrative preparation work needed to lay the foundation for Phase II.

The contract amount for Phase I was $71,520, and the contract term was initially one year. The SFMTA amended the Phase I contract on April 2017 to extend the term 90 days, so the Contractor could finalize the design documents for the replacement system.

In July 2017, the Contractor completed design for the replacement system, and, in November 2017, San Francisco Public Works awarded a separate contract to Bay Area Lightworks, Inc. (Construction Contractor) to construct the infrastructure to support, and install, the new system.

Phase II

The Contractor will perform Phase II under Contract No. SFMTA-2016-49, for which the SFMTA seeks authorization under this calendar item. Under Phase II, the Contractor will: furnish to the Construction Contractor the system equipment for the replacement system; provide construction consultation services while the Construction Contractor constructs the infrastructure to support, and installs, the new system; lease to the SFMTA and maintain the system equipment for the replacement system; and assist the SFMTA with the administration of the Program once the replacement system is operational.

Phase II will start when the Construction Contractor commences construction for the replacement system. The Construction Contractor has indicated construction will commence in September 2018.

The Contract for Phase II includes the following key terms:

- Contract not-to-exceed amount: $5,000,000;
- Contract term: up to three years and nine months, consisting of an initial one-year and nine-month term, with an option to extend for up to an additional two years, at the

SFMTA's sole discretion;
- Number of camera-enforced intersection: 19 enforced approaches at 13 intersections;
- System equipment: Includes state-of-the-art digital and radar technology to capture photographs and videos of red-light and illegal turn violations;
- Equipment Lease Attachment, Appendix E: Provides that the SFMTA will lease system equipment from the Contractor for the duration of the Contract;
- The Local Business Entity (LBE) subcontracting participation requirement: 15%.

STAKEHOLDER ENGAGEMENT

No outreach was necessary for this contract. The SFMTA will post in the newspaper a public notice to notify the public of the upgraded automated enforcement system prior to commencing the issuance of citations. Warning notices will be mailed to alleged violators for 30 days at each enforced approach prior to the issuance of citations.

ALTERNATIVES CONSIDERED

The Contract includes an option for the SFMTA to self-administer Program. Under this option, the Contractor could lease software and system equipment, provide training, and consultation and software development services to the SFMTA at the following costs:

• Software license lease per month	$400/month per Approach
• Training per hour	$80
• Consultation services per hour	$80
• Software development services per hour	$150
• System equipment lease	$926/month per Approach

This option is not the preferred way to proceed because the SFMTA lacks the staffing resources and technical knowledge to provide administrative and operational support for the Program.

FUNDING IMPACT

This contract is funded by the SFMTA's annual Operating Budget.

Monthly program administrative and operational costs for the initial contract term will be as follows:

• Construction consultation services	$728.95 per approach x 19 approaches = $13,850
• System equipment lease	$17,594 ($926 per approach x 19 approaches) x 45 months = $791,730
• Program administration	$48,904 ($2,573.89 per approach x 19 approaches) x 45 months = $2,200,680

The SFMTA estimates it will expend additional $1,993,740 in operating funds for maintenance and repairs of the replacement system over the initial contract term. These funds will be budgeted annually in the SFMTA's Sustainable Streets Division budget. The source of funds is red light camera citation revenues.

ENVIRONMENTAL REVIEW

On July 18, 2018, the SFMTA, under authority delegated by the Planning Department, determined that the Contract is not defined as a "project" under the California Environmental Quality Act (CEQA) pursuant to Title 14 of the California Code of Regulations Sections 15060(c) and 15378(b).

A copy of the CEQA determination is on file with the Secretary to the SFMTA Board of Directors and is incorporated herein by reference.

OTHER APPROVALS RECEIVED OR STILL REQUIRED

Approval was obtained when the Civil Service Commission approved Contract number 48177-14-15 on July 31, 2015 and when the Department of Human Resources approved the modification of Contract number 484177-14-15 on November 13, 2017.

The City Attorney has reviewed this report.

RECOMMENDATION

Staff requests authorization for the Director of Transportation to execute Contract No. SFMTA-2016-49 Red Light Camera Automated Photo Enforcement Program, between the SFMTA and American Traffic Solutions, Inc. for a contract amount not to exceed $5,000,000, and an initial contract term of one-year and nine-months, with an option to extend the term for up to an additional two years at the City's sole discretion.

SAN FRANCISCO
MUNICIPAL TRANSPORTATION AGENCY
BOARD OF DIRECTORS

RESOLUTION No. _____

WHEREAS, The SFMTA began the Red Light Camera Automated Photo Enforcement Program (Program) in collaboration with the San Francisco Police Department in 1996, to reduce the number of collisions, property damage, physical injuries, and deaths caused by red-light running; and,

WHEREAS, Collision data shows that the number of collisions involving injuries decreased 10 percent City-wide, and the total number of injuries decreased 15 percent in the five years after the Program began, as compared to the five years before the Program; and,

WHEREAS, The Program's existing Red Light Camera Automated Photo Enforcement System uses technology and equipment that is outdated; and,

WHEREAS, On April 14, 2015, the SFMTA issued a request for proposals to design an upgraded replacement system to capture red-light and illegal turn violations at 19 enforced approaches at 13 intersections, provide construction consultation services, lease and maintain system equipment, and support the SFMTA's administration of the Program (collectively, Services); and,

WHEREAS, American Traffic Solutions, Inc. was selected as the highest-ranked proposer to perform these Services; and,

WHEREAS, On July 18, 2018, the SFMTA, under authority delegated by the Planning Department, determined that the Contract is not defined as a "project" under the California Environmental Quality Act (CEQA) pursuant Title 14 of the California Code of Regulations Sections 15060(c) and 15378(b); and,

WHEREAS, A copy of the CEQA determination is on file with the Secretary to the SFMTA Board of Directors, and is incorporated herein by reference; and,

RESOLVED, That the San Francisco Municipal Transportation Agency Board of Directors authorizes the Director of Transportation to execute Contract No. SFMTA-2016-49 for the administration of the City's Red Light Camera Automated Photo Enforcement Program, between the SFMTA and American Traffic Solutions, Inc., for a contract amount not to exceed $5,000,000, and an initial contract term of one-year and nine-months, with an option to extend the term for up to an additional two years at the City's sole discretion.

I certify that the foregoing resolution was adopted by the San Francisco Municipal Transportation Agency Board of Directors at its meeting of August 21, 2018.

_____

Secretary to the Board of Directors
San Francisco Municipal Transportation Agency

City and County of San Francisco
Municipal Transportation Agency
One South Van Ness Ave., 7th Floor
San Francisco, California 94103

Agreement between the City and County of San Francisco and

American Traffic Solutions, Inc.

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Appendices:

City and County of San Francisco
Municipal Transportation Agency
One South Van Ness Ave., 7th Floor
San Francisco, California 94103

Agreement between the City and County of San Francisco and American Traffic Solutions, Inc. Contract No. SFMTA-2016-49

This Agreement, dated as of August 21, 2018, in the City and County of San Francisco, State of California, by and between American Traffic Solutions, Inc., a corporation duly organized and existing under the laws of Kansas, doing business as Verra Mobility (Contractor) and the City and County of San Francisco (City), acting by and through its Municipal Transportation Agency (SFMTA). (Contractor and the SFMTA, collectively the Parties.)

Recitals

A. In accordance with state law, the SFMTA wishes to utilize the City's Automated Photo Enforcement System to identify and issue Citations to motorists that commit Violations at certain City-street intersections. (Citation(s) and Violation(s), both terms defined in Article 1, below.)

B. On April 14, 2015, under authority of San Francisco Administrative Code Chapter 21.1, the SFMTA issued a request for proposals to upgrade and administer the System (RFP), pursuant to which the SFMTA competitively selected Contractor, the highest-qualified proposer, to perform the services over a two-phased contract.

C. The services for Phase I included preparation of construction-ready plans, specifications, and engineer's estimates to install the System Equipment (System Equipment defined in Article 1, below), which services Contractor performed under Contract No. SFMTA-2015-13.

D. The services for Phase II include furnishing of System Equipment to City's Construction Contractor, construction consultation, leasing of digital System Equipment, maintenance of System Equipment, and program administration (collectively, the Services), which Contractor will perform under this Agreement.

E. Contractor represents and warrants it is qualified to perform the Services required by City as set forth under this Agreement.

F. The Local Business Entity (LBE) subcontracting participation requirement for this Agreement is 15 %.

G. Approval for this Agreement was obtained when the Civil Service Commission approved Contract No. 48177-14/15 on August 17, 2015.

Now, THEREFORE, the Parties agree as follows:

Article 1 Definitions

The following definitions apply to this Agreement:

1.1 "Agreement" means this contract document, including all attached appendices, and applicable City Ordinances and Mandatory City Requirements that are specifically incorporated into this Agreement by reference as provided herein.

1.2 "Alleged Violator" means the driver of the vehicle that has committed an alleged Violation.

1.3 "Approach" means a group of traffic lanes at an intersection that is enforced by the System, and the System Equipment used to enforce that approach.

1.4 "Automated Photo Enforcement Program" means the City's automated photo enforcement program.

1.5 "Business Day" means days on which the SFMTA is officially open for business, except Saturdays, Sundays, and official holidays observed by the City and County of San Francisco.

1.6 "Business Rules" means the policies that define when and how a Citation can be issued, as set forth in Appendix A, Section 3.A together with the Business Rules Questionnaire to be completed by SFMTA and delivered to Contractor in substantially the form set forth as Appendix G.

1.7 "Camera Unit" means the camera, computer, and flash unit used for automated photo enforcement.

1.8 "**CCO**" means SFMTA Contract Compliance Office.

1.9 "Change Order" means the written instrument the SFMTA and Contractor execute to document their agreement on changes to the Services.

1.10 "Change Order Notice" means the document describing the proposed changes to the scope of Services requested by the SFMTA.

1.11 "Change Order Proposal" means the proposal prepared by the Contractor in response to the SFMTA's Change Order request.

1.12 "Citation or Notice to Appear" means the document detailing Violations captured by the System (see Appendix A), including, but not limited to, the California Judicial Council approved Citation form and no less than four (4) Images of the violation: one full view of the vehicle entering the intersection illegally, one full view of the vehicle in the center of the

intersection in violation, one enlargement of the license plate, and one enlargement of the driver's face.

1.13 "**City**" or "the City" means the City and County of San Francisco, a municipal corporation.

1.14 "**CMD**" means the Contract Monitoring Division of the City.

1.15 "Construction Contractor" means the City's construction contractor, with which the City has entered into a separate contract to install the System Equipment and perform related construction work.

1.16 "Construction Consultation" means the service the Contractor will provide during the construction phase in which the Contractor's qualified personnel will be present on site for key milestones, available to troubleshoot issues as they arise, answer questions about design and installation details, and will fully inspect and test the equipment after it is installed.

1.17 "Construction Design Plans" means the detailed design plans prepared by Contractor under Phase I and included in SF Public Works Contract No. 1000005983 for the installation of the System Equipment.

1.18 "**Contract Administrator**" means the contract administrator assigned to the Contract by the SFMTA, or his or her designated agent.

1.19 "Contractor Project Manager" means Contractor's designated personnel serving as the SFMTA's main point-of-contact for all day to day operational matters relating to the Automated Photo Enforcement Program.

1.20 "**Contractor**" or "**Consultant**" means Verra Mobility, with principal offices located at 1150 N. Alma School Road, Mesa, AZ 85201.

1.21 "Contractor's Proposal" means Contractor's response to Request for Proposals, dated June 18, 2015 and incorporated by reference into this Agreement as though fully set forth herein.

1.22 "Court Evidence Package" means the series of documents related to a particular alleged Violation prepared by the Contractor and sent to the SFPD upon request. See Appendix A, Section 3.A(vii).

1.23 "Day" means calendar day unless otherwise expressly specified.

1.24 "**Deliverables**" means Contractor's work product resulting from the Services that are provided by Contractor to City during the course of Contractor's performance of the Agreement, including without limitation, the work product described in the "Scope of Services" attached as Appendix A.

1.25 "**Effective Date**" means the date on which Contractor can begin work under this Agreement, as indicated in the Notice to Proceed, which date shall not be earlier than the date

upon which the City's Controller certifies the availability of funds for this Agreement as provided in Section 3.1.

1.26 "Events" means all vehicle movements that trigger the System, both Violations and non-Violations.

1.27 "Field Technical Service and Inspection Log" means the log produced after routine inspection and testing of the System Equipment is completed at each Approach to verify System Equipment is working properly.

1.28 "Image Analysis" means the human review of Images to determine if an Event meets the Business Rules and should be transferred to the SFPD for review and determination as to whether or not a Violation occurred.

1.29 "Image" means the digital photograph or digital video recording captured by the System Equipment.

1.30 "Image Processing Unit" means the computer, hub, or other unit that controls the camera, flash, detection device, key pad, and associated electronics. This unit may control one camera or several cameras.

1.31 "Indemnitee(s)" shall have the meaning set forth in Section 5.2.

1.32 "Lease" means the agreement between the SFMTA and the Contractor by which the Contractor shall lease the System Equipment to the SFMTA.

1.33 "Lease Fees" means the monthly fee paid to Contractor by the SFMTA for the lease of the System Equipment.

1.34 "Maintenance" means the work required to maintain the quality, reliability, and accuracy of the System Equipment, including periodic service and any adjustments or repairs made to System Equipment.

1.35 "Malfunction" means any malfunction, operational error, damage, or other error or problem with the System or System Equipment.

1.36 "Malfunction Notice" means a written notice that describes the time and date of discovery of the Malfunction, location and nature of the Malfunction, and any other relevant information related to the Malfunction.

1.37 "**Mandatory City Requirements**" means those City laws set forth in the San Francisco Municipal Code, including the duly authorized rules, regulations, and guidelines implementing such laws, that impose specific duties and obligations upon Contractor.

1.38 "Monthly Status Report" means the report prepared by the Contractor on a monthly basis detailing any Malfunctions, third-party damages, or other reasons affecting operation of the System and the number of days not in service because of those reasons at each Approach.

1.39 "Monthly Viewing Report" means the report prepared by the Contractor on a monthly basis detailing the number of events detected, Violations, and Citations issued at each Approach.

1.40 "Notice to Proceed" means the letter the SFMTA issues to Contractor indicating the Effective Date and end date of the term of this Agreement.

1.41 "**Party**" and "**Parties**" mean the City and Contractor either collectively or individually.

1.42 "Purchase Order" means the written order issued by the City to the Contractor, authorizing the Effective Date as provided in Section 2.1.

1.43 "Red Phase" means the portion of the traffic signal light sequence when a red signal indication is displayed.

1.44 "Request for Proposals" or "RFP" means the Request for Proposals issued by the City on April 14, 2015, and incorporated by reference into this Agreement as though fully set forth herein.

1.45 "Services" means the work performed by Contractor under this Agreement as specifically described in the "Scope of Services" attached as Appendix A, including all services, labor, supervision, materials, equipment, actions and other requirements to be performed and furnished by Contractor under this Agreement.

1.46 "**San Francisco Municipal Transportation Agency**" or "**SFMTA**" means the agency of City with jurisdiction over all surface transportation in San Francisco, as provided under Article VIIIA of the City's Charter.

1.47 "SFMTA Program Manager" means the SFMTA Program Manager responsible for direction and coordination of Automated Photo Enforcement Program.

1.48 "**SFPD**" means the San Francisco Police Department.

1.49 "System" means the complete automated photo enforcement system including, but not limited to, camera units and system equipment, complete design and installation, maintenance and servicing, image analysis, Notice to Appear (Citation) processing, system management software, citation processing by Contractor, and establishing and maintaining working relationships with all participating City agencies and departments relating to the Automated Photo Enforcement Program.

1.50 "System Equipment" means the equipment that includes, but is not limited to, proprietary cameras, computers, flash units, housing, poles, auxiliary flashes, conduits, image analysis units, pull boxes, wiring, and vehicle detection equipment.

1.51 "Third Party Damage" means damage caused by a party other than the City, its agents, employees, officers, contractors or Contractor.

1.52 "Traffic Signal Controller" means the signal controller, controller interface, control boxes, loops and detectors which are separate from the System Equipment whose primary function is the safe and orderly movement of traffic through an intersection by alternating right-of-way between intersecting streets.

1.53 "Vehicle Detection" means inductive wire loops, wireless in-pavement sensors, radar sensors, or any other type of detection used to detect vehicles.

1.54 "Violation" means the red light or other moving violation, such as an illegal turn, captured by the System.

1.55 "Violation Data" means all Images and data associated with a Violation.

1.56 "Warning Period/Grace Period" means the 30-day period immediately following the date of installation of a fully operational enforcement System when warning notices are issued instead of Citations.

Article 2 Term of the Agreement

2.1 The term of this Agreement shall commence on the Effective Date, and shall expire one year and nine months from the Effective Date, as set forth in the Notice to Proceed, unless earlier terminated as otherwise provided herein.

2.2 The City has two options to renew the Agreement for a period of one year each. The City may extend the term of this Agreement beyond the expiration date by exercising an option at the Director of Transportation's sole and absolute discretion and by modifying this Agreement as provided in Section 11.5 (Modification of this Agreement).

Article 3 Financial Matters

3.1 Certification of Funds; Budget and Fiscal Provisions; Termination in the Event of Non-Appropriation. This Agreement is subject to the budget and fiscal provisions of the City's Charter. Charges will accrue only after prior written authorization certified by the Controller in the form of a Purchase Order, and the amount of City's obligation hereunder shall not at any time exceed the amount certified for the purpose and period stated in such advance authorization. This Agreement will terminate without penalty, liability, or expense of any kind to City at the end of any fiscal year if funds are not appropriated for the next succeeding fiscal year. If funds are appropriated for a portion of the fiscal year, this Agreement will terminate, without penalty, liability, or expense of any kind to the City at the end of the term for which funds are appropriated. City has no obligation to make appropriations for this Agreement in lieu of appropriations for new or other agreements. City budget decisions are subject to the discretion of the Mayor and the Board of Supervisors. Contractor's assumption of risk of possible non-appropriation is part of the consideration for this Agreement.

THIS SECTION CONTROLS AGAINST ANY AND ALL OTHER PROVISIONS OF THIS AGREEMENT.

3.2 Guaranteed Maximum Costs. The City's payment obligation to Contractor cannot at any time exceed the amount certified by City's Controller for the purpose and period stated in such certification. Absent an authorized Emergency per the City Charter or applicable Code, no City representative is authorized to offer or promise, nor is the City required to honor, any offered or promised payments to Contractor under this Agreement in excess of the certified maximum amount without the Controller having first certified the additional promised amount and the Parties having modified this Agreement as provided in Section 11.5 (Modification of this Agreement).

3.3 Compensation.

3.3.1 Amount of Agreement. In no event shall the amount of this Agreement exceed FIVE MILLION DOLLARS ($5,000,000). Appendix B (Calculation of Charges) sets forth the charges Contractor is authorized to invoice to the SFMTA for performing the Services. Appendix B breaks down these authorized charges by category of Services as follows: program administration, estimated third-party damage repairs, construction consultation, and system equipment leases.

3.3.2 Payment. Unless provided otherwise in Appendix B, Contractor shall provide an invoice to the SFMTA on a monthly basis for Services completed in the immediately preceding month. The City shall pay Contractor for Services identified in the invoice that the SFMTA's designee, in their sole discretion, determines have been satisfactorily performed. The City shall pay Contractor within 30 Days of receipt of the invoice, unless the City notifies Contractor that a dispute as to the invoice exists. In no event shall the City be liable for interest or late charges for any late payments.

3.3.3 Payment Limited to Satisfactory Services. Contractor is not entitled to any payments from City until the SFMTA approves Services, including any Deliverables furnished, as complying with all the requirements of this Agreement. The City's payments to Contractor for Services performed shall not excuse Contractor from its obligation to replace Deliverables, including equipment, components, materials, or Services that do not comply with the requirements of this Agreement, even if the City does not detect or discover the non-compliance at the time such payments were made. The City may at any time reject Deliverables, equipment, components, materials, and Services that do not comply with the requirements of this Agreement, in which case Contractor shall replace such rejected Deliverables, equipment, components, materials, and Services without delay and at no additional cost to the City.

3.3.4 Withhold Payments. If Contractor fails to provide Services in accordance with Contractor's obligations under this Agreement, the City may withhold all payments due Contractor until such failure to perform is cured, and Contractor shall not stop work as a result of City's withholding of payments as provided herein.

3.3.5 Invoice Format. Invoices furnished by Contractor under this Agreement must be in a form acceptable to the Controller and City, and must include a unique invoice

number. Payment shall be made by City to Contractor at the electronic address specified in Section 3.3.6, or in such alternate manner as the Parties have mutually agreed upon in writing.

3.3.6 LBE Payment. Contractor must submit all required CMD payment forms to enable CCO to monitor Contractor's compliance with the LBE subcontracting commitments in this Agreement. Contractor shall pay its LBE subcontractors within three Business Days after receiving payment from SFMTA, except as otherwise authorized by the LBE Ordinance. The Controller is not authorized to pay invoices submitted by Contractor prior to Contractor's submission of all required CMD payment forms. Contractor's failure to submit all required CMD payment forms with each payment request may result in the Controller withholding 20% of the payment due pursuant to that invoice until the required CMD payment forms are provided. Following SFMTA's payment of an invoice, Contractor has 10 Days to submit a CMD Form 9 Payment Affidavit verifying its payments to LBE subcontractors.

3.3.7 Getting Paid for Goods and/or Services from the City.

(a) All City vendors receiving new contracts, contract renewals, or contract extensions must sign up to receive electronic payments through the City's Automated Clearing House (ACH) payments service/provider. Electronic payments are processed every business day and are safe and secure. To sign up for electronic payments, visit www.sfgov.org/ach.

(b) The following information is required to sign up: (i) The enroller must be their company's authorized financial representative, (ii) the company's legal name, main telephone number and all physical and remittance addresses used by the company, (iii) the company's U.S. federal employer identification number (EIN) or Social Security number (if they are a sole proprietor), and (iv) the company's bank account information, including routing and account numbers.

3.4 Audit and Inspection of Records. Contractor agrees to maintain and make available to the City, during regular business hours, accurate books and accounting records relating to Contractor's performance of the Services. Upon reasonable advance written notice, Contractor shall permit City to audit, examine, and make excerpts and transcripts from such books and records, and to make audits of all invoices, materials, payrolls, records, or personnel and other data related to all other matters covered by this Agreement, whether funded in whole or in part under this Agreement, subject to Section 13.1.3. Contractor shall maintain such data and records in an accessible location and condition for a period of not fewer than five years after final payment under this Agreement or until after final audit has been resolved, whichever is later. The State of California or any Federal agency having an interest in the subject matter of this Agreement shall have the same rights as conferred upon City by this Section 3.4. Contractor shall include the same audit and inspection rights and record retention requirements in all subcontracts.

3.5 Submitting False Claims. The full text of San Francisco Administrative Code Chapter 21, Section 21.35, including the enforcement and penalty provisions, is incorporated into

this Agreement. Pursuant to San Francisco Administrative Code section 21.35, any contractor or subcontractor who submits a false claim shall be liable to the City for the statutory penalties set forth in that section. A contractor or subcontractor will be deemed to have submitted a false claim to the City if the contractor or subcontractor: (a) knowingly presents or causes to be presented to an officer or employee of the City a false claim or request for payment or approval; (b) knowingly makes, uses, or causes to be made or used a false record or statement to get a false claim paid or approved by the City; (c) conspires to defraud the City by getting a false claim allowed or paid by the City; (d) knowingly makes, uses, or causes to be made or used a false record or statement to conceal, avoid, or decrease an obligation to pay or transmit money or property to the City; or (e) is a beneficiary of an inadvertent submission of a false claim to the City, subsequently discovers the falsity of the claim, and fails to disclose the false claim to the City within a reasonable time after discovery of the false claim.

3.6 Payment of Prevailing Wages.

3.6.1 Covered Services. Services to be performed by Contractor under this Agreement may involve the performance of trade work covered by the provisions of Section 6.22(e) (Prevailing Wages) of the Administrative Code (collectively, "Covered Services"). The provisions of Section 6.22(e) of the Administrative Code are incorporated as provisions of this Agreement as if fully set forth herein and will apply to any Covered Services performed by Contractor and its subcontractors.

3.6.2 Wage Rates. The latest prevailing wage rates for private employment on public contracts as determined by the San Francisco Board of Supervisors and the Director of the California Department of Industrial Relations, as such prevailing wage rates may be changed during the term of this Agreement, are hereby incorporated as provisions of this Agreement. Copies of the prevailing wage rates as fixed and determined by the Board of Supervisors are available from the Office of Labor Standards and Enforcement (OLSE) and are also available on the Internet at http://www.dir.ca.gov/DLSR/PWD. Contractor agrees that it shall pay not less than the prevailing wage rates, as fixed and determined by the Board, to all workers employed by Contractor who perform Covered Services under this Agreement. Contractor further agrees as follows:

3.6.3 Subcontract Requirements. As required by Section 6.22(e)(5) of the Administrative Code, Contractor shall insert in every subcontract or other arrangement, which it may make for the performance of Covered Services under this Agreement, a provision that said subcontractor shall pay to all persons performing labor in connection with Covered Services under said subcontract or other arrangement not less than the highest general prevailing rate of wages as fixed and determined by the Board of Supervisors for such labor or services.

3.6.4 Posted Notices. As required by Section 1771.4 of the California Labor Code, Contractor shall post job site notices prescribed by the California Department of Industrial Relations (DIR) at all job sites where Covered Services are to be performed.

3.6.5 Payroll Records. As required by Section 6.22(e)(6) of the Administrative Code and Section 1776 of the California Labor Code, Contractor shall keep or cause to be kept complete and accurate payroll records for all trade workers performing Covered Services. Such records shall include the name, address and social security number of each worker who provided Covered Services on the project, including apprentices, his or her classification, a general description of the services each worker performed each day, the rate of pay (including rates of contributions for, or costs assumed to provide fringe benefits), daily and weekly number of hours worked, deductions made and actual wages paid. Every subcontractor who shall undertake the performance of any part of Covered Services shall keep a like record of each person engaged in the execution of Covered Services under the subcontract. All such records shall at all times be available for inspection of and examination by the City and its authorized representatives and the DIR.

3.6.6 Certified Payrolls. Certified payrolls shall be prepared pursuant to Administrative Code Section 6.22(e)(6) and California Labor Code Section 1776 for the period involved for all employees, including those of subcontractors, who performed labor in connection with Covered Services. Contractor and each subcontractor performing Covered Services shall submit certified payrolls to the City and to the DIR electronically. Contractor shall submit payrolls to the City via the reporting system selected by the City. The DIR will specify how to submit certified payrolls to it. The City will provide basic training in the use of the reporting system at a scheduled training session. Contractor and all subcontractors that will perform Covered Services must attend the training session. Contractor and applicable subcontractors shall comply with electronic certified payroll requirements (including training) at no additional cost to the City.

3.6.7 Compliance Monitoring. Covered Services to be performed under this Agreement are subject to compliance monitoring and enforcement of prevailing wage requirements by the DIR and /or the OLSE. Contractor and any subcontractors performing Covered Services will cooperate fully with the DIR and/or the OLSE and other City employees and agents authorized to assist in the administration and enforcement of the prevailing wage requirements, and agrees to take the specific steps and actions as required by Section 6.22(e)(7) of the Administrative Code. Steps and actions include but are not limited to requirements that: (A) the Contractor will cooperate fully with the Labor Standards Enforcement Officer and other City employees and agents authorized to assist in the administration and enforcement of the Prevailing Wage requirements and other labor standards imposed on Public Works Contractor by the Charter and Chapter 6 of the San Francisco Administrative Code; (B) the Contractor agrees that the Labor Standards Enforcement Officer and his or her designees, in the performance of their duties, shall have the right to engage in random inspections of job sites and to have access to the employees of the Contractor, employee time sheets, inspection logs, payroll records and employee paychecks; (C) the contractor shall maintain a sign-in and sign-out sheet showing which employees are present on the job site; (D) the Contractor shall prominently post at each job-site a sign informing employees that the project is subject to the City's Prevailing Wage

requirements and that these requirements are enforced by the Labor Standards Enforcement Officer; and (E) that the Labor Standards Enforcement Officer may audit such records of the Contractor as he or she reasonably deems necessary to determine compliance with the Prevailing Wage and other labor standards imposed by the Charter and this Chapter on Public Works Contractors. Failure to comply with these requirements may result in penalties and forfeitures consistent with analogous provisions of the California Labor Code, including Section 1776(g), as amended from time to time.

3.6.8 Remedies. Should Contractor, or any subcontractor who shall undertake the performance of any Covered Services, fail or neglect to pay to the persons who perform Covered Services under this Contract, subcontract or other arrangement for the Covered Services, the general prevailing rate of wages as herein specified, Contractor shall forfeit, and in the case of any subcontractor so failing or neglecting to pay said wage, Contractor and the subcontractor shall jointly and severally forfeit, back wages due plus the penalties set forth in Administrative Code Section 6.22 (e) and/or California Labor Code Section 1775. The City, when certifying any payment which may become due under the terms of this Agreement, shall deduct from the amount that would otherwise be due on such payment the amount of said forfeiture.

Article 4 Services and Resources

4.1 Services Contractor Agrees to Perform. Contractor agrees to perform the Services described in Appendix A (Scope of Services). Officers and employees of the City are not authorized to request, and the City is not required to pay Contractor for, services beyond the Services described in Appendix A, unless Appendix A is modified as provided in Section 11.5 (Modification of this Agreement).

4.2 Qualified Personnel. Contractor shall utilize only competent personnel under the supervision of and in the employment of Contractor (or Contractor's authorized subcontractors) to perform the Services. Contractor shall comply with the City's reasonable requests to assign, re-assign, or remove personnel, but all personnel, including those assigned at City's request, shall be supervised by Contractor. Contractor shall commit adequate resources to allow timely performance of the Services within the timelines set forth in this Agreement.

4.3 Subcontracting.

4.3.1 Contractor may subcontract portions of the Services only upon prior written approval of City. Contractor is responsible for its subcontractors throughout the course of the work required to perform the Services. All Subcontracts must incorporate the terms of Article 10 (Additional Requirements Incorporated by Reference) of this Agreement, unless inapplicable. Neither Party shall, on the basis of this Agreement, contract on behalf of, or in the name of, the other Party. Any agreement made in violation of this provision shall be null and void.

4.3.2 City's execution of this Agreement constitutes its approval of the subcontractors listed below.

Urban Design Consulting Engineers
350 Townsend St., Suite 409
San Francisco, CA 94107

Direct Mail Center
1099 Mariposa Street
San Francisco, CA 94107
415-252-1600 ext 101

Bay Area Lightworks
1460 Yosemite Ave
San Francisco, CA 94124
415-822-2336

Qualfon Data Services Group, LLC
77 Mack Walters Rd Suite 200
Shelbyville, Kentucky 40065

4.4 Independent Contractor; Payment of Employment Taxes and Other Expenses.

4.4.1 Independent Contractor. For the purposes of this Article 4, "Contractor" shall be deemed to include not only Contractor, but also any agent or employee of Contractor. Contractor acknowledges and agrees that at all times, Contractor or any agent or employee of Contractor shall be deemed at all times to be an independent contractor and is wholly responsible for the manner in which it performs the Services and work requested by the City under this Agreement. Contractor, its agents, and employees shall not represent or hold themselves out to be employees of the City at any time. Contractor or any agent or employee of Contractor shall not have employee status with the City, nor be entitled to participate in any plans, arrangements, or distributions by the City pertaining to or in connection with any retirement, health or other benefits that the City may offer its employees. Contractor or any agent or employee of Contractor is liable for the acts and omissions of itself, its employees and its agents. Contractor shall be responsible for all obligations and payments, whether imposed by federal, state, or local law, including, but not limited to, FICA, income tax withholdings, unemployment compensation, insurance, and other similar responsibilities related to Contractor's performing the Services and work, or any agent or employee of Contractor providing same. Nothing in this Agreement shall be construed as creating an employment or agency relationship between the City and Contractor or any agent or employee of Contractor. Any terms in this Agreement referring to direction from the City shall be construed as providing for direction as to policy and the result of Contractor's

work only, and not as to the means by which such a result is obtained. The City does not retain the right to control the means or the methods by which Contractor performs work under this Agreement. Notwithstanding the foregoing, Contractor shall act as a limited agent of the SFMTA for purposes of (i) accessing to DMV records; and (ii) generating and administratively processing recorded Images of Events as described in this Agreement and the Business Rules. Contractor agrees to maintain and make available to the City, upon request and during regular business hours, accurate books and accounting records demonstrating Contractor's compliance with this section. Should the City determine that Contractor, or any agent or employee of Contractor, is not performing in accordance with the requirements of this Agreement, the City shall provide Contractor with written notice of such failure. Within five business days of Contractor's receipt of such notice, and in accordance with Contractor policy and procedure, Contractor shall remedy the deficiency. Notwithstanding, if the City believes that an action of Contractor, or any agent or employee of Contractor, warrants immediate remedial action by Contractor, the City shall contact Contractor and provide Contractor in writing with the reason for requesting such immediate action.

4.4.2 Payment of Employment Taxes and Other Expenses. If the City, in its discretion, or a relevant taxing authority such as the Internal Revenue Service or the State Employment Development Division, or both, determine Contractor is an employee for purposes of collection of any employment taxes, the amounts payable under this Agreement shall be reduced by amounts equal to both the employee and employer portions of the taxes due (and offsetting any credits for amounts already paid by Contractor which can be applied against this liability). The City shall then forward those amounts to the relevant taxing authority. If a relevant taxing authority determines a liability for past services performed by Contractor for City, upon notification of such fact by City, Contractor shall promptly remit such amount due or arrange with City to have the amount due withheld from future payments to Contractor under this Agreement (again, offsetting any amounts already paid by Contractor which can be applied as a credit against such liability). A determination of employment status pursuant to the preceding two paragraphs shall be solely for the purposes of the particular tax in question, and for all other purposes of this Agreement, Contractor shall not be considered an employee of the City. Notwithstanding the foregoing, Contractor agrees to indemnify and save harmless the City and its officers, agents and employees from, and, if requested, shall defend them against any and all claims, losses, costs, damages, and expenses, including attorneys' fees, arising from this section.

4.5 Assignment. The Services to be performed by Contractor are personal in character, and neither this Agreement nor any duties or obligations hereunder may be assigned or delegated by Contractor unless first approved by the City by written instrument executed and approved in the same manner as this Agreement. Any purported assignment made in violation of this provision shall be null and void.

4.6 Warranty. Contractor warrants to the City that the Services will be performed with the degree of skill and care that is required by current, good, and sound professional procedures and practices, and in conformance with generally accepted professional standards

prevailing at the time the Services are performed so as to ensure that all the Services performed are correct and appropriate for the purposes contemplated in this Agreement.

4.7 Liquidated Damages.

4.7.1 Contractor acknowledges that Contractor's failure to perform certain obligations under this Agreement, within the respective time limits imposed, will cause the City to incur costs and inconvenience not contemplated under this Agreement, that this cost and inconvenience will constitute damages to the City, the SFMTA, and the public, and that the exact amount of these damages will be extremely difficult or impractical to fix. The Parties agree that the amounts described below as liquidated damages are not penalties, that these amounts represent a fair and reasonable estimate of the damages the City will incur for the failures described, and that these amounts are fair compensation to the City for its losses.

(a) For each day Contractor fails to correct a Malfunction within the earlier of 72 hours of Contractor's discovery of the Malfunction or receipt of a Malfunction Notice, and where such failure results in loss or non-collection of Violation Data, Contractor agrees to pay the SFMTA liquidated damages in the amount of 1/30th of Contractor's monthly charges for the applicable System Equipment. Contractor's monthly charges for the applicable System Equipment include the Monthly Total for Program Administration Charges shown in Column B of Appendix B, Exhibit 1 plus the Monthly Total for System Equipment Lease Charges shown in Column C of Appendix B, Exhibit 4.

(b) For each failure to timely deliver to the SFPD a Court Evidence Package by the applicable time limit set forth in Appendix A, Section 3.A(vii) that results in the dismissal of the corresponding case, Contractor agrees to pay the SFMTA liquidated damages in the amount of $170.

4.7.2 The SFMTA may deduct a sum representing the liquidated damages from any money due to Contractor under this Agreement or any other contract between City and Contractor.

4.8 Bonding Requirements. Contractor is required to furnish a performance bond in a form acceptable to the City, in a sum of not less than one million dollars ($1,000,000) to guarantee the faithful performance of this contract.

Article 5 Insurance and Indemnity

5.1 Insurance.

5.1.1 Required Coverages. Without in any way limiting Contractor's liability pursuant to the "Indemnification" section of this Agreement, Contractor shall maintain in force, during the full term of the Agreement, insurance in the following amounts and coverages:

(a) Workers' Compensation, in statutory amounts, with Employers' Liability Limits not less than $1,000,000 each accident, injury, or illness; and

(b) Commercial General Liability Insurance with limits not less than $1,000,000 each occurrence and $2,000,000 general aggregate for Bodily Injury and Property Damage, including Contractual Liability, Personal Injury, Products and Completed Operations; and

(c) Commercial Automobile Liability Insurance with limits not less than $1,000,000 each occurrence, "Combined Single Limit" for Bodily Injury and Property Damage, including Owned, Non-Owned and Hired auto coverage, as applicable.

(d) Professional liability insurance, applicable to Contractor's profession, with limits not less than $1,000,000 each claim with respect to negligent acts, errors or omissions in connection with the Services.

(e) Technology Errors and Omissions Liability coverage, with limits of $1,000,000 each occurrence and each loss, and $2,000,000 general aggregate. The policy shall at a minimum cover professional misconduct or lack of the requisite skill required for the performance of services defined in the contract and shall also provide coverage for the following risks:

(i) Network security liability arising from the unauthorized access to, use of, or tampering with computers or computer systems, including hacker attacks; and

(ii) Liability arising from the introduction of any form of malicious software including computer viruses into, or otherwise causing damage to the City's or third person's computer, computer system, network, or similar computer related property and the data, software, and programs thereon.

(f) Contractor shall maintain in force during the full life of the agreement Cyber and Privacy Insurance with limits of not less than $5,000,000 per claim and $5,000,000 general aggregate. Such insurance shall include coverage for liability arising from theft, dissemination, and/or use of confidential information, including but not limited to, bank and credit card account information or personal information, such as name, address, social security numbers, protected health information or other personally identifying information, stored or transmitted in electronic form. Excess or umbrella coverage may be used to comply with this requirement.

5.1.2 Commercial General Liability and Commercial Automobile Liability Insurance policies must be endorsed to provide:

(a) Name as Additional Insured the City and County of San Francisco, its Officers, Agents, and Employees.

(b) That such policies are primary insurance to any other insurance available to the Additional Insureds, with respect to any claims arising out of this Agreement, and that insurance applies separately to each insured against whom claim is made or suit is brought.

5.1.3 All policies shall be endorsed to provide 30 days' advance written notice to the City of cancellation for any reason or intended non-renewal, and ten days' written notice for non-payment of premium. Notices shall be sent to the City address set forth in Section 11.1 (Notices to the Parties). All notices, certificates and endorsements shall include the SFMTA contract number and title on the cover page. Contractor shall provide 30 days' written notice to City prior to implementation of a reduction of limits or material change of insurance coverage as specified herein.

5.1.4 Should any of the required insurance be provided under a claims-made form, Contractor shall maintain such coverage continuously throughout the term of this Agreement and, without lapse, for a period of three years beyond the expiration of this Agreement, to the effect that, should occurrences during the contract term give rise to claims made after expiration of the Agreement, such claims shall be covered by such claims-made policies.

5.1.5 Should any of the required insurance be provided under a form of coverage that includes a general annual aggregate limit or provides that claims investigation or legal defense costs be included in such general annual aggregate limit, such general annual aggregate limit shall be double the occurrence or claims limits specified above.

5.1.6 Should any required insurance lapse during the term of this Agreement, requests for payments originating after such lapse shall not be processed until the City receives satisfactory evidence of reinstated coverage as required by this Agreement, effective as of the lapse date. If insurance is not reinstated, the City may, at its sole option, terminate this Agreement effective on the date of such lapse of insurance.

5.1.7 Before commencing any Services, Contractor shall furnish to City certificates of insurance and additional insured policy endorsements with insurers with ratings comparable to A-, VIII or higher, that are authorized to do business in the State of California, and that are satisfactory to City, in form evidencing all coverages set forth above. Failure to maintain insurance shall constitute a material breach of this Agreement. Approval of the insurance by City shall not relieve or decrease Contractor's liability hereunder.

5.1.8 The Workers' Compensation policy(ies) shall be endorsed with a waiver of subrogation in favor of the City for all work performed by the Contractor, its employees, agents and subcontractors.

5.1.9 If Contractor will use any subcontractor(s) to provide Services, Contractor shall require the subcontractor(s) to provide all necessary insurance and to name the City and County of San Francisco, its officers, agents and employees and the Contractor as additional insureds.

5.2 Indemnification. Contractor shall indemnify and hold harmless the City and its officers, agents, and employees ("Indemnitee(s)") from, and, if requested, shall defend them from and against any and all claims, demands, losses, damages, costs, expenses, and liability

(legal, contractual, or otherwise) arising from or in any way connected with any: (i) injury to or death of a person, including employees of City or Contractor; (ii) loss of or damage to property; (iii) violation of local, state, or federal common law, statute or regulation, including but not limited to privacy or personally identifiable information; (iv) strict liability imposed by any law or regulation; or (v) losses arising from Contractor's execution of subcontracts not in accordance with the requirements of this Agreement applicable to subcontractors; so long as such Liabilities (as set forth in subsections (i) – (v) above) arise directly or indirectly from Contractor's performance of the Services described in Appendix A to Agreement, including, but not limited to, Contractor's use of facilities or equipment provided by the City or others, regardless of the negligence of, and regardless of whether liability without fault is imposed or sought to be imposed on City, except to the extent that such indemnity is void or otherwise unenforceable under applicable law, and except where such Liabilities are the result of the active negligence or willful misconduct of the City and is not contributed to by any act of, or by any omission to perform some duty imposed by law or agreement on Contractor, its subcontractors, or either's agent or employee. The foregoing indemnity shall include, without limitation, reasonable fees of attorneys, consultants and experts and related costs and City's costs of investigating any claims against the City.

In addition to Contractor's obligation to indemnify City, Contractor specifically acknowledges and agrees that it has an immediate and independent obligation to defend City from any claim which actually or potentially falls within this indemnification provision, even if the allegations are or may be groundless, false or fraudulent, which obligation arises at the time such claim is tendered to Contractor by City and continues at all times thereafter.

Contractor shall indemnify and hold City harmless from all loss and liability, including attorneys' fees, court costs and all other litigation expenses for any infringement of the patent rights, copyright, trade secret or any other proprietary right or trademark, and all other intellectual property claims of any person or persons arising directly or indirectly from the receipt by City, or any of its officers or agents, of Contractor's Services.

5.2.1 Limitations. No insurance policy covering Contractor's performance under this Agreement shall operate to limit Contractor's liabilities under this provision. Nor shall the amount of insurance coverage operate to limit the extent of such liabilities. Contractor assumes no liability whatsoever for the sole negligence, active negligence, or willful misconduct of any Indemnitee or the contractors of any Indemnitee.

5.2.2 Intellectual Property Infringement. Contractor shall also indemnify, defend and hold harmless all Indemnitees from all suits or claims for infringement of the patent rights, copyright, trade secret, trade name, trademark, service mark, or any other proprietary right of any person or persons in consequence of the use by the City, or any of its boards, commissions, officers, or employees of articles, work or deliverables supplied in the performance of Services. Infringement of patent rights, copyrights, or other proprietary rights in the performance of this Agreement, if not the basis for indemnification under the law, shall nevertheless be considered a material breach of contract.

Article 6 Liability of the Parties

6.1 Liability of City. THE CITY'S PAYMENT OBLIGATIONS UNDER THIS AGREEMENT SHALL BE LIMITED TO THE PAYMENT OF THE COMPENSATION PROVIDED FOR IN SECTION 3.3.1 (PAYMENT) OF THIS AGREEMENT. NOTWITHSTANDING ANY OTHER PROVISION OF THIS AGREEMENT, IN NO EVENT SHALL THE CITY BE LIABLE, REGARDLESS OF WHETHER ANY CLAIM IS BASED ON CONTRACT OR TORT, FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOST PROFITS, ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT OR THE SERVICES PERFORMED IN CONNECTION WITH THIS AGREEMENT.

6.2 Liability for Use of Equipment. The City shall not be liable for any damage to persons or property as a result of the use, misuse, or failure of any equipment used by Contractor, or any of its subcontractors, or by any of their employees, even though such equipment is furnished, rented, or loaned by City.

6.3 Liability for Incidental and Consequential Damages. The City and Contractor waive claims against each other for incidental and consequential damages that arise out of or relate to this Agreement.

Article 7 Payment of Taxes

7.1 Except for any applicable California sales and use taxes charged by Contractor to the City, Contractor shall pay all taxes, including possessory interest taxes levied upon or as a result of this Agreement, or the Services delivered pursuant hereto. Contractor shall remit to the State of California any sales or use taxes paid by the City to Contractor under this Agreement. Contractor agrees to promptly provide information requested by the City to verify Contractor's compliance with any State requirements for reporting sales and use tax paid by City under this Agreement.

7.2 Contractor acknowledges that this Agreement may create a "possessory interest" for property tax purposes. Generally, such a possessory interest is not created unless the Agreement entitles the Contractor to possession, occupancy, or use of City property for private gain. If such a possessory interest is created, then the following shall apply:

7.2.1 Contractor, on behalf of itself and any permitted successors and assigns, recognizes and understands that Contractor, and any permitted successors and assigns, may be subject to real property tax assessments on the possessory interest.

7.2.2 Contractor, on behalf of itself and any permitted successors and assigns, recognizes and understands that the creation, extension, renewal, or assignment of this Agreement may result in a "change in ownership" for purposes of real property taxes, and therefore may result in a revaluation of any possessory interest created by this Agreement. Contractor accordingly agrees on behalf of itself and its permitted successors and assigns to

report on behalf of the City to the County Assessor the information required by Revenue and Taxation Code section 480.5, as amended from time to time, and any successor provision.

7.2.3 Contractor, on behalf of itself and any permitted successors and assigns, recognizes and understands that other events also may cause a change of ownership of the possessory interest and result in the revaluation of the possessory interest. (see, e.g., Rev. & Tax. Code section 64, as amended from time to time). Contractor accordingly agrees on behalf of itself and its permitted successors and assigns to report any change in ownership to the County Assessor, the State Board of Equalization or other public agency as required by law.

7.2.4 Contractor further agrees to provide such other information as may be requested by the City to enable the City to comply with any reporting requirements for possessory interests that are imposed by applicable law.

Article 8 Termination and Default

8.1 Termination for Convenience

8.1.1 The City shall have the option, in its sole discretion, to terminate this Agreement, at any time during the term hereof, for convenience and without cause. The City shall exercise this option by giving Contractor written notice no less than 30 days in advance of termination. The notice shall specify the date on which termination shall become effective.

8.1.2 Upon receipt of the notice of termination, Contractor shall commence and perform, with diligence, all actions necessary on the part of Contractor to effect the termination of this Agreement on the date specified by the City and to minimize the liability of Contractor and the City to third parties as a result of the termination. All such actions shall be subject to the prior approval of the City. Such actions shall include, without limitation:

(a) Halting the performance of all Services under this Agreement on the date(s) and in the manner specified by the SFMTA.

(b) Terminating all existing orders and subcontracts, and not placing any further orders or subcontracts for materials, Services, equipment, or other items.

(c) At the SFMTA's direction, assigning to the City any or all of Contractor's right, title, and interest under the orders and subcontracts terminated. Upon such assignment, the SFMTA shall have the right, in its sole discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.

(d) Subject to the SFMTA's approval, settling all outstanding liabilities and all claims arising out of the termination of orders and subcontracts.

(e) Completing performance of any Services that the SFMTA designates to be completed prior to the date of termination specified by the SFMTA.

(f) Taking such action as may be necessary, or as the SFMTA may direct, for the protection and preservation of any property related to this Agreement which is in the possession of Contractor and in which the SFMTA has or may acquire an interest.

8.1.3 In addition to the invoice reflecting the fee as provided in Appendix B for the Services performed under this Agreement, within 30 days after the specified termination date, Contractor shall submit to the SFMTA an invoice, which shall set forth each of the following as a separate line item:

(a) The reasonable cost to Contractor, without profit, for all additional SFMTA-authorized services performed prior to the specified termination date, for which such services the SFMTA has not already tendered payment. Reasonable costs may include a reasonable allowance for actual overhead, not to exceed a total of 10% of Contractor's direct costs for such additional services. Any overhead allowance shall be separately itemized. Contractor may also recover the reasonable cost of preparing the invoice.

(b) A reasonable allowance for profit on the cost of the additional services described in the immediately preceding subsection (a), provided that Contractor can establish, to the satisfaction of the SFMTA, that Contractor would have made a profit had all Services under this Agreement been completed, and provided further, that the profit allowed shall in no event exceed 5% of such cost.

(c) The reasonable cost to Contractor of handling material or equipment returned to the vendor, delivered to the SFMTA or otherwise disposed of as directed by the SFMTA.

(d) A deduction for the cost of materials to be retained by Contractor, if such materials had previously been paid for by the SFMTA, amounts realized from the sale of materials and not otherwise recovered by or credited to the SFMTA, and any other appropriate credits to the SFMTA against the cost of the Services or other work.

8.1.4 In no event shall the City be liable for costs incurred by Contractor or any of its subcontractors after the termination date specified by the SFMTA, except for those costs specifically enumerated and described in Section 8.1.3. Such non-recoverable costs include, but are not limited to, anticipated profits on the Services under this Agreement, post-termination employee salaries, post-termination administrative expenses, post-termination overhead or unabsorbed overhead, attorneys' fees or other costs relating to the prosecution of a claim or lawsuit, prejudgment interest, or any other expense which is not reasonable or authorized under Section 8.1.3.

8.1.5 In arriving at the amount due to Contractor under this Section, the SFMTA may deduct: (i) all payments previously made by the SFMTA for Services covered by Contractor's final invoice; (ii) any claim which the SFMTA may have against Contractor in connection with this Agreement; (iii) any invoiced costs or expenses excluded pursuant to the immediately preceding Section 8.1.4; and (iv) in instances in which, in the opinion of the SFMTA, the cost of any Service performed under this Agreement is excessively high due to costs incurred to remedy or replace defective or rejected Services, the difference between the invoiced amount and the SFMTA's estimate of the reasonable cost of performing the invoiced Services in compliance with the requirements of this Agreement.

8.1.6 The City's payment obligation under this Section shall survive termination of this Agreement.

8.2 Termination for Default; Remedies.

8.2.1 Each of the following shall constitute an immediate event of default (Event of Default) under this Agreement:

(a) Contractor fails or refuses to perform or observe any term, covenant or condition contained in any of the following Sections of this Agreement:

3.5	Submitting False Claims
4.5	Assignment
Article 5	Insurance and Indemnity
Article 7	Payment of Taxes
10.10	Alcohol and Drug-Free Workplace
11.10	Compliance with Laws
13.1	Nondisclosure of Private, Proprietary or Confidential Information

(b) Contractor fails or refuses to perform or observe any other term, covenant, or condition contained in this Agreement, including any obligation imposed by ordinance or statute and incorporated by reference herein, and such default continues for a period of ten days after written notice thereof from the SFMTA to Contractor.

(c) Contractor (i) is generally not paying its debts as they become due; (ii) files, or consents by answer or otherwise to the filing against it of a petition for relief or reorganization or arrangement or any other petition in bankruptcy or for liquidation or to take advantage of any bankruptcy, insolvency or other debtors' relief law of any jurisdiction; (iii) makes an assignment for the benefit of its creditors; (iv) consents to the appointment of a custodian, receiver, trustee, or other officer with similar powers of Contractor or of any substantial part of Contractor's property; or (v) takes action for the purpose of any of the foregoing.

(d) A court or government authority enters an order (i) appointing a custodian, receiver, trustee, or other officer with similar powers with respect to Contractor or with respect to any substantial part of Contractor's property, (ii) constituting an order for relief or approving a petition for relief or reorganization or arrangement or any other petition in bankruptcy or for liquidation or to take advantage of any bankruptcy, insolvency or other debtors' relief law of any jurisdiction, or (iii) ordering the dissolution, winding-up or liquidation of Contractor.

8.2.2 On and after any Event of Default, City shall have the right to exercise its legal and equitable remedies, including, without limitation, the right to terminate this Agreement or to seek specific performance of all or any part of this Agreement. In addition, where applicable, City shall have the right (but no obligation) to cure (or cause to be cured) on behalf of

Contractor any Event of Default; Contractor shall pay to City on demand all costs and expenses incurred by City in effecting such cure, with interest thereon from the date of incurrence at the maximum rate then permitted by law. City shall have the right to offset from any amounts due to Contractor under this Agreement or any other agreement between City and Contractor: (i) all damages, losses, costs, or expenses incurred by City as a result of an Event of Default; and (ii) any liquidated damages levied upon Contractor pursuant to the terms of this Agreement; and (iii), any damages imposed by any ordinance or statute that is incorporated into this Agreement by reference, or into any other agreement with the City.

8.2.3 All remedies provided for in this Agreement may be exercised individually or in combination with any other remedy available hereunder or under applicable laws, rules, and regulations. The exercise of any remedy shall not preclude or in any way be deemed to waive any other remedy. Nothing in this Agreement shall constitute a waiver or limitation of any rights that City may have under applicable law.

8.2.4 Any notice of default must be sent by registered mail to the address set forth in Article 11.

8.3 Non-Waiver of Rights. The omission by either Party at any time to enforce any default or right reserved to it, or to require performance of any of the terms, covenants, or provisions hereof by the other Party at the time designated, shall not be a waiver of any such default or right to which the party is entitled, nor shall it in any way affect the right of the party to enforce such provisions thereafter.

8.4 Rights and Duties upon Termination or Expiration.

8.4.1 This Section and the following Sections of this Agreement listed below, shall survive termination or expiration of this Agreement:

3.3.3	Payment Limited to Satisfactory Services
3.4	Audit and Inspection of Records
3.5	Submitting False Claims
Article 5	Insurance and Indemnity
6.1	Liability of City
6.3	Liability for Incidental and Consequential Damages
Article 7	Payment of Taxes
8.1.6	Payment Obligations
8.4.3	Wind Down
9.1	Ownership of Results
9.2	Works for Hire
11.6	Dispute Resolution Procedure
11.7	Agreement Made in California; Venue
11.8	Construction
11.9	Entire Agreement
11.10	Compliance with Laws

11.11 Severability

13.1 Nondisclosure of Private, Proprietary or Confidential Information

8.4.2 Subject to the survival of the sections and articles identified in Section 8.4.1 above, if this Agreement is terminated prior to expiration of the term specified in Article 2, this Agreement shall be of no further force or effect. Contractor shall transfer title to City, and deliver in the manner, at the times, and to the extent, if any, directed by City, any work in progress, completed work, supplies, equipment, and other materials produced as a part of, or acquired in connection with the performance of this Agreement, and any completed or partially completed work which, if this Agreement had been completed, would have been required to be furnished to City.

8.4.3 Wind Down

Upon termination of this Agreement, including because it has reached the end of its term, the Parties shall take the following actions:

(a) SFMTA shall cease using the Axsis System™ to capture Events.

(b) SFMTA shall return or allow ATS to recover all provided equipment within a reasonable time not to exceed 90 days.

(c) Within 120 days of termination of the Agreement, ATS shall provide SFMTA all evidence package data and information for all Violations then maintained in the Axsis System™ on behalf of the SFMTA. The information shall be delivered in the standard ATS format to the SFMTA on removable media. Upon delivery of said evidence package data and information the SFMTA agrees that ATS is no longer under any obligation to maintain evidence package data or information and that any public records request for such information shall be responded to exclusively by SFMTA, as SFMTA will be the custodian of records for any and all Violations and related evidence package data and information.

Article 9 Rights In Deliverables

9.1 Ownership of Results. Any interest of Contractor or its subcontractors, in the Deliverables, including any drawings, plans, specifications, blueprints, studies, reports, memoranda, computation sheets, computer files, and media or other documents prepared by Contractor or its subcontractors for the purposes of this Agreement, shall become the property of and will be transmitted to City. However, unless expressly prohibited elsewhere in this Agreement, Contractor may retain and use copies for reference and as documentation of its experience and capabilities.

9.2 Works for Hire. If, in connection with the Services, Contractor or its subcontractors create Deliverables including, without limitation, artwork, copy, posters, billboards, photographs, videotapes, audiotapes, systems designs, software, reports, diagrams, surveys, blueprints, source codes, or any other original works of authorship, whether in digital or any other format, such works of authorship shall be works for hire as defined under Title 17 of

the United States Code, and all copyrights in such works shall be the property of the City. If any Deliverables created by Contractor or its subcontractors under this Agreement are ever determined not to be works for hire under U.S. law, Contractor hereby assigns all Contractor's copyrights to such Deliverables to the City, agrees to provide any material and execute any documents necessary to effectuate such assignment, and agrees to include a clause in every subcontract imposing the same duties upon subcontractors. With City's prior written approval, Contractor and its subcontractors may retain and use copies of such works for reference and as documentation of their respective experience and capabilities.

Article 10 Additional Requirements Incorporated by Reference

10.1 Laws Incorporated by Reference. The full text of the laws listed in this Article 10, including enforcement and penalty provisions, are incorporated by reference into this Agreement. The full text of the San Francisco Municipal Code provisions incorporated by reference in this Article and elsewhere in the Agreement (Mandatory City Requirements) are available at http://www.amlegal.com/codes/client/san-francisco_ca.

10.2 Conflict of Interest. By executing this Agreement, Contractor certifies it does not know of any fact that constitutes a violation of Section 15.103 of the City's Charter; Article III, Chapter 2 of City's Campaign and Governmental Conduct Code; Title 9, Chapter 7 of the California Government Code (Section 87100 *et seq.*), or Title 1, Division 4, Chapter 1, Article 4 of the California Government Code (Section 1090 *et seq.*), and further agrees promptly to notify the City if it becomes aware of any such fact during the term of this Agreement.

10.3 Prohibition on Use of Public Funds for Political Activity. In performing the Services, Contractor shall comply with San Francisco Administrative Code Chapter 12G, which prohibits funds appropriated by the City for this Agreement from being expended to participate in, support, or attempt to influence any political campaign for a candidate or for a ballot measure. Contractor is subject to the enforcement and penalty provisions in Chapter 12G.

10.4 Reserved.

10.5 Nondiscrimination Requirements

10.5.1 Nondiscrimination in Contracts. Contractor shall comply with the provisions of Chapters 12B and 12C of the San Francisco Administrative Code. Contractor shall incorporate by reference in all subcontracts the provisions of Sections12B.2(a), 12B.2(c)-(k), and 12C.3 of the San Francisco Administrative Code and shall require all subcontractors to comply with such provisions. Contractor is subject to the enforcement and penalty provisions in Chapters 12B and 12C.

10.5.2 Nondiscrimination in the Provision of Employee Benefits. San Francisco Administrative Code 12B.2. Contractor does not as of the date of this Agreement, and will not during the term of this Agreement, in any of its operations in San Francisco, on real property owned by San Francisco, or where work is being performed for the City elsewhere in the United States, discriminate in the provision of employee benefits between employees with

domestic partners and employees with spouses and/or between the domestic partners and spouses of such employees, subject to the conditions set forth in San Francisco Administrative Code Section 12B.2.

10.6 Local Business Enterprise and Non-Discrimination in Contracting Ordinance. Contractor shall comply with all applicable provisions of Chapter 14B (LBE Ordinance). Contractor is subject to the enforcement and penalty provisions in Chapter 14B. Contractor shall utilize LBE Subcontractors for at least 15% of the Services except as otherwise authorized in writing by the Director of CMD. Contractor shall incorporate the requirements of the LBE Ordinance in each subcontract made in the fulfillment of Contractor's LBE subcontracting commitments.

10.7 Minimum Compensation Ordinance. Contractor shall pay Covered Employees (as such term is defined in San Francisco Administrative Code Chapter 12P) no less than the minimum compensation required by San Francisco Administrative Code Chapter 12P. Contractor is subject to the enforcement and penalty provisions in Chapter 12P. By signing and executing this Agreement, Contractor certifies it is in compliance with Chapter 12P.

10.8 Health Care Accountability Ordinance. Contractor shall comply with San Francisco Administrative Code Chapter 12Q. Contractor shall choose and perform one of the Health Care Accountability options set forth in San Francisco Administrative Code Chapter 12Q.3. Contractor is subject to the enforcement and penalty provisions in Chapter 12Q.

10.9 First Source Hiring Program. Contractor must comply with all of the provisions of the First Source Hiring Program, Chapter 83 of the San Francisco Administrative Code, that apply to this Agreement, and Contractor is subject to the enforcement and penalty provisions in Chapter 83.

10.10 Alcohol and Drug-Free Workplace. The City reserves the right to deny access to, or require Contractor to remove from, City facilities personnel of any Contractor or subcontractor who City has reasonable grounds to believe has engaged in alcohol abuse or illegal drug activity which in any way impairs City's ability to maintain safe work facilities or to protect the health and well-being of City employees and the general public. The City shall have the right of final approval for the entry or re-entry of any such person previously denied access to, or removed from, City facilities. Illegal drug activity means possessing, furnishing, selling, offering, purchasing, using or being under the influence of illegal drugs or other controlled substances for which the individual lacks a valid prescription. Alcohol abuse means possessing, furnishing, selling, offering, or using alcoholic beverages, or being under the influence of alcohol.

10.11 Limitations on Contributions. By executing this Agreement, Contractor acknowledges that it is familiar with Section 1.126 of the City's Campaign and Governmental Conduct Code, which prohibits any person who contracts with the City for the rendition of personal services, for the furnishing of any material, supplies or equipment, for the sale or lease of any land or building, or for a grant, loan or loan guarantee, from making any campaign

contribution to (1) an individual holding a City elective office if the contract must be approved by the individual, a board on which that individual serves, or the board of a state agency on which an appointee of that individual serves, (2) a candidate for the office held by such individual, or (3) a committee controlled by such individual, at any time from the commencement of negotiations for the contract until the later of either the termination of negotiations for such contract or six months after the date the contract is approved. The prohibition on contributions applies to each prospective party to the contract; each member of Contractor's board of directors; Contractor's chairperson, chief executive officer, chief financial officer and chief operating officer; any person with an ownership interest of more than 20 percent in Contractor; any subcontractor listed in the bid or contract; and any committee that is sponsored or controlled by Contractor. Contractor must inform each such person of the limitation on contributions imposed by Section 1.126 and provide the names of the persons required to be informed to City.

10.12 Reserved (Slavery Era Disclosure).

10.13 Reserved (Working with Minors).

10.14 Consideration of Criminal History in Hiring and Employment Decisions

10.14.1 Contractor agrees to comply fully with and be bound by all of the provisions of Chapter 12T (City Contractor/Subcontractor Consideration of Criminal History in Hiring and Employment Decisions) of the San Francisco Administrative Code (Chapter 12T), including the remedies provided, and implementing regulations, as may be amended from time to time. The provisions of Chapter 12T are incorporated by reference and made a part of this Agreement as though fully set forth herein. The text of the Chapter 12T is available on the web at http://sfgov.org/olse/fco. Contractor is required to comply with all of the applicable provisions of 12T, irrespective of the listing of obligations in this Section. Capitalized terms used in this Section and not defined in this Agreement shall have the meanings assigned to such terms in Chapter 12T.

10.14.2 The requirements of Chapter 12T shall only apply to a Contractor's or subcontractor's operations to the extent those operations are in furtherance of the performance of this Agreement, shall apply only to applicants and employees who would be or are performing work in furtherance of this Agreement, and shall apply when the physical location of the employment or prospective employment of an individual is wholly or substantially within the City of San Francisco. Chapter 12T shall not apply when the application in a particular context would conflict with federal or state law or with a requirement of a government agency implementing federal or state law.

10.15 Reserved (Public Access to Nonprofit Records and Meetings).

10.16 Food Service Waste Reduction Requirements. Contractor shall comply with the Food Service Waste Reduction Ordinance, as set forth in San Francisco Environment Code Chapter 16, including but not limited to the remedies for noncompliance provided therein.

10.17 Reserved (Sugar-Sweetened Beverage Prohibition).

10.18 Tropical Hardwood and Virgin Redwood Ban. Pursuant to San Francisco Environment Code Section 804(b), the City urges Contractor not to import, purchase, obtain, or use for any purpose, any tropical hardwood, tropical hardwood wood product, virgin redwood or virgin redwood wood product.

10.19 Reserved (Preservative Treated Wood Products).

Article 11 General Provisions

11.1 Notices to the Parties. Unless otherwise indicated in this Agreement, all written communications sent by the Parties may be by U.S. mail or e-mail, and shall be addressed as follows:

To City: Monica Giese, Program Manager
SFMTA Sustainable Streets
One South Van Ness Avenue, 7th Floor
San Francisco, CA 94103-5417
Email: monica.giese@sfmta.com

To Contractor: Elizabeth Caracciolo, Executive Vice President
Verra Mobility
1150 N. Alma School Road
Mesa, AZ 85201
Email: liz.caracciolo@atsol.com

With a copy to:

Verra Mobility
1150 N. Alma School Road
Mesa, AZ 85201
ATTN: Legal Department

Any notice of default must be sent by either registered mail or an overnight delivery service. Either Party may change the address to which notice is to be sent by giving written notice thereof to the other Party. If email notification is used, the sender must specify a receipt notice.

11.2 Compliance with Americans with Disabilities Act. Contractor shall provide the Services in a manner that complies with the Americans with Disabilities Act (ADA), including but not limited to Title II's program access requirements, and all other applicable federal, state and local disability rights legislation.

11.3 Reserved.

11.4 Sunshine Ordinance. Contractor acknowledges that this Agreement and all records related to its formation, Contractor's performance of Services, and City's payment are

subject to the California Public Records Act, (California Government Code section 6250 et. seq.), and the San Francisco Sunshine Ordinance, (San Francisco Administrative Code Chapter 67). Such records are subject to public inspection and copying unless exempt from disclosure under federal, state or local law.

11.5 Modification of this Agreement. This Agreement may not be modified, nor may compliance with any of its terms be waived, except as noted in Section 11.1 (Notices to Parties) regarding change in personnel or place, and except by written Change Order (See Change Order process in Appendix A, Section 4). Changer Orders shall be executed and approved as required under City law and under the policy of the SFMTA Board of Directors. Contractor shall cooperate with the SFMTA to submit to the CCO any amendment, modification, supplement, or Change Order that would result in a cumulative increase of the original amount of this Agreement by more than 20% (CMD Contract Modification Form).

11.6 Dispute Resolution Procedure.

11.6.1 Negotiation; Alternative Dispute Resolution. The Parties will attempt in good faith to resolve any dispute or controversy arising out of or relating to the performance of services under this Agreement. If the Parties are unable to resolve the dispute, then, pursuant to San Francisco Administrative Code Section 21.35, Contractor may submit to the Contract Administrator a written request for administrative review and documentation of the Contractor's claim(s). Upon such request, the Contract Administrator shall promptly issue an administrative decision in writing, stating the reasons for the action taken and informing the Contractor of its right to judicial review. If agreed by both Parties in writing, disputes may be resolved by a mutually agreed-upon alternative dispute resolution process. If the parties do not mutually agree to an alternative dispute resolution process or such efforts do not resolve the dispute, then either Party may pursue any remedy available under California law. The status of any dispute or controversy notwithstanding, Contractor shall proceed diligently with the performance of its obligations under this Agreement in accordance with the Agreement and the written directions of the City. Neither Party will be entitled to legal fees or costs for matters resolved under this section.

11.6.2 Government Code Claim Requirement. No suit for money or damages may be brought against the City until a written claim therefor has been presented to and rejected by the City in conformity with the provisions of San Francisco Administrative Code Chapter 10 and California Government Code Section 900, et seq. Nothing set forth in this Agreement shall operate to toll, waive or excuse Contractor's compliance with the California Government Code Claim requirements set forth in San Francisco Administrative Code Chapter 10 and California Government Code Section 900, et seq.

11.7 Agreement Made in California; Venue. The formation, interpretation and performance of this Agreement shall be governed by the laws of the State of California. Venue for all litigation relative to the formation, interpretation and performance of this Agreement shall be in San Francisco.

11.8 Construction. All paragraph captions are for reference only and shall not be considered in construing this Agreement.

11.9 Entire Agreement. This Agreement sets forth the entire agreement between the parties, and supersedes all other oral or written provisions. This Agreement may be modified only as provided in Section 11.5 (Modification of this Agreement).

11.10 Compliance with Laws. Contractor shall keep itself fully informed of the City's Charter, codes, ordinances, and duly adopted rules and regulations, and of all state and federal laws in any manner affecting the performance of this Agreement, and must at all times comply with such local codes, ordinances, and regulations and all applicable laws as they may be amended from time to time.

11.11 Severability. Should the application of any provision of this Agreement to any particular facts or circumstances be found by a court of competent jurisdiction to be invalid or unenforceable, then (a) the validity of other provisions of this Agreement shall not be affected or impaired thereby, and (b) such provision shall be enforced to the maximum extent possible so as to effect the intent of the parties and shall be reformed without further action by the parties to the extent necessary to make such provision valid and enforceable.

11.12 Cooperative Drafting. This Agreement has been drafted through a cooperative effort of City and Contractor, and both Parties have had an opportunity to have the Agreement reviewed and revised by legal counsel. No Party shall be considered the drafter of this Agreement, and no presumption or rule that an ambiguity shall be construed against the Party drafting the clause shall apply to the interpretation or enforcement of this Agreement.

11.13 Order of Precedence. Contractor agrees to perform the Services in accordance with the terms and conditions of this Agreement, implementing task orders, the RFP, and Contractor's proposal dated June 18, 2015. The RFP and Contractor's proposal are incorporated by reference as though fully set forth herein. Should there be a conflict of terms or conditions, this Agreement and any implementing task orders shall control over the RFP and the Contractor's proposal. In the case of a conflict between the terms of the Business Rules Questionnaire and the terms in Appendix A, Section 3.A (Business Rules), the terms of the Business Rules Questionnaire shall control.

Article 12 SFMTA Specific Terms

12.1 Large Vehicle Driver Safety Training Requirements.

12.1.1 Contractor agrees that before any of its employees and subcontractors drive large vehicles within the City and County of San Francisco, those employees and subcontractors shall successfully complete either (a) the SFMTA's Large Vehicle Urban Driving Safety training program or (b) a training program that meets the SFMTA's approved standards for large vehicle urban driving safety. The SFMTA's approved standards for large vehicle urban driving safety is available for download at www.SFMTA.com/largevehicletrainingstandards. This requirement does not apply to drivers providing delivery services who are not employees or

subcontractors of Contractor. For purposes of this Section, "large vehicle" means any single vehicle or combination of vehicle and trailer with an unladen weight of 10,000 pounds or more, or a van designed to carry ten or more people.

12.1.2 By entering into this Agreement, Contractor agrees that if Contractor fails to comply with the Large Vehicle Driver Safety Training Requirements, the City will suffer actual damages that will be impractical or extremely difficult to determine; further, Contractor agrees that the sum of up to ONE THOUSAND DOLLARS ($1,000) per employee or subcontractor who is permitted to drive a large vehicle in violation of these requirements is not a penalty, but is a reasonable estimate of the loss that City will incur based on the Contractor's failure to comply with this requirement, established in light of the circumstances existing at the time this Contract was awarded. City may deduct a sum representing the liquidated damages from any money due to Contractor. Such deductions shall not be considered a penalty, but rather agreed monetary damages sustained by City because of Contractor's failure to comply.

Article 13 Data and Security

13.1 Nondisclosure of Private, Proprietary or Confidential Information.

13.1.1 If this Agreement requires the City to disclose "Private Information" to Contractor within the meaning of San Francisco Administrative Code Chapter 12M, Contractor and Subcontractor shall use such information only in accordance with the restrictions stated in Chapter 12M and in this Agreement and only as necessary in performing the Services. Contractor is subject to the enforcement and penalty provisions in Chapter 12M.

13.1.2 In the performance of Services, Contractor may have access to City's proprietary or confidential information, the disclosure of which to third parties may damage City. If City discloses proprietary or confidential information to Contractor, such information must be held by Contractor in confidence and used only in performing the Agreement. Contractor shall exercise the same standard of care to protect such information as a reasonably prudent contractor would use to protect its own proprietary or confidential information.

13.1.3 No information given by Contractor to City will be of a confidential nature, unless Contractor specifically designates in writing the information as proprietary and confidential, and provides in writing the legal basis why said information would be exempt from disclosure under applicable public records laws. If Contractor discloses its proprietary or confidential information to City, City will hold such information in confidence, except to the extent disclosure is required by law and provided City gives Contractor notice of such requirement prior to any such disclosure and takes reasonable steps to enable and permit Contractor to seek a protective order or take other protective action.

13.2 Reserved. (Payment Card Industry (PCI) Requirements)

13.3 Reserved. (Business Associate Agreement)

Article 14 MacBride Principles And Signature

14.1 MacBride Principles-Northern Ireland. The provisions of San Francisco Administrative Code §12F are incorporated herein by this reference and made part of this Agreement. By signing this Agreement, Contractor confirms that Contractor has read and understood that the City urges companies doing business in Northern Ireland to resolve employment inequities and to abide by the MacBride Principles, and urges San Francisco companies to do business with corporations that abide by the MacBride Principles.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day first mentioned above.

CITY	**CONTRACTOR**
San Francisco **Municipal Transportation Agency**	**American Traffic Solutions, Inc.** **dba Verra Mobility**
_____ Edward D. Reiskin Director of Transportation Authorized By: Municipal Transportation Agency Board of Directors Resolution No: _____ Adopted: _____ Attest: _____ Roberta Boomer, Secretary Approved as to Form: Dennis J. Herrera City Attorney By: _____ Isidro A. Jiménez Deputy City Attorney	_____ Elizabeth Caracciolo Executive Vice President 1150 N. Alma School Road Mesa, AZ 85201 <u>Acknowledgement of Large Vehicle Driver Safety Training Requirements</u>: By signing this Agreement, Contractor acknowledges that it has read and understands Section 12.1: Large Vehicle Driver Safety Training Requirements. City vendor number: **82130**

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Appendices

A Scope of Services
B Calculation of Charges
C Sample Court Evidence Package
D System Requirements for Supplied Equipment and Technical Specifications
E Equipment Lease Attachment
F Additional City Requirements
G Form Business Rules Questionnaire

Appendix A

SCOPE OF SERVICES

A. This Appendix A sets forth the scope of services ("Services") Contractor shall perform for Phase II of the upgrade to the City's Automated Photo Enforcement System ("System"). The System means the Camera Units, other System Equipment, and all other equipment, software, and processes that comprise and allow the proper functioning and administration of the Automated Photo Enforcement Program. Phase I consisted of construction design services to design the new System, as well as administrative preparation work needed to lay the foundation for Phase II.

B. In accordance with state and local law, the Program's primary objective is to reduce collisions at signalized intersections resulting from red light violations, illegal turns, and other moving violations ("Violations"). The upgraded system will cover 19 approaches at 13 street intersections within the City ("Approaches") (see Section 2.A., below). The SFMTA, however, does not at any time during the term of this Agreement guarantee Contractor a specific number of Approaches or volume of work. The SFMTA reserves the right to increase or reduce the number of Approaches according to its needs.

C. The Services fall into three broad categories, as follows: System construction; System maintenance; and program administration. Each category is described in detail below.

D. In performing the Services Contractor shall work with other City agencies, as needed, including (but not limited to) the SFMTA, San Francisco Police Department ("SFPD"), Department of Public Works ("DPW"), City Attorney's Office ("City Attorney"), Superior Court of California/County of San Francisco ("Court"), and Department of Public Health ("DPH").

E. Capitalized terms used, but not defined in the Appendix A, shall have the meaning given to those terms in Article 1 of the Agreement.

1. SYSTEM CONSTRUCTION

A. Construction Consultation

(i) Construction Contractor will install and perform construction work necessary for all System Equipment, except for System Equipment Contractor installs under Public Works Contract No. 1000005983.

(ii) Contractor shall provide construction consultation services to Construction Contractor. Contractor shall perform construction consultation services for the duration of the System's construction phase and to the satisfaction of the SFMTA.

(iii) Contractor shall have qualified personnel present on site for key construction milestones, and available to the SFMTA to answer questions about design and installation details, and to troubleshoot issues as they arise. Key construction milestones include, but are not limited to the following:

(a) Pre-construction meeting.

(b) Laying out location of poles and conduit ("white lining").

(c) Identifying location of underground utilities through the Underground Service Alert (USA).

(d) Underground construction, including boring, trenching and placement of conduit.

(e) Foundation and pole placement.

(f) Wiring.

(g) Equipment mounting.

(h) Equipment testing.

(i) Equipment turn on.

(iv) Contractor shall support Construction Contractor as provided for in this Agreement in its installation of System Equipment in accordance with SFMTA-approved designs.

(v) Contractor shall test all System Equipment in accordance with manufacturer's recommendations and best practices, and ensure System Equipment captures violations when they occur and produces clear Images. As part of this testing, Contractor shall provide to the SFMTA, for the SFMTA's review and approval of image quality, sample violation photographs from each Approach tested.

B. Supply of System Equipment

(i) Contractor shall furnish and have delivered to Construction Contractor System Equipment, unless the City agrees to another location for delivery. Contractor shall coordinate delivery with Construction Contractor.

(ii) Contractor shall furnish System Equipment identified in Appendix D – System Requirements for Equipment and Technical Specifications, which shall meet or exceed each of the requirements listed therein.

(iii) As specified in Appendix E – Equipment Lease Attachment, the cost to deliver the System Equipment is the responsibility of the Contractor. The SFMTA will pay a monthly fee to lease the System Equipment as set forth in Appendix B, Exhibit 4 – Supply of System Equipment Lease Fees.

C. Plans and Drawings

(i) Construction Design Plans. During Phase 1, Contractor prepared the Construction Design Plans, which have been incorporated into Public Works Contract No. 1000005983. Any additional design plans the City requests the Contractor to produce under this Agreement shall be prepared by a California-registered civil or electrical engineer, and shall be subject to the City's plan check, permitting, and inspection procedures.

(ii) As-Built Plans.

(a) The SFMTA will furnish to Contractor as-built plans of the System upon completion of the System's construction.

(b) Contractor shall maintain the as-built plans thereafter, and shall update the as-built plans to reflect accurately all subsequent modifications, upgrades, or adjustments to the System; Contractor's engineer of record shall date and stamp updates to the as-built plans to reflect subsequent modifications, upgrades, and adjustments to the System.

(c) Contractor shall keep in its offices up-to-date as-built plans, and shall provide copies of all as-built plans, as updated, to the SFMTA. The SFMTA will keep the copies in the SFMTA Engineering offices.

(d) For Approaches with two sets of vehicle-detection equipment (i.e., one set for traffic control and one set for photo enforcement), Contractor shall maintain and update all as-built plans to easily and accurately identify the System's operational detection

equipment. Abandoned loops shall be intentionally cut on two sides so it is clear that the loops have been abandoned, and to eliminate the possibility of loop-to-loop crosstalk.

2. SYSTEM MAINTENANCE

Contractor's compensation for maintenance of the System and System Equipment shall be in accordance with the itemized monthly cost breakdown contained in Appendix B, Exhibit 1 – Program Administration.

A. Approaches

(i) For the term of this Agreement and under the SFMTA's direction, Contractor shall maintain the System and System Equipment at the following Approaches:

(1) 4th St SB at Harrison St
(2) 6th St SB at Bryant St
(3) 6th St SB at Folsom St
(4) 8th St SB at Folsom St
(5) 19th Ave NB at Sloat Blvd
(6) 19th Ave SB at Sloat Blvd
(7) Bryant St EB at 6th St
(8) Divisadero St NB at Bush St
(9) Fell St WB at Masonic Ave
(10) Harrison St WB at 4th St
(11) Hayes St WB at Polk St
(12) Market St EB at Octavia Blvd
(13) Oak St EB at Octavia Blvd
(14) Oak St EB right turn lanes at Octavia Blvd
(15) Octavia Blvd NB at Oak St
(16) Park Presidio Blvd SB at Lake St
(17) Polk St SB at Hayes St
(18) So. Van Ness Ave NB at 14th St
(19) Van Ness Ave SB left turn lanes at Broadway

(ii) Under the SFMTA's direction and immediately upon Construction Contractor's completion of each Approach, Contractor shall commence to administer and maintain each Approach, in accordance with Appendix D – System Requirements for Equipment and Technical Specifications.

B. No Modifications to System Allowed

(i) Contractor shall not modify, remove, or relocate any part of the System or System Equipment without the SFMTA's prior, written approval; provided however, Contractor may upgrade System as part of regularly scheduled upgrades or as required.

(ii) Prohibited modifications, removals, and relocations apply to, but are not limited to, vehicle detection equipment, cameras, flashes, software, poles, or any part of the System that could affect the accuracy and reliability of the enforcement of Violations under this Agreement.

C. Maintenance and Servicing

(i) Field Maintenance

(a) During the term of this Agreement, Contractor shall be solely responsible for the day-to-day field maintenance of the System and all System Equipment; specific field maintenance tasks include, but are not limited to, those set forth below.

(b) Before commencing field maintenance tasks, Contractor shall submit to the SFMTA, for the SFMTA's approval, a Field Technical Service and Inspection Log. Upon receiving the SFMTA's approval, Contractor shall use the Field Technical Service and Inspection Log to record all field maintenance tasks. Contractor shall keep in its files the original Field Technician Service and Inspection Logs (which may be electronic) for use as evidence, as required by law.

(c) Unless otherwise stated herein, Contractor shall receive no additional compensation for field maintenance tasks.

(ii) Inspection and Testing.

(a) Contractor shall inspect and test the System and System Equipment in accordance with manufacturers' specifications and as necessary to ensure the System's uninterrupted operation.

(b) Contractor shall perform daily remote monitoring of the System.

(c) At least once a week, Contractor shall inspect and test all System Equipment and the functionality of the System as a whole at each Approach, and produce a Field Technical Service and Inspection Log to keep in its files and to include in Court Evidence Packages. Contractor may perform weekly testing and inspections remotely (i.e., outside San Francisco).

(d) At least once a month, Contractor shall physically inspect System Equipment in person at each Approach and complete a Field Technical Service and Inspection Log documenting completion of the inspection and any defects found.

(iii) Maintenance and Repair.

(a) General/Graffiti Removal. Contractor shall perform all maintenance and repair of the System and System Equipment; Contractor's maintenance and repair responsibilities include but are not limited to keeping the System Equipment (e.g., camera casings, etc.) clean and free of graffiti.

(b) Malfunctions.

(1) Notices. Upon the SFMTA's or Contractor's discovery of any malfunction, operational error, or other error or problem with the System or System Equipment ("Malfunction"), the SFMTA or Contractor, as applicable, will provide the other Party written notice of the Malfunction ("Malfunction Notice"). The Malfunction Notice will describe the time and date of discovery, location, and nature of the Malfunction, as well as any other information the Party sending the notice wishes to include.

(2) Response Times. Contactor shall exercise best efforts to correct Malfunctions within the earlier of 24 hours of Contractor's discovery of the Malfunction or receipt of a Malfunction Notice. If, however, it is not commercially reasonable for Contractor to correct the Malfunction within this time Contractor shall provide to the SFMTA Program Manager a written report that describes: (i) the nature of the Malfunction; (ii) available options to correct the Malfunction, including estimated timeline to correct; and (iii) Contractor's recommendation how to proceed with the correction. The SFMTA reserves the right to determine the final course of action in all such cases.

(c) Repair Delays. Contractor's delays in repairing System Equipment that cause a lapse or decrease in enforcement at any Approach shall be limited to no more than three months from the earlier date of the Malfunction Notice or Contractor's discovery of the underlying Malfunction. Contractor shall not charge the SFMTA lease fees for System Equipment that is inactive or not collecting Violation data for three or more months.

(iv) Loss of Violation Data. Contractor shall be liable to the SFMTA for loss of Citation revenue that results from maintenance or repairs to System Equipment, as described in Section 4.7 Liquidated Damages.

(v) Other Maintenance Requirements.

(a) Contractor shall not open traffic signal controller boxes without prior, written authorization from the SFMTA and without the physical presence of an SFMTA representative.

(b) Contractor shall furnish and supply to all Approaches electrical, telephone, DSL, cable, or other broadband services, as necessary to ensure the System's uninterrupted operation.

(c) Contractor shall ensure the System's electrical connections with SFMTA equipment and systems are optically or otherwise isolated.

(d) If so directed by the SFMTA, Contractor shall furnish and install flash units on cameras to ensure images produced by the System's cameras ("Images") are of a quality sufficient to allow San Francisco Police Department (SFPD) personnel to identify Violations.

(e) If the SFMTA determines Image quality for any Approach has deteriorated below acceptable levels, then, upon the SFMTA's written request, Contractor shall repair, replace, or upgrade the System Equipment, as necessary, to restore Image quality to SFMTA-accepted levels.

(f) Contractor shall make available the Contractor Project Manager (or a reasonable alternate) to the SFMTA Program Manager every day during the term of this Agreement.

(g) The Image Processing Unit may only be connected to the traffic signal controller to obtain the following:

(1) Contact closure of signal when traffic light enters the amber phase.

(2) Contact closure of signal when traffic light enters the red phase.

(3) Power source (120V AC).

(h) The system clock time and other data elements displayed in images shall be automatically resynchronized in the event of a main power failure or otherwise supplied with backup power sufficient to maintain such information for a minimum of seven days without power.

(i) Contractor shall make available a technician to attend meetings or walkthroughs when conflicts with public or private construction projects may impact the continual function of the System; Contractor's technician shall recommend mitigation measures to minimize those impacts, and shall provide advice for the appropriate restoration of the System after the completion of construction activity.

3. PROGRAM ADMINISTRATION

Contractor's compensation for administration of the Automated Photo Enforcement Program shall be in accordance with the itemized monthly cost breakdown contained in Appendix B, Exhibit 1 – Program Administration.

A. Business Rules

(i) General. Contractor shall administer the Automated Photo Enforcement Program in accordance with the Business Rules and applicable law, including the California

Vehicle Code. The Business Rules are subject to change only as a result of changes to local or state law, including the California Vehicle Code, or as determined by the SFMTA and mutually agreed to by Contractor.

(ii) Warning Period. For one month prior to the SFPD issuing Citations at each Approach, Contractor shall collect System-generated data for the Approach (including but not limited to volumes of vehicles monitored and Violations) and mail warning notices to registered owners that would otherwise receive Citations, as determined by the SFPD. If so requested by the SFMTA, Contractor shall assist the SFMTA in making public announcements of the Automated Photo Enforcement Program at least one month prior to the commencement of the enforcement at any Approach.

(iii) Requirements for Issuing Citations

(a) Contractor shall process Violations in accordance with the applicable mailing requirements in the California Vehicle Code and this Section 3.A(iii).

(b) Contractor shall review System-generated data and Images for each Event to ensure the Event meets the requirements in this Section 3.A(iii), and shall forward only those Events that meet these requirements to SFPD for final review and determination as to whether or not a Violation occurred prior to issuance of Citations.

(c) Contractor shall review Images to ensure they comply with California Vehicle Code section 210, which requires "a clear photograph of a vehicle's license plate and the driver of the vehicle." A "clear photograph of the vehicle's license plate" shall mean the license plate number is legible; a "clear photograph of the driver of the vehicle" shall mean the face of the driver ("Alleged Violator") is identifiable.

(d) For each compliant Image, Contractor, acting as the City's agent, shall utilize the license plate number shown to identify the vehicle's registered owner by direct online access to the California Department of Motor Vehicles ("DMV"), and shall review the corresponding Image, video recording of the Event, and DMV information to confirm the registered owner and license plate are a match.

(e) Contractor shall obtain the registered owner's current address on file with the DMV for purposes of mailing the Citation, except when the City is reissuing a Citation to the actual driver. In that circumstance, City, the Court or the registered owner shall provide Contractor with the address of the actual driver.

(f) The City shall not issue Citations where the age or gender of the driver in the Images clearly does not match that of the registered owner, except when a commercial or government entity is the registered owner of the vehicle, or the City has reissued the Citation to the driver.

(g) Contractor shall include the California driver's license number of the Alleged Violator on the Citation, except when a commercial or governmental entity is the registered owner of the vehicle.

(h) Contractor shall generate Citations only for Violations occurring 0.3 or more seconds into the red phase.

(i) Contractor shall generate Citations only for vehicles traveling over a minimum speed threshold. City shall determine minimum speed for issuance of Citations.

(j) Contractor shall process Citations for all vehicles registered to governmental agencies, except emergency vehicles or vehicles used by the SFPD, or other law enforcement agency escort vehicles.

(k) For Events that do not result in the issuance of a Citation (or Notice to Appear), Contractor shall destroy driver information, data and Images within 24 hours

of determining the Event does not meet the City's Business Rules, or the SFPD's rejection of the Event. For Violations that do result in the issuance of a Citation, Contractor shall destroy all related information, including but not limited to all data, Images, and paper records within 15 Business Days of final disposition.

(l) Contractor shall maintain and observe the terms of its agreement with the DMV, which provides Contractor with access to registered owner information.

(iv) Signing Citations

(a) Contractor shall transmit electronically each Citation to the SFPD for the SFPD's review, approval, and electronic signature.

(b) All information on the Citation shall be clearly legible, with all written information accurate, as supplied from the DMV records. The SFPD will reject any Citations that are not clearly legible.

(c) Contractor shall mail to Alleged Violators only SFPD-approved and signed Citations. Unless otherwise ordered by the SFPD or the Court, Contractor shall mail all SFPD-approved and signed Citations within 11 days of the alleged Violation. Contractor shall retain an exact copy of each SFPD-approved and signed Citation in accordance with the applicable record retention policy, and shall file the original Citation with the Court.

(d) Officers of the SFPD will be available to review, approve, and sign Citations each week, Monday through Friday, except legal holidays. An SFPD officer's signing of a Citation shall be deemed the act of issuing the Citation, as required by the California Vehicle Code.

(e) Only the officer of the SFPD that reviews each Citation shall have authority to issue the Citation, which decision shall be made at the officer's sole discretion. Contractor shall not issue a Citation or other notices of Violations in connection with the System without the express, written authorization of the SFMTA and SFPD. Contractor shall not cancel or void Citations approved and signed by an officer of the SFPD without written consent from both SFMTA Program Manager and the Captain of the SFPD Traffic Unit.

(v) Mailing Citations

(a) Contractor shall prepare Citations on a form approved by the Court and the California Judicial Council. Contractor shall provide on the Citation only the information required by the Court, the California Judicial Council, and California Vehicle Code section 40518.

(b) To the extent possible and without blocking the image of the Alleged Violator, Contractor shall crop or block the faces of all passengers shown in Images provided with Citations.

(c) Contractor shall work with the Court to identify and establish a mutually agreed upon numbering system for Citations.

(d) With each Citation, Contractor shall include a separate, SFMTA-approved instruction sheet with detailed response procedures and a statement describing the System's technology used to issue the Citation, including information necessary to interpret all data shown on the Images. If so reasonably requested by the SFMTA, Contractor shall translate Citations to other languages, not to exceed three languages including English. Contractor shall modify information on Citations if requested by the SFMTA at no additional cost to the SFMTA. Contractor shall be responsible for printing envelopes, Citations, and all other materials sent to Alleged Violators.

(e) For owners of commercial vehicle, Contractor shall include the Affidavit of Custodian of Records along with the Notice to Appear to each Citation.

(f) Contractor shall process photographs and video recordings on a schedule that allows for preparing and mailing signed Citations in compliance with California Vehicle Code mailing requirements. Notwithstanding California Vehicle Code section 40518, Contractor shall mail Citations signed by the SFPD within 11 days of the alleged Violation, unless otherwise ordered by the SFPD or the Court. For each signed Citation Contractor mails, Contractor shall obtain a Certificate of Mailing declaration issued by the United States Postal Service attesting to the signed Citation's form of service. Contractor shall provide a copy of the Certificate of Mailing declaration to the SFPD, Traffic Company within three Business Days of mailing the signed Citation.

(g) Contractor shall submit the data from the signed Citation to the Court electronically by a means and in a form mutually agreed upon by the Court and Contractor within five Business Days after mailing each signed Citation.

(h) Mailing costs (postage and handling) for Citations are considered a part of Contractor's day-to-day business functions and no additional payment is made for postage and handling outside of Contractors payment for Administrative Support Services as listed in Contractor's cost proposal and contained in Appendix B, Exhibit 1 – Program Administration.

(vi) Citation Dismissals and Reissues to Alleged Violators

(a) Contractor shall use an SFMTA-approved form to inform registered owners they may identify the Alleged Violator, if the driver shown in the Image is not the registered owner. The form shall state the registered owner may do so by written declaration, without making a personal appearance before the Court.

(b) If a registered owner provides complete information identifying the Alleged Violator, along with the required supporting documentation (copy of registered owner's driver license and recent photo), Contractor shall process a new Citation naming the driver but only if SFMTA's age and gender match requirements are met. If any of the information or documentation is incomplete, Contractor shall send a letter to the registered owner requesting the missing information or documents. After the SFPD determines to transfer liability and issue the new Citation, Contractor shall notify the Court of the reissue so the Court can dismiss the prior Citation.

(c) If a registered owner is unable to identify the Alleged Violator, he or she may submit a written request for a secondary review along with the required supporting documentation (copy of registered owner's driver license and recent photo). Contractor shall forward secondary review requests to the signing SFPD officer, who will review the Images again and decide whether or not the registered owner is the driver. After completion of the secondary review, at the instruction of the SFPD through the Axsis Violations Processing System, Contractor shall mail a letter to the registered owner informing him or her of the SFPD officer's final determination. If the SFPD officer determines that the registered owner is not the driver, Contractor shall notify the Court so that the Court can process a dismissal of the Citation.

(d) In the case of a commercially registered vehicle, Contractor shall prepare the Citation for issuance to the registered owner, and include with the Citation an Affidavit of Custodian of Records. If the registered owner of the commercial vehicle provides a complete and executed Affidavit of Custodian of Records that identifies the actual driver, along with the required supporting documentation (such as a driver's log, rental agreement, taxi waybill, etc.) showing who was driving the vehicle at the time of the Violation, Contractor shall process a new Citation naming the actual driver. Contractor shall assist with obtaining all necessary documents for a commercially registered vehicle, including business records, for prosecution of violations as directed by the Court and the City Attorney's Office.

(e) If it becomes necessary to dismiss an issued Citation for reasons other than those noted above, the SFMTA, the SFPD, or the Court will notify Contractor in a format mutually acceptable to all parties.

(vii) Court Evidence Packages.

(a) Upon the SFPD's request, Contractor shall prepare and deliver to the SFPD a series of items related to a particular Violation, which shall consist of the documents listed below ("Court Evidence Package"). An example of a Court Evidence Package is provided in Appendix C, Sample Court Evidence Package.

(1) Contractor's Affidavit of Custodian of Records.

(2) Copy of Notice to Appear;

(3) Copies of maintenance logs from the intersection of the particular alleged Violation covering the time period when the Violation occurred;

(4) A statement describing the technology used including information necessary to interpret all data shown on Images;

(5) An instruction sheet detailing how violators may address the Citation;

(6) A completed affidavit of custodian of records for commercial vehicle owners, when applicable;

(7) A completed form identifying a driver other than the registered owner when applicable;

(8) The United States Postal Service ("USPS") Certificate of Mailing;

(9) Images: one full view of the vehicle entering the intersection illegally, one full view of the vehicle in the center of the intersection in violation, one enlargement of the license plate, and one enlargement of the driver's face and;

(10) Any other document(s) requested by the Court.

(b) Contractor shall also provide computerized or on-line access to Violation data, photographs and video recordings for court proceedings. In addition, Contractor shall provide access to Violation photographs and video recordings for review by Alleged Violators at the court. Contractor shall also provide hardcopy versions of the Violation data and photographic images and electronic copies of video recordings, in advance of the court hearings as requested by City.

(c) If the SFPD requests a Court Evidence Package 10 or more Business Days before the court date, Contractor shall provide the Court Evidence Package to the SFPD no later than five Business Days before the court date. If the SFPD provides a request to Contractor fewer than 10 Business Days before the court date but no less than two Business Days before the court date, Contractor shall provide the Court Evidence Package to the SFPD prior to the date of the proceeding.

(d) Contractor shall assist with obtaining all necessary documents, including business records, for prosecution of Violations as directed by the City Attorney's Office. When requested by the City Attorney's Office, Contractor shall provide the Evidence Package in response to an Alleged Violator's discovery request within three Business Days to the City Attorney's Office.

B. Training; Court Testimony

(i) Training Course.

(a) Contractor shall train SFPD officers in providing testimony, at court proceedings, about the operation of the System and administration of the Program. Contractor shall work with the SFMTA and the City Attorney's Office to train the SFPD.

(b) Contractor shall provide the training course within one month of the SFMTA's request, unless the SFMTA requests a later date. At each training, Contractor shall train up to ten City employees, including SFPD officers and other employees identified by the SFMTA.

(c) Contractor shall provide a "Certificate of Training" to each police officer and other trainee that successfully completes the training.

(ii) Court Testimony.

(a) Contractor shall provide at each court proceeding one or more expert witnesses, as required, to provide expert testimony about the following: the System's technology, field maintenance, and operations; the processing of Images and Citations; and any other component of the Automated Photo Enforcement Program or System Contractor manages under this Agreement. The Superior Court of California, County of San Francisco typically holds court proceedings (or trials) in connection with the Automated Photo Enforcement Program each week at 850 Bryant Street, San Francisco, CA 94103, on Monday, Tuesday, Wednesday, and Thursday at 1:30 pm. Court proceedings for juvenile Alleged Violators are held at the Juvenile Traffic Court, 375 Woodside Avenue, San Francisco, CA 94127.

(b) Contractor shall provide an original, written declaration from a qualified employee or subcontractor of Contractor who can testify that the System was properly operating at the time of the alleged Violation (Affidavit of Custodian of Records). Contractor shall work with the City Attorney's Office to prepare this declaration.

C. Quality Assurance Audits

(i) Contractor agrees that quality control of the Automated Photo Enforcement Program is essential to this Agreement, and will be achieved as follows: (a) at least one qualified individuals within Contractor's staff shall review each Image as described in Section 3.A.iii; (b) Contractor shall conduct automated quality assurance audits with escalation as needed to a second Contractor staff member to perform a secondary Image review; (b) SFPD officers will review all Citations before issuing; and (c) the SFMTA will conduct external audits of the System and Automated Photo Enforcement Program for compliance with this Agreement and applicable law. The SFMTA will conduct these external audits using random samples of Violations on a periodic basis.

(ii) Contractor shall provide the SFMTA access to all Contractor-maintained Automated Photo Enforcement Program data, including but not limited to data about Events, Violations, and Citations (i.e., issued and non-issued Citations) at each Approach. Contractor shall ensure the SFMTA has access to these data directly and remotely at any time and independently of Contractor's staff.

(iii) To conduct external audits of the System, the SFMTA may select and use samples of any Contractor-maintained data, including but not limited to data about triggered Events, Violations, and Citations. The SFMTA's external audits may examine Contactor's compliance with any guideline or requirement that applies under this Agreement or law to the Automated Photo Enforcement Program or System, including but not limited to the clarity of Images, chain of custody and handling of evidence, review and approval process for Citations, non-issued Citations, reconciliation of total number of approved Citations for any given time period and number of citations mailed (confirmation of mailing) within the same time period, and compliance with all confidentiality laws and agreements.

(iv) At no time may the quality assurance audits described in this Section 3.C. compromise, contradict, or violate any law or regulation regarding operation of the Program.

D. Monthly Reports

(i) General. Contractor shall prepare and submit electronically (i.e., by email) to the SFMTA Program Manager the Monthly Viewing Report and Monthly Status Report (each described below), and any other reports that the SFMTA may reasonably request, by no later than 21 days after the end of each month. The format for the content of these reports shall be approved by the SFMTA. The timely submission of all reports is a necessary and material term and condition of this Agreement.

(ii) Monthly Viewing Report. The Monthly Viewing Report shall provide the numerical data needed to evaluate performance of the established Measures of Effectiveness (MOEs) (See Section 3.F.iii.). The Monthly Viewing Report shall include the data listed below, from the preceding month, and all prior months in the current calendar year, for each Approach individually, and in a System-wide summary:

(a) number of Events detected;

(b) of total Events, the number of alleged Violations and the number of non-Violations;

(c) of the non-Violations detected, a detailed breakdown of the reasons why no Violation occurred;

(d) number of Violations for which Citations were issued;

(e) of Citations issued, the numbers that involved traveling straight through the intersection, turning right, and turning left;

(f) of the Violations detected but for which Citations were not issued, the number not issued for controllable reasons, the number not issued for uncontrollable reasons, and a detailed breakdown of the controllable and uncontrollable reasons for non-issuance;

(g) daily average vehicle volume;

(h) daily average Citation issuance;

(i) average speeds of Violations and issued Citations;

(j) average red seconds of Violations and issued Citations;

(k) Citation issuance rates compared to total Violations and to controllable Violations.

(iii) Monthly Status Report. As a part of the monthly reporting process, Contractor shall continuously monitor and analyze System operations across all Approaches. For each Approach, the Monthly Status Report shall list and describe the nature of all Malfunctions, third-party damage, and other reasons affecting the operation of the System during the preceding month. For each Malfunction, third-party damage, and other reason affecting the operation of the System, the Monthly Status Report shall indicate whether and the number of Days the affected Approach was not in service. The SFMTA Program Manager and Contractor will use this information to jointly develop and implement final solutions to correct Malfunctions. All solutions are subject to final assessment and approval by the SFMTA Program Manager.

E. Management Meetings.

(i) Each month, the SFMTA Program Manager and Contractor Project Manager shall meet to review the System's performance and discuss items in the Monthly Report, as applicable.

(ii) The SFMTA Program Manager may schedule a meeting on a monthly basis with Contractor, the SFPD, the Court, and any other interested City department or agency,

to exchange information on the administration of the Program. Contractor's attendance at such meetings is mandatory.

F. Standards of Performance

(i) General. Contractor agrees the Program's primary objective is to reduce collisions at signalized intersections resulting from Violations. To meet this primary objective, Contractor warrants it designed and implemented the System to monitor and enforce Violations at each Approach by automatically capturing enough data about each Violation to issue, enforce, and adjudicate a lawful Citation.

(ii) Unenforceable Citations. Both Parties acknowledge certain Violations may not produce enforceable Citations because of a variety of controllable and uncontrollable factors. "Controllable factors" include but are not limited to the accuracy, reliability, and efficiency of the System, as maintained by Contractor, the System's downtime, Malfunctions, clarity and quality of Images, and expiration of mailing deadline. "Uncontrollable factors" are factors beyond Contractor's control and include but are not limited to the availability of license plate and driver information, age and/or gender mismatch, missing, illegible or obstructed license plate, obstructed view of vehicle or driver, SFPD processing delays, and Force Majeure events.

(iii) Measures of Effectiveness (MOEs).

(a) Once a quarter, the SFMTA Program Manager and Contractor Project Manager shall meet to mutually identify and establish (or maintain in place previously established) MOEs that track the System's effectiveness. For example, MOEs may include: number of events captured; number of Citations issued; number of Citations contested; number of enforceable Citations lost because of controllable factors and uncontrollable factors; and results from quality assurance auditing. The SFMTA Program Manager and Contractor Project Manager may establish any MOEs upon which they mutually agree. MOEs may change depending on seasonal factors, construction issues, citation issuance, intersections being enforced, enforcement objectives, or any other factors, as determined by SFMTA.

(b) During this quarterly meeting, the SFMTA Program Manager may establish performance goals for each MOE in place for that quarter.

(c) During this quarterly meeting, Contractor Project Manager shall explain to the SFMTA Program Manager any trends or variances shown in the MOEs in place for that quarter. If the quarterly MOEs do not meet performance goals (if any) established by the SFMTA Program Manager, Contractor Project Manager and SFMTA Program Manager shall mutually determine the causes and establish an action plan to improve the System's performance in the next quarter to meet the goals, or adjust the goals. Any such action plan or goal adjustment shall be subject to the SFMTA's approval.

G. Technical Upgrades

(i) As Contractor develops and offers new products or upgrades of existing products, Contractor shall give the SFMTA the opportunity to upgrade to Contractor's newest product offerings.

(ii) On or about each anniversary of the Effective Date of this Agreement, Contractor shall provide a written report to the SFMTA's Program Manager describing Contractor's newest product offerings and their applicability to the System.

(iii) Contractor shall not implement any new technology products or technical upgrades without the SFMTA's written approval, except for software upgrades performed in the ordinary course or as needed.

(iv) Technical upgrades will be requested or approved as outlined in Appendix A, Section 4. Changes to the Services.

(v) If so requested or approved by the SFMTA, back-office software upgrades and firmware upgrades shall be provided to the City at no additional cost during the term of this Agreement.

H. Legal Changes and Challenges

Contractor shall perform any modifications to the System, as defined by Appendix D – System Requirements for Equipment and Technical Specifications, as required by changes to California Vehicle Code, San Francisco Traffic Code, local, state, or federal laws or regulations, or any legal action that has jurisdiction over or bearing on the System, as directed by the SFMTA and at no cost to the City.

I. Internet Customer Service

Contractor shall create and maintain an internet site where Alleged Violators can review Citations and color photographs while ensuring confidentiality, a link to online court payment processing, general information to the alleged violators regarding the System, information regarding the status of a specific Citation, detailed instructions on how to respond to a citation, and the ability to download the Affidavit of Non-Liability and Affidavit of Custodian of Records forms. Contractor's internet site shall be available twenty-four (24) hours a day, 365 days per year. The City shall approve all information contained and provided by the internet site prior to Contractor's implementation.

J. Permits

Contractor is responsible for obtaining an annual encroachment permit with the California Department of Transportation (Caltrans) for each enforced intersection located on a State highway or Caltrans Right of Way.

K. Data Security

(i) Data Encryption. Contractor shall encrypt all System-generated data prior to electronic transmission via broadband communication. To encrypt such data, Contractor shall use a secure, tamperproof encryption system; Contractor shall encrypt data using, at minimum, the triple-DES encryption algorithm. The methods Contractor uses to encrypt and secure System-generated data shall, at all times, be subject to City's review and approval. The SFMTA must approved Contractor's proposed substitutions of encryption algorithms before Contractor deploys substitutions.

(ii) Loss of Data. Contractor shall be solely responsible for loss of Violation Data that results from failure to secure System-generated data in accordance with the terms of this Agreement. Accordingly, Contractor shall be subject to liquidated damages in accordance with Section 4.7 of the Agreement.

L. Public Awareness Efforts

(i) Events or Campaigns. From time to time during the term of this Agreement, the SFMTA may elect to conduct or participate in a public awareness event or campaign about the Program.

(ii) Request for Contractor Resources or Media Materials. Upon the SFMTA's request, and at no additional cost to the SFMTA, Contractor shall provide the SFMTA reasonable public relations resources and media materials up to $25,000 annually. For example, public relations resources and media materials include, but are not limited to, Contractor's staff assisting the SFMTA with public information and education efforts, graphic design work, purchasing promotional materials and give-away items, and drafting press releases and campaign schedules.

(iii) Contractor's Proposal. Upon the City's request for public relations resources or media materials, Contractor shall submit a proposal for the SFMTA to review and

approve. The proposal shall describe, and provide detailed quantity and cost information for, the specific public relations resources and media materials requested by the SFMTA.

4. CHANGES TO THE SERVICES

(i) Changer Order Notice. The SFMTA may request changes to the scope of Services (e.g., that Contractor provide additional products or services, or enforce additional moving violations, in accordance with law), by issuing to Contractor a written Change Order Notice, which will describe the proposed changes in reasonable detail.

(ii) Change Order Proposal. Upon Contractor's receipt of a Change Order Notice, Contractor shall deliver to the SFMTA a Change Order Proposal that includes:

(a) a written statement describing the effect, if any, the proposed changes would have on the pricing terms of this Agreement;

(b) a detailed breakdown of the charges and schedule effects;

(c) a description of any changes to the System's specifications or obligations of the Parties;

(d) a schedule for delivery of the proposed changes and other performance obligations; and

(e) any other information relating to the proposed changes reasonably requested by the City.

(iii) Change Order Negotiations. Following the SFMTA's receipt of the Change Order Proposal, the Parties shall negotiate in good faith and agree to: (a) a plan and schedule for implementation of the proposed changes to the Services; (b) the time, manner, and amount of payment or price increases or decreases; (c) any other matters relating to the proposed changes to the Services; except that, if any proposed change involves only the addition of equipment or services to the existing System, the then-existing pricing terms set forth in Appendix B shall apply.

(iv) Failure to Agree on Terms of Change Order. If the Parties do not reach agreement on the terms of any Change Order, the SFMTA may either cancel the Change Order and have the corresponding services performed by other available sources, or direct Contractor to proceed with the Change Order under such conditions as City may require to assure quality and timeliness of the services. Contractor may not refuse to undertake a City-ordered Change Order; provided however, City's payment to Contractor for this work shall be on the basis of (1) actual cost of direct labor (hourly rates), (2) actual cost of materials and equipment usage, and (3) a fixed mark-up to cover Contractors overhead and profit equal to 15%.

5. SERVICES PROVIDED BY ATTORNEYS

Any Services to be provided by a law firm or attorney must be reviewed and approved in writing in advance by the City Attorney. No invoices for services provided by law firms or attorneys, including, without limitation, as subcontractors of Contractor, will be paid unless the provider received advance written approval from the City Attorney.

6. SFMTA LIAISON

In performing the Services provided for in this Agreement, Contractor's liaison with the SFMTA will be Monica Giese, Automated Photo Enforcement Program Manager, or her designee.

Appendix B

CALCULATION OF CHARGES

This Appendix B sets forth the charges Contractor is authorized to invoice to the SFMTA for performing the Services. Authorized charges are broken down and provided herein by category of Service as follows:

Exhibit 1 Program Administration Charges

Exhibit 2 Repair of Third-Party Damage

Exhibit 3 Construction Consultation

Exhibit 4 System Equipment Lease Charges

Exhibit 5 Option to Self-Administer

See Section 3.3 (Compensation) of this Agreement for additional provisions regarding payments to Contractor.

Appendix B

CALCULATION OF CHARGES

Exhibit 1
Program Administration Charges

Contractor's monthly charges to administer the Program are set forth in the table below.

The SFMTA will pay Contractor the Monthly Total shown in Column A only after Contractor commences operation of the System Equipment for the 19 Approaches set forth in Appendix A, Section 2.A. Prior to that time, the monthly payment owing from the SFMTA to Contractor will be calculated as follows: Monthly Total from Column B × number of Approaches for which System Equipment has been installed and operations have commenced.

Contractor's monthly charges shall increase or decrease by the Monthly Total shown in Column B for each Approach the SFMTA adds or removes, respectively, from Contractor's scope of Services.

Itemized Monthly Charges	**A** **Charges for 19 Digital Approaches (13 Intersections)**	**B** **Charges per Approach**
Transportation	$1,489	$78.37
Rent	Not applicable	Not applicable
Administrative Overhead	$8,948	$470.95
Systems Support	$18,858	$992.53
Monthly Report Preparation	Included in Systems Support	Included in Systems Support
Fixed Maintenance Costs	$16,827	$885.63
Expert Witness Testimony	$2,782	$146.42
Monthly Total	**$48,904**	**$2,573.89**

Appendix B

CALCULATION OF CHARGES

Exhibit 2
Repair of Third-Party Damage

Contractor's charges to repair damage to the System Equipment caused by third parties are set forth in the table below by repair item. Charges shall apply per incident of damage caused by third parties.

If third-party damage is caused to System Equipment not listed below, and the SFMTA requests that Contractor repair such equipment, Contractor shall perform the repairs and payment to Contractor shall be on the basis of (1) actual cost of direct labor (hourly rates), (2) actual cost of materials and equipment usage, and (3) a fixed mark-up to cover Contractors overhead and profit equal to 15%.

AutoPatrol™ System	**Cost**
AP Strobe Assembly	$5,100.87
AP Strobe with Housing	$6,257.64
Strobe Bulb	$1,037.88
Radar Sensor	$12,822.50
SCIV 16MP Camera	$21,303.75
60MM Lens	$2,744.98
60MM IR Filter	$2,001.66
SCIV 16MP Camera Right	$21,303.75
SCIV 29MP Camera	$28,897.78
SCIV 29MP Camera Right	$28,897.78
80MM Lens	$3,248.26
80MM IR Filter	$1,946.46
80MM Polarizer	$1,930.79
Basler Video Camera	$3,133.75
HD Video Upgrade Kit	$3,420.10
Cradle Point	$1,959.60
Antennae	$1,275.35
1 TB Hard Drive	$1,864.35
Power Supply Module	$2,445.51
Interface Module	$1,919.17
ISK Module	$1,667.59
Traffic Light Controller Module	$2,070.56
10M SCIV Power Cable	$1,809.35

10M SCIV System Cable	$1,846.01
110V Camera Enclosure Cable	$1,764.82
10M Patch Cable	$1,702.83
10M SCIV Lan Cable	$1,794.51
10M Flash System Cable	$1,814.59
10M 110V Flash Cable	$1,801.49
Multi Modem	$1,430.60
Cable, Antennae, LMR, 36"	$1,695.68
Cable, Null Modem, DB9 Male/Male	$1,689.35
20' Pole	$1,863.00
10' Pole	$1,771.00
Base, Pole, Extended neck	$1,589.30
Cap, Pole	$1,128.73
Collar, Pole	$1,164.95
AP Driver Liability Kit	$78,145.95
AP Driver Liability Dual Frontal Kit	$110,943.55
2" PVC Conduit, cable comms/power ($36.80 per LF ≤ 100ft) plus $1495 labor	$36.80/LF + $1495
3" PVC Conduit, cable comms/power ($43.70 per LF ≤ 100ft) plus $1495 labor	$43.70/LF + $1495
2" PVC Conduit, cable comms/power ($9.20 per LF > 100ft) plus $1495 labor	$9.20/LF + $1495
3" PVC Conduit, cable comms/power ($17.25 per LF > 100ft) plus $1495 labor	$17.25/LF + $1495

Legacy System	**Cost**
AP Strobe Assembly	$5,100.87
AP Strobe with Housing	$6,257.64
Strobe Bulb	$1,037.88
Outer Enclosure D Shape	$8,290.27
Camera Enclosure, Left	$3,592.69
20' Pole	$1,863.00
Base, Pole, Extended neck	$1,589.30
Cap, Pole	$1,128.73
Collar, Pole	$1,164.95
Fabick Epoxy	$1,518.00
Fabick Mixing Tube	$1,497.30
Sensys Access Point	$2,932.50
Sensys Mounting Bracket	$1,612.99
Sensys Wireless Sensor	$1,919.35
Sensys Access Box	$1,610.00
Sensys CC Card	$1,734.20
Sensys EX Card	$1,451.30
TC-16MP Camera	$8,023.55
Tamron Cannon Lens	$2,397.75

IR Cut Filter	$1,945.80
Bosch Camera	$2,396.60
Bosch Lens	$2,087.25
Cradle Point	$2,333.35
Antennae	$1,649.10
Multi Modem	$1,804.35
Cable, Antennae, LMR, 36"	$1,695.68
Cable, Null Modem, DB9 Male/Male	$1,689.35
DB9 Pigtail Cable	$1,691.04
BNC Y Connector	$1,504.15
Gender Changer	$1,497.99
Master Controller Card	$2,428.80
Power Supply Card	$1,591.60
1' Patch Cable	$1,122.76
2' Patch cable	$1,122.50
Power Supply Cable	$1,121.54
DVR	$2,554.15
FTP Server	$2,139.00
Reboot Controller	$2,098.75
Linksys 8 Port	$1,560.54
I/O Module Rack	$1,543.24
I/O Yellow Unit	$1,511.16
Serial Device 2 Port	$1,380.56
Serial Cable	$1,308.86
Multi Modem	$1,430.60
PBCA, RLC Backplane	$1,602.53
PBCA, RLC Interface	$1,647.49
2" PVC Conduit, cable comms/power ($36.80 per LF ≤ 100ft) plus $1495 labor	$36.80/LF + $1495
3" PVC Conduit, cable comms/power ($43.70 per LF ≤ 100ft) plus $1495 labor	$43.70/LF + $1495
2" PVC Conduit, cable comms/power ($9.20 per LF > 100ft) plus $1495 labor	$9.20/LF + $1495
3" PVC Conduit, cable comms/power ($17.25 per LF > 100ft) plus $1495 labor	$17.25/LF + $1495

PLP Option	**Cost**
8' Piezo	$2,615.10
6' Piezo	$2,538.05
Piezo Interface Card	$1,420.03
Loop Detector Card	$1,447.16
Grout	$2,592.10

Appendix B

CALCULATION OF CHARGES

Exhibit 3
Construction Consultation

The SFMTA will pay Contractor the total cost of Construction Consultation listed in Column A, below, upon completion of installation and testing of System Equipment for all 19 Approaches, unless City determines a lesser number of Approaches to install, in which case SFMTA will pay Contractor upon the completion of the lesser number of Approaches.

Contractor's Construction Consultation fee will increase or decrease by the Total shown in Column B for each Approach the SFMTA adds or removes, respectively, from Contractor's scope of Services.

	A	**B**
Construction Consultation	**Cost for 19 Digital Approaches (13 Intersections)**	**Cost per Approach**
Construction Consultation	$13,850	$728.95
TOTAL	**$13,850**	**$728.95**

Appendix B

CALCULATION OF CHARGES

Exhibit 4
System Equipment Lease Charges

The monthly fees payable to Contractor for the SFMTA's lease of System Equipment are set forth below.

A	B	C	D
Item	**# Units**	**Lease Price per month per unit**	**Total Cost per Month (# units x $/per month)**
Cameras (including image processing unit and housing)	19	$893	$16,967
Poles	19	$33	$627
Monthly Total	**19**	**$926**	**$17,594**

The SFMTA will pay Contractor the "TOTAL" shown in Column D only after Contractor has commenced operation of the System Equipment for the 19 Approaches set forth in Appendix A, Section 2.A. Prior to that time, the monthly lease payment owing from the SFMTA to Contractor will be calculated as follows: Total from Column C × number of Approaches for which System Equipment has been installed and operations have commenced.

If the number of Approaches changes, the monthly lease payment will change accordingly based on the "TOTAL" shown in Column C. For example, if the SFMTA adds two new Approaches to, and removes one Approach from, the System, the monthly lease payment owing to Contractor would increase by $926 to $18,520.

Appendix B

CALCULATION OF CHARGES

Exhibit 5
Option to Self-Administer

The monthly fees payable to Contractor is the SFMTA exercises the option to self-administer the Automated Photo Enforcement Program.

Item	Cost
Software License	
a. Lease $/Month	$400/month per Approach
b. Purchase	N/A
Training ($/hr)	$80
Consultation ($/hr)	$80
Software Development ($/hr)	$150
System Equipment Lease	Same as charges in Appendix B, Exhibit 4 (System Equipment Lease Charges)

Appendix C

SAMPLE COURT EVIDENCE PACKAGE

[A PDF of the Sample Court Evidence Package is available upon request.]

Appendix D

SYSTEM REQUIREMENTS AND TECHNICAL SPECIFICATIONS

Contractor shall maintain the System in accordance with the requirements and technical specifications in this Appendix D. These requirements and technical specifications shall apply to each Approach, as the System Equipment for the Approach is installed and completed, and the System as a whole, as applicable. Additional City requirements and specifications apply where indicated below and are provided in Appendix F.

1. The System

a. The System shall incorporate existing camera technology used to enforce red light and illegal turn violations (Violations). This existing camera technology shall have an established record of reliable performance, as proven by continuous on-street service capturing red light and illegal turn violations for no less than six months.

b. The System shall accurately identify vehicles, whose drivers commit Violations while traveling through signalized and un-signalized intersections, and left-turn traffic signals, by taking no less than two photographs of the front and rear views of each such vehicle.

c. The System shall record Violations at all times of the day and night, during each season of the year, and all conditions of varying sunlight and shadowing. The System's photographs shall capture the following views:

(1) Front and rear views of vehicle;
(2) Characters and numbers on vehicle's reflective and non-reflective license plates;
(3) Superimposed data and information (i.e., date, time, location code, lane number, amber time, red time, and location event number).

d. The System shall be fully suitable and functional for unattended use, under all weather conditions.

2. Power and Other Connections

a. Interfaces between the Image Processing Unit and traffic signal equipment shall be coupled, so the System does not interfere with the operation of the traffic signal equipment.

b. The System's electrical service current shall be fused at a rating no higher than 20A, and signal phase current shall be fused at a rating no higher than 5A.

3. Housing and Poles

a. Contractor shall not attach System Equipment to existing City equipment unless the City grants Contractor written permission to do so.

4. Cameras

a. The System's cameras shall produce high-resolution images of each Violation, so the SFPD can clearly identify the driver and license plate number.

b. The cameras shall produce video recordings of vehicles committing Violations.

c. For each Event, the System shall produce at least two images, which include clear depictions of the vehicle's driver and license plate.

d. For red light Violations, the camera images shall capture front and rear images at the following moments:

(1) The vehicle behind the stop line when the light was already red.

(2) The vehicle in the intersection committing the red light Violation.

e. For illegal turn Violations, the camera images shall capture front and rear images at the following moments:

(1) The vehicle approaching the illegal turn movement.

(2) The vehicle having completed the illegal turn movement.

5. Image Processing Unit

a. The Image Processing Unit shall count traffic volumes and the number of Violations.

b. Image Processing Unit shall provide ATS Live™, which provides live motion video of the intersection to allow for remote surveillance of the intersection from a centralized traffic management center. Contractor shall not record or retain for any period of time any live motion video produced by ATS Live™, except for the Images captured by the photo enforcement System Equipment, which is accessible through ATS Live. Contractor shall retain the ownership rights to all meta-data, business intelligence, and other analytics Contactor obtains, gathers, or mines for its own purposes through use of Contractor's camera systems, including the data created through ATS Live™. City will comply with all federal, state, and local laws, ordinances, regulations and orders with respect to its access to and use of ATS Live™, including without limitation any laws relating to data privacy or photo enforcement.

c. The Image Processing Unit shall provide the capability to calculate and monitor vehicle speed. Events shall be recorded only when vehicles have entered the detection zone exceeding a SFMTA-specified minimum speed. The minimum speed shall be adjustable to the nearest mile per hour.

d. The Image Processing Unit shall record data pertinent to each Violation,

including but not limited to date, time, location code, lane number, amber time, red time, and location event number.

6. Flash

Flash units shall provide sufficient illumination for the System's cameras to capture clear images of Violations, as follows:

a. For an area of up to three traffic lanes or approximately 40 feet wide at a distance of up to 150 feet.

b. At varying levels of ambient light conditions (i.e., all light and weather conditions).

c. For both the first and second Violation images.

7. Vehicle Detection Equipment

a. The System's vehicle detection capabilities shall be sensitive to speed and direction.

b. The System shall detect vehicles separately in each traffic lane, and identify which lane triggers the Violation caught in the camera's image.

c. If used for vehicle detection, inductive loops shall comply with the requirements in Section 3.3.A of Specification 34 41 13 (Inductive Loop Installation)

d. If used for vehicle detection, wireless in-pavement sensors shall comply with the requirements in Section 3.3.B of Specification 34 41 13 (Wireless Magnetometer Vehicle Detection System Installation, Warranty, and System Support).

e. For any Approach, Contractor shall deactivate or remove inductive loops or wireless in-pavement sensors, as applicable, within five days notice from the City that construction work will commence. Contractor shall be compensated for the reactivation or reinstallation of the loops or sensors as specified in Appendix B, Exhibit 2 Estimated Third Party Damage Repairs.

8. Vehicle Detection Installation and Operation

a. Contractor shall install and operate all vehicle detection equipment to the satisfaction of the SFMTA. The SFMTA shall have the right to inspect, confirm, specify, and approve all installations, removals, and relocations of, and modifications to vehicle detection equipment, and all other System Equipment. The following requirements shall govern the use, installation, removal, and relocation of, and modification to vehicle loop detectors used in the System.

b. There are two critical measurements for vehicle detection loops, referred to as pitch measurements. First, is the center-to-center distance between the loops,

that is the pitch measurement. Second, is the measurement distance from the stop line to the leading edge of the second detection loop. In all cases where vehicle detection is used as a part of this System, the following requirements apply:

(1) The shortest pitch dimension, where more than one pitch measurement may be applicable, shall be used for the camera unit setting (that is, in order that the measurement be in the favor of the motorist). This requirement shall govern all vehicle detector loop installations under this Agreement. If any unusual vehicle detector loop configurations occur due to intersection geometrics, or if loop removals, relocations, or modifications of any kind are encountered by Contractor or found to be necessary under this Agreement that fall outside of this specification, Contractor shall notify SFMTA the next business day and provide a recommended installation specification for approval by SFMTA.

(2) For detection technology other than inductive loops, such as wireless in pavement sensors or radar detection, installation may be different. Detectors shall be installed per the manufacturer's recommendation to achieve the desired results described above for inductive loops.

(3) In all cases, Contractor shall seek and obtain SFMTA permission for all vehicle detector installation specifications or modifications that may fall outside of these criteria before beginning, continuing, or restarting enforcement mode. SFMTA has approved the use of Contractor's AutoPatrol™ camera systems.

(4) Contractor shall make every effort to ensure that installation of all vehicle detection equipment is in accordance with the manufacturer's installation instructions and the accepted design plans. Any variance between the designed location of vehicle detection loops and the actual installation of such loops shall be noted on the As-Built plans. Camera unit and measured detection loop pitch values shall both correspond to design values but in no event shall exceed 1% between the measured values and those input to the Camera unit.

(5) At those intersections where two sets of detection equipment (i.e., one set for traffic control and one set for photo enforcement) are in place making it difficult to determine with certainty which set of equipment is currently operational for the photo enforcement system, all As-Built drawings shall be provided so that the operational detection equipment can be readily identified. Abandoned loops must be intentionally cut on two sides so that it is clear that the loops have been abandoned as

well as to eliminate any possibility of loop to loop crosstalk.

9. Cabinets

a. If a cabinet is required to house System Equipment, the cabinet shall be the smallest cabinet available that can house the necessary equipment and provide a reasonable amount of working space.

b. If Contractor needs to access the existing traffic signal cabinet, Contractor shall perform work in compliance with plans and requirements in Specification 34 41 13, Traffic Signals.

10. Conduit, Pull Boxes, and Wiring

Contractor shall perform all conduit, pull box, bonding and grounding, foundation, wiring, and electrical work in compliance with requirements in Specifications 26 04 00, General Requirements for Electrical and 26 05 00, Common Work Results for Electrical.

11. Trenching, Excavation, Backfill, Compaction, and Pavement Restoration

a. Contractor shall perform all trenching, excavation, backfill, and compaction work in compliance with the requirements in Specification 31 23 34, Pavement Cutting and Excavation.

b. Contractor shall perform all cold planning of asphalt pavement, and restoration of asphalt or concrete pavement in compliance with the requirements in Specifications 32 01 16.71, Cold Milling Asphalt Paving, 32 12 16, Asphalt Paving, and 32 13 13, Concrete Paving.

12. Maintenance

a. Contractor shall design the Image Processing Unit so Malfunctions can be easily identified and debugged. The Image Processing Until shall, at a minimum, provide the following features:

(1) Perform self-test on the photographic unit and flash.

(2) Record date and time of camera shutdown in the event of a Malfunction.

b. Contractor shall inspect and test System Equipment on a routine basis to verify System Equipment is working properly.

c. Contractor shall keep in its files the original Field Technician Service and Inspection Logs for use as evidence, as required by the court.

Appendix E

(Agreement No. SFMTA-2016-49)

City and County of San Francisco
Municipal Transportation Agency
One South Van Ness Avenue, 7th Floor
San Francisco, California 94103

Equipment Lease Attachment

This Lease is an attachment to the Agreement between the City and County of San Francisco (City), acting through its Municipal Transportation Agency (SFMTA), and American Traffic Solutions, Inc., doing business as Verra Mobility, (Lessor), dated August 21, 2018. The Terms and conditions of this Lease are referenced in and incorporated into the Agreement between the City and Lessor (collectively, the Parties). Capitalized terms used but not defined in this Lease shall have the meanings given to those terms in the Agreement.

Recitals

A. On April 14, 2015, under authority of San Francisco Administrative Code Chapter 21.1, the SFMTA issued a request for proposals to upgrade and administer the City's Automated Photo Enforcement System (System), pursuant to which the SFMTA competitively selected Lessor, the highest-qualified proposer, to perform the services over a two-phased contract.

B. The services for Phase I included preparation of construction ready plans, specifications, and engineer's estimates to install the System Equipment, which services Lessor performed under Contract No. SFMTA-2015-13.

C. The Services for Phase II include construction consultation, leasing of digital System Equipment, maintenance of System Equipment, and program administration, which Lessor will perform under this Agreement.

D. This Lease sets for the terms and conditions for the City's lease from Lessor of the digital System Equipment.

NOW, THEREFORE, the City and Lessor agree as follows:

1. Certification of Funds; Budget and Fiscal Provisions; Termination in the Event of Non Appropriation. This Lease and the Agreement are subject to the budget and fiscal provisions of the City's Charter. Charges will accrue only after prior written authorization certified by the City's Controller, and any amount of the City's obligation hereunder shall not at any time exceed the amount certified for the purpose and period stated in such advance authorization. This Lease and the Agreement will terminate without penalty, liability, or expense of any kind to the City at the end of any fiscal year in the event funds are not appropriated for the next succeeding fiscal year. If funds are appropriated for a portion of the fiscal year, this Lease

and the Agreement will terminate, without penalty, liability or expense of any kind at the end of the term for which funds are appropriated, and Lessor's sole remedy shall be repossession of the leased System Equipment. This Section shall control against any and all other provisions of this Lease and the Agreement.

2. Term of the Lease. Subject to Section 1, the term of this Lease shall be from the date when the first Approach is operational until the end of the term or earlier termination of the Agreement, as applicable.

3. No Automatic Renewal. Notwithstanding anything to the contrary contained in this Lease (including, without limitation, any terms and conditions of Lessor attached hereto): (a) in no event shall the term of this Lease be longer than the initial term expressly stated in this Lease; (b) any automatic renewal or extension (whether or not conditioned upon any notice or absence thereof from either Party) or any similar "evergreen" provision shall be deemed null and void *ab initio*; and (c) the term of this Lease shall not be extended or renewed except by written agreement duly authorized, executed and delivered by City. In the event of any inconsistency within this Lease relating to the duration of the initial term hereof, the shorter initial term shall govern. If no initial term is stated in this Lease, then the term shall be one year from the date on which the term commences.

4. City's Payment Obligation. In no event will the City make an advance payment under this Lease. If any payment of any amount of monies is required by any vendor or manufacturer prior to acceptance of the leased System Equipment by the City, Lessor is to advance such amounts. The City will make a good faith effort to pay all invoices within 30 days of billing. In no event will the City pay any late fees or charges for payments made after the 30-day period. Lessor and the City understand and intend that the obligations of the City to pay Lease Fees hereunder shall constitute a current expense of the City and shall not in any way be construed to be a debt of the City in contravention of any applicable constitutional or statutory limitations or requirements concerning the creation of indebtedness by the City, nor shall anything contained herein constitute a pledge of the general tax revenues, funds, or monies of the City. The City shall pay Lease Fees, exclusively from legally available funds, to Lessor or, in the event of an authorized assignment by Lessor to its assignee, according to the terms of this Lease, upon presentation of invoices furnished by Lessor in a form acceptable to the Controller. Each invoice must have a unique identifying number. Payments will be made in United States Dollars by warrant drawn on the Treasurer of the City and County of San Francisco. Lease Fees shall be in consideration for the City's use of the leased System Equipment during the applicable fiscal year in which such payments are due. In no event shall the amount of this Lease exceed ONE MILLION FIFTY-FIVE THOUSAND, SEVEN HUNDRED AND FORTY-TWO DOLLARS ($1,055,742). The breakdown of costs associated with this Lease appears in Exhibit 4 of Appendix B to the Agreement, to which this Lease is attached.

5. Guaranteed Maximum Costs. The City's obligation hereunder shall not at any time exceed the amount certified by the Controller for the purpose and period stated in such certification. Except as may be provided by laws governing emergency procedures, officers and employees of the City are not authorized to request, and the City is not required to reimburse the Contractor for, commodities or services beyond the agreed upon scope of Services unless the changed scope is authorized by amendment and approved as required by law. Officers and

employees of the City are not authorized to offer or promise, nor is the City required to honor, any offered or promised additional funding in excess of the maximum amount of funding certified for the Agreement without certification of the additional amount by the Controller. The Controller is not authorized to make payments on any contract for which funds have not been certified as available in the budget or by supplemental appropriation.

6. Submitting False Claims; Monetary Penalties. Pursuant to San Francisco Administrative Code §21.35, any contractor, subcontractor, or consultant that submits a false claim shall be liable to the City for the statutory penalties set forth in that section. A contractor, subcontractor, or consultant will be deemed to have submitted a false claim to the City if the contractor, subcontractor, or consultant: (a) knowingly presents or causes to be presented to an officer or employee of the City a false claim or request for payment or approval; (b) knowingly makes, uses, or causes to be made or used a false record or statement to get a false claim paid or approved by the City; (c) conspires to defraud the City by getting a false claim allowed or paid by the City; (d) knowingly makes, uses, or causes to be made or used a false record or statement to conceal, avoid, or decrease an obligation to pay or transmit money or property to the City; or (e) is a beneficiary of an inadvertent submission of a false claim to the City, subsequently discovers the falsity of the claim, and fails to disclose the false claim to the City within a reasonable time after discovery of the false claim.

7. Maintenance. Lessor shall be responsible for all service, repair, and maintenance of the leased System Equipment unless otherwise specified by this Lease or the Agreement. Lessor, at its sole cost and expense, shall keep the leased System Equipment in good operating order, repair, condition, and appearance and shall furnish all parts, mechanisms, or devices required to keep the leased System Equipment in good mechanical and working order.

8. Use, Licenses. The City will not use or operate the leased System Equipment improperly, carelessly, in violation of any applicable law, or in a manner contrary to that contemplated by this Lease.

9. Delivery of Equipment; Transportation. It is the responsibility of Lessor to arrange with the manufacturer(s) and/or vendor(s) for delivery of the leased System Equipment. Charges for delivery are the responsibility of Lessor. The leased System Equipment to be provided under this Lease shall be delivered to a location the City designates. The City shall provide a minimum of two weeks advanced notice to Lessor to deliver and furnish the leased System Equipment ready and available for installation by Construction Contractor. All leased System Equipment shall be delivered to and stored by the Construction Contractor, unless the City has agreed upon another location.

10. Installation. Lessor shall provide construction consultation services to the Construction Contractor during the assembly and installation of the leased System Equipment at each Approach. Lessor shall provide and make any adjustments, fine tuning, and troubleshooting necessary to obtain optimal performance of the leased System Equipment as necessary at locations the City designates.

11. Relocation of System Equipment. Lessor agrees that the City may upon reasonable notice to Lessor, relocate the leased System Equipment or any item or items thereof to any

location or locations within the geographical boundaries of the City or where the City has offices at the City's sole discretion and cost. Prior to any such relocation the City agrees to execute or obtain and deliver to Lessor such documents that Lessor reasonably requests to protect Lessor's right, title, and interest in the leased System Equipment.

12. Lessor's Removal and the City's Surrender of the System Equipment. At the end of the term of this Lease, or unless sooner terminated, and in accordance with the Agreement, Lessor agrees, at Lessor's cost to accept and remove the leased System Equipment as provided in this Lease. Lessor's failure to accept and remove the leased System Equipment shall entitle the City to remove the leased System Equipment and place it in any storage facility in San Francisco at Lessor's sole expense and Lessor shall hold the City free and harmless from any expense or damages of any kind occasioned thereby and arising therefrom.

13. Default. In the event of a default by Lessor under this Lease or the Agreement, the City shall have the right to exercise its legal and equitable remedies, including, without limitation, the right to terminate this Lease. In addition, the City shall have the right (but no obligation) to cure (or cause to be cured) on behalf of Lessor any default by Lessor. Lessor shall pay to the City on demand all costs and expenses the City incurs in effecting such cure, with interest thereon from the date of incurrence at the maximum rate then permitted by law. The City shall have the right to offset from any amounts due to Lessor under this Lease or the Agreement all damages, losses, costs or expenses incurred by City as a result of such default by Lessor.

14. Force Majeure. Lessor shall not be liable for its failure to furnish leased System Equipment on the date(s) specified by the City, or to remove leased System Equipment in accordance with the terms of this Lease, nor shall the City be liable for delay in installation or removal of leased System Equipment if such failures result from causes beyond the reasonable control of either Party. Such causes include acts of God, acts of civil or military authority, fires, strikes, floods, epidemics, quarantine, war, riot, delays in transportation, care shortages, and inability due to causes beyond its reasonable control to obtain necessary labor, materials, or manufacturing facilities (force majeure events). In the event of such force majeure events, the Party under obligation to perform shall perform as soon as the force majeure event ceases or is removed.

15. The City's Right to Use Other Equipment Simultaneously with the Equipment. The City does not grant Lessor an exclusive right during the term of this Lease to supply the City with any equipment. The City reserves the right to lease or purchase from any other supplier or lessor equipment similar to or different from the leased System Equipment, which such equipment the City may use contemporaneously with any item of leased System Equipment leased hereunder.

16. Disclaimer of Warranties. Lessor hereby assigns to the City for and during the term of this Lease, to the extent permitted by law, all manufacturer's or vendor's warranties or guaranties, express or implied, issued on or applicable to the leased System Equipment. Lessor authorizes the City, to the extent permitted by law, to enforce in its own name any warranty, representation or other claim enforceable against the manufacturer or vendor. The City acknowledges that the leased System Equipment has been purchased by Lessor on behalf of the

City in accordance with the City's specifications. The City shall look directly to the manufacturer or vendor for any warranties or any service for the leased System Equipment.

17. Indemnification. Lessor shall indemnify and save harmless the City and its officers, agents, and employees from, and, if requested, shall defend them against any and all loss, cost, damage, injury, liability, and claims thereof for injury to or death of a person, including employees of Lessor, or loss of or damage to property, arising directly or indirectly from Lessor's performance of this Lease, including, but not limited to, Lessor's use of facilities or equipment provided by City or others, regardless of the negligence of, and regardless of whether liability without fault is imposed or sought to be imposed on City, except to the extent that such indemnity is void or otherwise unenforceable under applicable law in effect on or validly retroactive to the date of this Lease, and except where such loss, damage, injury, liability or claim is the result of active negligence or willful misconduct of the City and is not contributed to by any act of, or by any omission to perform some duty imposed by law or agreement on Lessor, its subcontractors or either's agent or employee. The foregoing indemnity shall include, without limitation, reasonable fees of attorneys, consultants and experts and related costs and the City's costs of investigating any claims against the City.

In addition to Lessor's obligation to indemnify the City, Lessor specifically acknowledges and agrees that it has an immediate and independent obligation to defend the City from any claim which actually or potentially falls within this indemnification provision, even if the allegations are or may be groundless, false or fraudulent, which obligation arises at the time such claim is tendered to Lessor by the City and continues at all times thereafter. Lessor shall indemnify and hold the City harmless from all loss and liability, including attorney's fees, court costs and all other litigation expenses for any infringement of the patent rights, copyright, trade secret or any other proprietary right or trademark of any person or persons in consequence of the use by the City, or any of its officers or agents, of articles or services to be supplied in the performance of this Lease.

18. Enjoyment of the Equipment. So long as the City is not in default under this Lease, Lessor hereby covenants to provide the City, during the term of this Lease, with quiet use and enjoyment of the leased System Equipment, and the City shall during the term of this Lease peaceably and quietly have and hold and enjoy the equipment, without suit, trouble, or hindrance from Lessor, except as expressly set forth in this Lease. Any assignee of Lessor shall not interfere with the City's quiet use and enjoyment during the Lease Term so long as the City is not in default pursuant to this Lease.

19. Title to the Equipment. Title to the leased System Equipment and any and all additions, repairs, replacements, or modifications thereto shall be held in the name of Lessor, and the City shall have no right, title, or interest in the leased System Equipment or any additions, repairs, replacements, or modifications thereto except as expressly set forth in this Lease.

20. Liability for Damage to Equipment. It is understood and agreed the City is responsible for loss of or damage to any Lessor-owned equipment used under this Lease, but only if the loss or damage is caused by the negligent or wrongful actions of the City's officers, agents, and employees.

21. Incidental and Consequential Damages. The City and Lessor waive claims against each other for incidental and consequential damages that arise out of or relate to this Agreement. Nothing in this Lease or the Agreement shall constitute a waiver or limitation of any other rights which the City may have under applicable law.

22. Insurance. Without in any way limiting Contractor's liability pursuant to the "Indemnification" sections of this Lease or the Agreement, Contractor shall maintain in force, during the full term of this Lease, all insurance amounts and coverages set forth in Section 5.1 (Insurance) of the Agreement. The provisions in Section 5.1 of the Agreement apply to this Lease.

23. Provisions Controlling. Lessor further agrees that in the event of conflicting language between this "Equipment Lease Attachment" and Lessor's printed form, this "Equipment Lease Attachment" shall take precedence.

24. Lessor's Default. Failure or refusal of Lessor to perform or do any act herein required shall constitute a default. In the event of any default, in addition to any other remedy available to the City, this Contract may be terminated by the City upon ten days' written notice. Such termination does not waive any other legal remedies available to the City.

25. Taxes. The City will reimburse Lessor for California sales and use taxes Lessor actually pays. If applicable, Lessor shall add California sales and use taxes to its monthly invoice, with the taxes properly identified on each monthly invoice. Lessor shall be liable for any other taxes presently in effect which may be levied upon this Agreement, the transaction, or the leased System Equipment or services delivered pursuant hereto. Lessor will be responsible for all property taxes. If any new taxes are enacted after the date of execution of this Lease, those taxes shall be borne as mutually agreed by the Parties. Lessor shall indemnify and hold the City harmless from any fines, penalties, or interest thereon imposed during the term of this Lease or in connection with termination of this Lease by any federal, State, or local government or taxing authority. The taxes covered by this Section shall only include those attributable to the leased System Equipment. Under no circumstances will the City pay any taxes imposed on, based on, or measured by the net income of Lessor.

26. Assignment. Notwithstanding any other provision in this Lease, in no event shall all or any portion of this Lease be assigned without the prior written approval of the SFMTA and the City Attorney. Furthermore, in no event shall Lessor effect a public offering of certificates of participation, municipal securities, or other debt instruments presenting fractionalized interests in this Lease. For purposes of this Section, a public offering shall occur when the certificates of participation, municipal securities, or other debt instruments are either: (a) offered or sold to more than twenty investors; or, (b) offered or sold in denominations of less than $10,000.

27. Reserved

28. Notices to Parties. Unless otherwise indicated elsewhere in this Lease, all written communications sent by the Parties shall be by U.S. mail, e-mail, or by fax, and shall be addressed as follows:

To City: Monica Giese, Project Manager

Automated Photo Enforcement Program
Sustainable Streets Division
San Francisco Municipal Transportation Agency
1 South Van Ness Ave, 7th Floor
San Francisco, CA 94103-5417
Email: monica.giese@sfmta.com

To Contractor: Elizabeth Caracciolo, Executive Vice President
Verra Mobility
1150 N. Alma School Road
Mesa, AZ 85201
Email: liz.caracciolo@atsol.com

With a copy to:

Verra Mobility
1150 N. Alma School Road
Mesa, AZ 85201
ATTN: Legal Department

Any notice of default must be sent by registered mail or overnight delivery service.

29. Section Headings. All section headings contained herein are for convenience and reference only and are not intended to define or limit the scope of any provision of this Lease.

30. Waiver. The waiver by either Party of any breach by either Party of any term, covenant or conditions hereof shall not operate as a waiver of any subsequent breach of the same or any other term, covenant or condition hereof.

31. Governing Law. This Lease shall be governed exclusively by the provisions hereof and by the laws of the State of California.

32. Entire Agreement; Modifications. The Agreement, together with its appendices, including this Lease, constitute the entire agreement between the Parties. This Lease shall not be modified, amended, altered, or changed except in writing as herein provided. All agreements between the Parties are included herein and no promises or statements have been made by either Party unless endorsed hereon in writing. No change or waiver of any provisions hereof shall be valid unless made in writing with the consent of both Parties and executed in the same manner as this Lease. Any provision of this Lease found to be prohibited by law shall be ineffective to the extent of such prohibition without invalidating the remainder of this Lease. Subject to the specific provisions of this Lease, this Lease shall be binding upon and inure to the benefit of the parties and their respective successors and assigns.

33. Nondiscrimination; Penalties

a. Lessor Shall Not Discriminate. In the performance of this Lease, Lessor agrees not to discriminate against any employee, City and County employee working with Lessor or its

subcontractors, applicant for employment with Lessor or its subcontractors, or against any person seeking accommodations, advantages, facilities, privileges, services, or membership in all business, social, or other establishments or organizations, on the basis of the fact or perception of a person's race, color, creed, religion, national origin, ancestry, age, height, weight, sex, sexual orientation, gender identity, domestic partner status, marital status, disability or Acquired Immune Deficiency Syndrome or HIV status (AIDS/HIV status), or association with members of such protected classes, or in retaliation for opposition to discrimination against such classes.

b. Subcontracts. Lessor shall incorporate by reference in all subcontracts the provisions of Sections 12B.2(a), 12B.2(c)-(k), and 12C.3 of the San Francisco Administrative Code (copies of which are available from Purchasing) and shall require all subcontractors to comply with such provisions. Lessor's failure to comply with the obligations in this subsection shall constitute a material breach of this Agreement.

c. Nondiscrimination in Benefits. Lessor does not as of the date of this Lease, and will not during the term of this Lease, in any of its operations in San Francisco or where work is being performed for the City or elsewhere within the United States, discriminate in the provision of bereavement leave, family medical leave, health benefits, membership or membership discounts, moving expenses, pension and retirement benefits or travel benefits, as well as any benefits other than the benefits specified above, between employees with domestic partners and employees with spouses, and/or between the domestic partners and spouses of such employees, where the domestic partnership has been registered with a governmental entity pursuant to state or local law authorizing such registration, subject to the conditions set forth in Section 12B.2(b) of the San Francisco Administrative Code.

d. Condition to Contract. As a condition to this Agreement, Lessor shall execute the "Chapter 12B Declaration: Nondiscrimination in Contracts and Benefits" form (form CMD-12B-101) with supporting documentation and secure the approval of the form by the San Francisco Human Rights Commission.

e. Incorporation of Administrative Code Provisions by Reference. The provisions of Chapters 12B and 12C of the San Francisco Administrative Code are incorporated in this Section by reference and made a part of this Agreement as though fully set forth herein. Lessor shall comply fully with and be bound by all of the provisions that apply to this Agreement under such Chapters of the Administrative Code, including but not limited to the remedies provided in such Chapters. Without limiting the foregoing, Lessor understands that pursuant to §§12B.2(h) and 12C.3(g) of the San Francisco Administrative Code, a penalty of $50 for each person for each calendar day during which such person was discriminated against in violation of the provisions of this Agreement may be assessed against Lessor and/or deducted from any payments due Lessor.

34. Reserved. (EIC Forms)

35. MacBride Principles—Northern Ireland. Pursuant to San Francisco Administrative Code §12F.5, the City and County of San Francisco urges companies doing business in Northern Ireland to move towards resolving employment inequities, and encourages such companies to abide by the MacBride Principles. The City and County of San Francisco urges San Francisco companies to do business with corporations that abide by the MacBride Principles. By signing

below, the person executing this agreement on behalf of Contractor acknowledges and agrees that he or she has read and understood this section.

36. Tropical Hardwoods and Virgin Redwood Ban. Pursuant to §804(b) of the San Francisco Environment Code, the City and County of San Francisco urges contractors not to import, purchase, obtain, or use for any purpose, any tropical hardwood, tropical hardwood wood product, virgin redwood or virgin redwood wood product.

37. Limitations on Contributions. Through execution of this Lease, Lessor acknowledges it is familiar with section 1.126 of the City's Campaign and Governmental Conduct Code, which prohibits any person who contracts with the City for the rendition of personal services, for the furnishing of any material, supplies or equipment, for the sale or lease of any land or building, or for a grant, loan or loan guarantee, from making any campaign contribution to (1) an individual holding a City elective office if the contract must be approved by the individual, a board on which that individual serves, or the board of a state agency on which an appointee of that individual serves, (2) a candidate for the office held by such individual, or (3) a committee controlled by such individual, at any time from the commencement of negotiations for the contract until the later of either the termination of negotiations for such contract or six months after the date the contract is approved. Lessor acknowledges that the foregoing restriction applies only if the contract or a combination or series of contracts approved by the same individual or board in a fiscal year have a total anticipated or actual value of $50,000 or more. Lessor further acknowledges the prohibition on contributions applies to each prospective party to the contract; each member of Lessor's board of directors; Lessor's chairperson, chief executive officer, chief financial officer, and chief operating officer; any person with an ownership interest of more than 20 percent in Lessor; any subcontractor listed in the bid or contract; and any committee that is sponsored or controlled by Lessor. Additionally, Lessor acknowledges Lessor must inform each of the persons described in the preceding sentence of the prohibitions contained in Section 1.126**.** Lessor further agrees to provide to the City the names of each person, entity or committee described above.

38. Prohibition on Political Activity with City Funds. In accordance with San Francisco Administrative Code Chapter 12.G, Lessor may not participate in, support, or attempt to influence any political campaign for a candidate or for a ballot measure (collectively, "Political Activity") in the performance of the services provided under this Lease. Lessor agrees to comply with San Francisco Administrative Code Chapter 12.G and any implementing rules and regulations promulgated by the City's Controller. The terms and provisions of Chapter 12.G are incorporated herein by this reference. If Lessor violates the provisions of this section, the City may, in addition to any other rights or remedies available hereunder, (i) terminate this Lease, and (ii) prohibit Lessor from bidding on or receiving any new City contract for a period of two years. The Controller will not consider Lessor's use of profit as a violation of this section.

39. Sunshine Ordinance. In accordance with Section 67.24(e) of the San Francisco Administrative Code, contracts, contractors' bids, responses to requests for proposals and all other records of communications between the City and persons or firms seeking contracts shall be open to inspection immediately after a contract has been awarded. Nothing in this provision requires the disclosure of a private person's or organization's net worth or other proprietary financial data submitted for qualification for a contract or other benefit until and unless that

person or organization is awarded the contract or benefit. Information provided which is covered by this paragraph will be made available to the public upon request.

40. Conflict of Interest. Through its execution of this Lease, Lessor acknowledges that it is familiar with the provision of Section 15.103 of the City's Charter, Article III, Chapter 2 of the City's Campaign and Governmental Conduct Code, and Section 87100 et seq. and Section 1090 et seq. of the Government Code of the State of California, and certifies that it does not know of any facts which constitutes a violation of said provisions and agrees that it will immediately notify the City if it becomes aware of any such fact during the term of this Lease.

41. Compliance with Laws. Lessor shall keep itself fully informed of the City's Charter, codes, ordinances and regulations of the City and of all state, and federal laws in any manner affecting the performance of this Lease, and must at all times comply with such local codes, ordinances, and regulations and all applicable laws.

42. Protection of Private Information. Lessor has read and agrees to the terms set forth in San Francisco Administrative Code Sections 12M.2, "Nondisclosure of Private Information," and 12M.3, "Enforcement" of Administrative Code Chapter 12M, "Protection of Private Information," which are incorporated herein as if fully set forth. Lessor agrees that any failure of Lessor to comply with the requirements of Section 12M.2 of this Chapter shall be a material breach of the Lease. In such an event, in addition to any other remedies available to it under equity or law, the City may terminate the Lease, bring a false claim action against Lessor pursuant to Chapter 6 or Chapter 21 of the Administrative Code, or debar Lessor.

43. Reserved. (Sugar-Sweetened Beverage Prohibition)

44. Reserved. (Food Service Waste Reduction Requirements)

45. Cooperative Drafting. This Lease has been drafted through a cooperative effort of both Parties, and both Parties have had an opportunity to have the Lease reviewed and revised by legal counsel. Neither Party shall be considered the drafter of this Lease, and no presumption or rule that an ambiguity shall be construed against the Party drafting the clause shall apply to the interpretation or enforcement of this Lease.

IN WITNESS WHEREOF, the Parties hereto have executed this Lease on the day first mentioned above.

CITY	**CONTRACTOR**
San Francisco Municipal Transportation Agency _____ Edward D. Reiskin Director of Transportation AUTHORIZED BY: MUNICIPAL TRANSPORTATION AGENCY BOARD OF DIRECTORS Resolution No: _____ Adopted: _____ Attest: _____ Roberta Boomer, Secretary to the SFMTA Board of Directors Approved as to Form: Dennis J. Herrera City Attorney By: _____ Isidro A. Jiménez Deputy City Attorney	**American Traffic Solutions, Inc.** **dba Verra Mobility** I have read and understood paragraph 35, the City's statement urging companies doing business in Northern Ireland to move towards resolving employment inequities, encouraging compliance with the MacBride Principles, and urging San Francisco companies to do business with corporations that abide by the MacBride Principles. _____ Elizabeth Caracciolo Executive Vice President Verra Mobility 1150 N. Alma School Road Mesa, AZ 85201 City vendor number: **82130**

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Appendix F

ADDITIONAL CITY REQUIREMENTS

The following City Requirements are included in Appendix F:

Exhibit 1 01 55 26 Traffic Control

Exhibit 2 26 04 00 General Requirements for Electrical

Exhibit 3 26 05 00 Common Work Results For Electrical

Exhibit 4 31 23 34 Pavement Cutting and Excavation

Exhibit 5 32 01 16.71 Cold Milling Asphalt Paving

Exhibit 6 32 12 16 Asphalt Paving

Exhibit 7 32 13 13 Concrete Paving

Exhibit 8 34 41 13 Traffic Signals

SECTION 01 55 26

TRAFFIC CONTROL
(FOR SIGNAL PROJECTS)

PART I – GENERAL

1.1 DESCRIPTION

A. This Section sets forth the minimum requirements for traffic routing and traffic control under Contract Documents.

B. The Contractor may perform the traffic routing work utilizing his/her own forces, or may engage a subcontractor to perform the traffic routing work. If the Contractor intends to engage a subcontractor to perform this work, the subcontractor must possess a C-31 Construction Zone Traffic Control license issued by the State of California Contractors State License Board, and said subcontractor shall be listed on the list of Subcontractors to be submitted as part of the sealed bid.

C. In the event that an excavation code citation fee is levied against SFMTA in relation to work performed by the Contractor or Subcontractor for this project, an amount equal to the citation fee will be deducted from subsequent progress payment.

D. The Contractor shall provide at all times for the protection of the traveling public, pedestrians and workers within the area covered by the limits of construction when the area is affected by construction equipment and/ or activities.

E. The Contractor shall so conduct operations as to cause the least possible obstruction and inconvenience to the public and area residents, and shall have under construction no greater length or amount of work, than set forth in the specifications, and that can be executed properly with due regard to the rights of the public and area residents.

F. To protect the safety and convenience of the general public and area residents and to safeguard the workers and the work, the Contractor shall furnish, install, and maintain the following traffic signs and traffic control devices:
1. Traffic signs and parking prohibition signs
2. Barricades with flashers
3. Delineators
4. High level warning devices
5. Solar-powered flashing arrow signs
6. Pedestrian barricade
7. Temporary striping, reflective markers, and overlay markers, for both construction and interim re-alignments of traffic lanes and cross-walks prior to final striping

The Contractor shall install additional devices not listed herein as work conditions require.

G. The Contractor shall be responsible for the following:
1. Providing flag persons as needed
2. Responding to requests and complaints from local merchants and residents regarding traffic related concerns.

H. The Contractor shall provide traffic lanes and routing of vehicular and pedestrian traffic, as specified herein, in a manner that will be safe and that will minimize traffic congestion and delays during construction.

1.2 APPLICABLE STANDARDS

A. In addition to compliance with this Section, the Contractor shall comply with all applicable requirements of the latest editions of the following (except as modified herein):
1. California Vehicle Code.
2. City & County of San Francisco Municipal Transportation Code.
3. Other Applicable Government Regulations.
4. Standard Specifications, Department of Public Works, City and County of San Francisco, (DPW Standard Specification (SSDPWSF)).
5. Standard Specifications and Plans, Department of Transportation, State of California (Caltrans Standard Specifications (CTSS) and Caltrans Standard Plans (CTSP)).
6. California Manual on Uniform Traffic Control Devices (MUTCD)
7. "Work Area Traffic Control Handbook", BNI Books.
8. Regulations for Excavating and Restoring Streets in San Francisco, Department of Public Works, City and County of San Francisco.
9. Regulations for Working in San Francisco Streets ("Blue Book"), SFMTA, City and County of San Francisco.

B. Copies of the SSDPWSF may be viewed at the following website: http://sfdpw.org/index.aspx?page=294. Copies of the CTSS and CTSP may be viewed at the following website: http://www.dot.ca.gov/hq/esc/oe/construction_standards.html or obtained from the Caltrans office, 111 Grand Avenue, Oakland, CA 94623; Telephone No. (510) 286-4444, on payment of prescribed purchase price. Copies of the Blue Book may be viewed at the following website: http://www.sfmta.com/services/streets-sidewalks/construction-regulations or obtained at the San Francisco Municipal Transportation Agency, 1 South Van Ness Avenue, 7th Floor, San Francisco, CA 94103-5417; telephone (415) 701-4500.

C. Sections 300 thru 322, 600 thru 609 and 900 thru 911 of the SSDPWSF shall apply. Sections 10 thru 95 of CTSS shall apply.

1.3 SUBMITTALS

A. Contractor's Proposed Sequence of Construction and Traffic Control Plans
1. The Contractor shall submit traffic control plans in accordance with the Caltrans' "Manual of Traffic Controls for Construction and Maintenance Work Zones" and the contract plans. The traffic control plans shall be submitted to the Traffic Engineer through the Engineer within 14 days following Notice To Proceed. No work shall be allowed before the traffic control plans have been accepted by the City. A Detour Bicycle Path Plan shall be included in the Traffic Control Plans. Refer also to Part 3 of this Section.
2. The Contractor shall submit the traffic control plans and schedule on 4 sets (copies) of 11" wide x 17" long bond plan sheets. Plan drawings shall be submitted demonstrating the proposed sequence and construction relative to the installation of underground conduit and median construction work at the following locations and approaches:

Intersection	Approach(es)
4th Street and Harrison Street	ALL
6th Street and Bryant Street	ALL
6th Street and Folsom Street	Eastbound
8th Street and Folsom Street	ALL
14th Street and South Van Ness Avenue	ALL
19th Avenue and Sloat Boulevard	ALL

Broadway and Van Ness Avenue	ALL
Bush Street and Divisadero Street	ALL
Fell Street and Masonic Avenue	ALL
Hayes Street and Polk Street	ALL
Lake Street and Park Presidio Boulevard	ALL
Market Street and Octavia Boulevard	ALL
Oak Street and Octavia Boulevard	ALL
3rd Street and Harrison Street	ALL
4th Street and Howard Street	Westbound
5th Street and Harrison Street	ALL
5th Street and Mission Street	ALL
6th Street and Bryant Street	ALL
9th Street and Howard Street	ALL
Francisco Street and Richardson Avenue	ALL
Geary Boulevard and Park Presidio Boulevard	ALL
Lyon Street and Marina Boulevard	ALL

3. The following minimum information, unless otherwise required by the Traffic Engineer, shall be shown on each set of traffic control drawings submitted. Failure to submit any of the required information will result in rejected traffic control plans.
   a. The sequence and construction of any lane transition, including all proposed parking restrictions, number of cones, length of required transition zones, and location of required construction or regulatory signs, as required to complete the construction.
   b. The time required for each phase of the work, including the beginning and ending dates.
   c. Location and description of temporary striping, pavement markings, signs, and other traffic control devices necessary to provide and maintain the adequate number and width of traffic lanes specified in Article 3.1, and to provide and maintain safe passage and protection for pedestrians.
   d. Proposed changes (removals, relocation or temporary installations) of roadway channelization, flashing arrow signs, traffic signs, traffic signals, and bus stops.
   e. Materials and equipment storage areas shall be noted on the plans.
   f. Trench protection plan, if any excavated trench is left open during non-working hours.

   These traffic control plans shall not be construed as preventing the Contractor from proceeding with their mobilization of plant and equipment and placing orders for materials upon receipt of the Notice to Proceed, nor shall the Contractor be entitled to any delays due to “REJECTED” traffic control plans and maintenance drawings.
4. As part of the traffic control submittal, the Contractor shall also provide a detailed crosswalk closure plan showing flaggers, proper barricades, signing, and delineators. The Contractor shall use this plan to close a sidewalk/crosswalk when open trenches are present in the vicinity of the sidewalk/crosswalk area and when using heavy equipment such as ditch witches.

B. Caltrans Encroachment Permit
   1. The Contractor shall apply for and obtain a Caltrans encroachment/work permit for the following intersection(s):

INTERSECTION (S)

4th Street and Harrison Street
19th Avenue and Sloat Boulevard
Broadway and Van Ness Avenue
Lake Street and Park Presidio
Market Street and Octavia Boulevard
5th Street and Harrison Street
8th Street and Harrison Street
Bush Street and Van Ness Avenue
Francisco Street and Richardson Avenue
Fulton Street and Park Presidio Boulevard
Geary Boulevard and Park Presidio Boulevard
Lyon Street and Marina Boulevard

2. The Contractor shall submit a copy of the Caltrans encroachment/work permit to the Engineer before starting any work at the above intersection(s):
3. The Contractor shall request the permit number from the Engineer to include on the Contractor's permit application.
4. The Contractor shall pay permit fee to Caltrans.
5. All work required to obtain the Caltrans encroachment/work permit shall be considered incidental to the Traffic Routing bid item and no additional payment(s) will be made thereafter. Payment for the permit fee shall be provided under the Caltrans encroachment/work permit bid item as an allowance.

1.4 LIQUIDATED DAMAGES

A. The Contractor shall pay liquidated damages in the amount of Two Hundred Dollars ($200.00) per traffic sign, traffic device, and/or non-skid steel plate per calendar day for everyday when the required sign, traffic device, and/or non-skid steel plate is not furnished and in place in accordance with this specification.

B. The Contractor shall restore and maintain the traffic lane requirements in accordance with these Specifications. Unless authorized and directed by the Engineer in writing to do otherwise, the Contractor shall pay liquidated damages in the amount of Five Hundred Dollars ($500.00) per hour, or portion per lane thereof for failure to provide the lane requirements. The Contractor shall pay liquidated damages in the amount of One Hundred Dollars ($100.00) per traffic sign and/or required traffic device per calendar day for every day when the required sign and/or the traffic device is not furnished and in place in accordance with these Specifications. The maximum liquidated damages per any twenty-four hour period is Two Thousand Dollars ($2,000.00).

C. The Contractor shall pay liquidated damages in the amount of Five Hundred Dollars ($500.00) per day per block or any portion thereof for every day where there is not continuous construction activity within 24 hours of the posted effective date and time of the temporary "Tow-Away No Stopping Zone."

D. The Contractor shall pay liquidated damages in the amount of Five Hundred Dollars ($500.00) per day for every day when solar operated Flashing Arrow Boards are not provided in accordance with these Specifications.

E. The Engineer shall furnish the Contractor with the Weekly Progress Report showing the date, period of time of violation, and the assessed liquidated damages.

F. The Contractor will be allowed fifteen (15) days from the issuance of the Weekly

Progress Report showing the liquidated damages in which to file a written protest and explain any extenuating circumstances. Otherwise, the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct.

G. The amount of liquidated damages described in this Section shall be deducted from the monthly progress payments to be made to the Contractor.

H. See Article 3.10 of Section 34 41 13 for liquidated damages relating to relocation of traffic signs.

PART 2 - PRODUCTS

2.1 GENERAL

A. All traffic signs, barricades, delineators, flashing arrow signs and other traffic control devices shall conform to the requirements of the latest edition of the California MUTCD and to the requirements of the CALTRANS STANDARD SPECIFICATIONS, except as specified herein. The California MUTCD is available online at: http://www.dot.ca.gov/hq/traffops/engineering/mutcd/index.htm

B. All special construction traffic signs shall be reflectorized with black messages/symbols having 6" (15 cm) and/or 8" (20 cm) high series D letters on orange colored aluminum plate. The message and size of the letters shall be determined by the Engineer through the Traffic Engineer. Any changes on any signs shall be made with appropriate decals.

C. All barricades shall have flashers. The flashers shall be maintained in good operating condition at all times by the Contractor.

D. Any equipment that does not operate properly or any device that is not in good operating condition shall be removed from the job site immediately at the Contractor's expense.

2.2 DELINEATORS

Delineators for lane taper areas for the separation of traffic from other work, shall be either reflectorized traffic cones minimum 28 inches (71 cm) high, or reflectorized portable tubular delineators minimum 36 inches (91 cm) high, with orange posts and yellow/white reflectors. Reflector units shall be 3"x 12" (8 cm x 30 cm) minimum.

2.3 PLATING

See Section 3.1 C of this Section for details.

2.4 TAPE FOR TEMPORARY STRIPING

The Contractor shall use temporary removable tape to demarcate traffic lane lines in high traffic volume, commercial, and/or Downtown core areas, crosswalks, and STOP lines after paving and/or as instructed by the City Representative through the Traffic Engineer. The Contractor shall use any one of the following removable tapes furnished with a foil backing):

A. Swarco Visa-Line

B. Brite-Line Series 100

C. ATM Series 200

The tape for temporary striping shall be as follows:

1. 12" crosswalk line: to be delineated by three 4" tape
   examples: crosswalk & STOP lines
2. 8" solid white: to be delineated by two 4" tape
   examples: striping across intersection and
   left or right turn lane lines
3. 4" broken white/yellow: to be delineated by one 4" tape
   (typically 7' long, 17' gaps*)
4. Double centerlines: to be delineated by two 4" yellow tape
   (3" apart)

* These dimensions for broken lines apply for streets with posted speed limits of 35 MPH or less. For speed limits of 40 MPH or more, the dimensions should be 12' long stripes with 36' gaps. Consult Chapter 6 of the California Traffic Manual for further details.

2.5 TEMPORARY REFLECTIVE OVERLAY PAVEMENT MARKERS AFTER PAVING

The Contractor shall use temporary overlay markers to demarcate traffic lane lines in low traffic volume, non-commercial, and/or non-Downtown core areas and/or as instructed by the City Representative through the Traffic Engineer after paving and concrete street work. The Contractor shall use any one of the following):

1. Davidson Plastic Model TOM (Standard) with Reflexite PC 1000 or WZ with Reflexite AC 1000 sheeting
2. Stimsonite Model 300 " Temporary Overlay Markers"
3. Hi-way Safety Inc. Model 1280 / 1281 with Reflexite PC 1000

PART 3 – EXECUTION

3.1 VEHICULAR AND PEDESTRIAN TRAFFIC

A. Traffic Lane Requirements

1. The Contractor shall provide the minimum number of lanes listed in the following table to satisfactorily accommodate **through** vehicular and bicycle traffic. In addition to the specified lanes for through traffic, the Contractor shall provide an additional left/right turn lane of 11-foot width at the intersection, when there already is an existing separate left/right turn lane. The remaining portion of streets within the limits of the work may be closed to through traffic. However, vehicular access to properties along the project site shall be provided at all times to the satisfaction of the Engineer.

2.

Traffic Lane Requirements
Number and Width of Lanes for Through Traffic

Street	Time	Northbound	Southbound	Eastbound	Westbound
4th Street at Harrison Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	4 @ 10' * 4 @ 10' * 2 @ 10' *	---	---
Harrison Street at 4th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	5 @ 10' * 5 @ 10' * 3 @10' *
6th Street at Bryant Street and Folsom Street	7-9 AM (M-F) 3-7 PM (M-F) All Other Times	3 @ 10' * 3 @ 10' * 2 @ 10' *	3 @ 10' 3 @ 10' 2 @ 10'	---	---
Bryant Street at 6th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	5 @ 10' 5 @ 10' 3 @ 10'	---

Folsom Street at 6th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	4 @ 10' * 4 @ 10' * 2 @ 10' *	---

* No additional turn lanes required.

Street	Time	Northbound	Southbound	Eastbound	Westbound
8th Street at Folsom Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	3 @ 10' +1 @ 5' BL 3 @ 10' +1 @ 5' BL 2 @ 10' +1 @ 5' BL	---	---
Folsom Street at 8th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	3 @ 10' + 1 @ 10' RT +1 @ 5' BL 3 @ 10' + 1 @ 10' RT +1 @ 5' BL 1 @ 10' + 1 @ 10' RT +1 @ 5' BL	---
14th Street at South Van Ness Avenue	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	2 @ 10' + 1 @ 5' BL 2 @ 10' + 1 @ 5' BL 1 @ 10' + 1 @ 5' BL
South Van Ness Avenue at 14th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	2 @ 10' 1 @ 12' 1 @ 12'	1 @ 12' 2 @ 10' 1 @ 12'	---	---
19th Avenue at Sloat Boulevard	At All Times	Per Caltrans	Per Caltrans	---	---
Sloat Boulevard at 19th Avenue	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Per Caltrans	4 @ 10' * 4 @ 10' * 2 @ 10' *
Broadway at Van Ness Avenue	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	2 @ 10' 2 @ 10' 1 @ 12'	2 @ 10' 2 @ 10' 1 @ 12'
Van Ness Avenue at Broadway	At All Times	Per Caltrans	Per Caltrans	---	---
Bush Street at Divisadero Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	3 @ 10' 3 @ 10' 2 @ 10'	---
Divisadero Street at Bush Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	2 @ 10' 2 @ 10' 1 @ 12'	2 @ 10' 2 @ 10' 1 @ 12'	---	---
Fell Street at Masonic Avenue	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	4 @ 9' +1 @ 9' LT 4 @ 9' +1 @ 9' LT 2 @ 10' +1 @ 9' LT

Masonic Avenue at Fell Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	3 @ 10' 3 @ 10' 2 @ 10'	3 @ 10' * Full Roadway 2 @ 10' *	---	---
Hayes Street at Polk Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	3 @ 10' 3 @ 10' 2 @ 10'

* No additional turn lanes required.

Street	Time	Northbound	Southbound	Eastbound	Westbound
Polk Street at Hayes Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	1 @ 5' BL 1 @ 5' BL 1 @ 5' BL	2 @ 10' + 1 @ 5' BL 2 @ 10' + 1 @ 5' BL 1 @ 12' + 1 @ 5' BL	---	---
Lake Street at Park Presidio Boulevard	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Full Roadway Full Roadway 1 @ 12'	Full Roadway Full Roadway 1 @ 12'
Park Presidio Boulevard at Lake Street	At All Times	Per Caltrans	Per Caltrans	---	---
Market Street at Octavia Boulevard	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Full Roadway Full Roadway 1 @ 10' + 1 @ 10' LT + 1 @ 5' BL	Full Roadway Full Roadway 1 @ 12' + 1 @ 5' BL
Octavia Boulevard N/O Market Street	7-9 AM (M-F) 3-7 PM (M-F) All Other Times	2 @ 10' + 1 @ 5' BL 2 @ 10' + 1 @ 5' BL 1 @ 12' + 1 @ 5' BL	2 @ 10' + 1 @ 5' BL 2 @ 10' + 1 @ 5' BL 1 @ 12' + 1 @ 5' BL	---	---
McCoppin Street from Market Street to Elgin Park	At All Times	---	---	---	1 @ 12'
Elgin Park at McCoppin Street	At All Times	1 @ 12' (Reversible Lane)		---	---
Octavia Boulevard S/O Market Street	At All Times	Per Caltrans	Per Caltrans	---	---
Oak Street W/O Octavia Boulevard	7-9 AM (M-F) 3-7 PM (M-F) All Other Times	---	---	2 @ 10' + 2 @ 10' RT 2 @ 10' + 2 @ 10' RT 1 @ 10' + 1 @ 10' RT	---
Oak Street E/O Octavia Boulevard	7-9 AM (M-F) 3-7 PM (M-F) All Other Times	---	---	3 @ 10' 3 @ 10' 2 @ 10'	---
Octavia Boulevard at	7-9 AM (M-F)	2 @ 10' + 1 @ 10' Fr Rd.	2 @ 10' + 1 @ 10' Fr Rd.	---	---

Oak Street	3-7 PM (M-F) All Other Times	2 @ 10' + 1 @ 10' Fr Rd. 1 @ 12' + 1 @ 10' Fr Rd.	2 @ 10' + 1 @ 10' Fr Rd. 1 @ 12' + 1 @ 10' Fr Rd.		
1st Street at Folsom Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	4 @ 10' 4 @ 10' 2 @ 10'	---	---

Street	Time	Northbound	Southbound	Eastbound	Westbound
Folsom Street W/O 1st Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	2 @ 10' + 1 @ 10' RT + 1 @ 5' BL 2 @ 10' + 1 @ 10' RT + 1 @ 5' BL 2 @ 10' + 1 @ 10' RT + 1 @ 5' BL	1 @ 12' 1 @ 12' 1 @ 12'
Folsom Street E/O 1st Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	3 @ 10' + 1 @ 5' BL 3 @ 10' + 1 @ 5' BL 2 @ 10' + 1 @ 5' BL	1 @ 12' 1 @ 12' 1 @ 12'
3rd Street and Harrison Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	Full Roadway Full Roadway 3 @ 10' *	---	---	---
Harrison Street E/O 3rd Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	2 @ 10' 2 @ 10' 1 @ 12'	3 @ 10' 3 @ 10' 2 @ 10'
Harrison Street W/O 3rd Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	4 @ 10' 4 @ 10' 2 @ 10'
4th Street at Howard Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	Full Roadway Full Roadway 2 @ 10' + 1 @ 10' RT	---	---
Howard Street at 4th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	Full Roadway Full Roadway 2 @ 10' + 1 @ 10' LT + 1 @ 5' BL
5th Street and Mission Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	2 @ 10' + 1 @ 10' RT 2 @ 10' + 1 @ 10' RT 1 @ 12' + 1 @ 10' RT	2 @ 10' 2 @ 10' 1 @ 12'	---	---
Mission Street and 5th Street	7-9 AM (M-F) 4-6 PM (M-F)	---	---	Full Roadway Full Roadway	Full Roadway Full Roadway

	All Other Times			1 @ 12’	1 @ 12’ + 1 @ 10’ RT
5th Street at Harrison Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	Full Roadway Full Roadway 1 @ 12’ + 1 @ 10’ LT	Full Roadway Full Roadway 1 @ 12’ + 1 @ 10’ RT	---	---
Harrison Street at 5th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	5 @ 10’ * 5 @ 10’ * 3 @ 10’ *
I-80 Off-Ramp at 5th Street	At All Times	---	---	---	Per Caltrans

* No additional turn lanes required.

Street	Time	Northbound	Southbound	Eastbound	Westbound
5th Street at Howard Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	2 @ 10’ 2 @ 10’ 1 @ 12’	3 @ 10’ * 3 @ 10’ * 1 @ 10’ + 1 @ 10’ RT	---	---
Howard Street at 5th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	4 @ 10’ + 1 @ 5’ BL 4 @ 10’ + 1 @ 5’ BL 2 @ 10’ + 1 @ 5’ BL
7th Street at Mission Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	4 @ 10’ + 1 @ 5’ BL 4 @ 10’ + 1 @ 5’ BL 2 @ 10’ + 1 @ 5’ BL	---	---	---
Mission Street at 7th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Full Roadway Full Roadway 1 @ 12’	Full Roadway Full Roadway 1 @ 12’
8th Street at Harrison Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	4 @ 10’ + 1 @ 5’ BL 4 @ 10’ + 1 @ 5’ BL 2 @ 10’ + 1 @ 5’ BL	---	---
Harrison Street at 8th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	---	5 @ 10’ 5 @ 10’ 3 @ 10’
I-80 Ramp at 8th Street	At All Times	---	---	---	Per Caltrans
9th Street at Howard Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	5 @ 10’ 5 @ 10’ 3 @ 10’	---	---	---
Howard Street at 9th Street	7-9 AM (M-F) 4-6 PM (M-F)	---	---	---	3 @ 10’ + 1 @ 10’ RT + 1 @ 5’ BL 3 @ 10’ + 1 @ 10’ RT

	All Other Times				+ 1 @ 5' BL 2 @ 10' + 1 @ 10' RT + 1 @ 5' BL
15th Street at Mission Street	At All Times	---	---	---	1 @ 12'
Mission Street at 15th Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	2 @ 9'6" 2 @ 9'6" 1 @ 12'	2 @ 9'6" 2 @ 9'6" 1 @ 12'	---	---
Bush Street at Van Ness Avenue	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	4 @ 10' 3 @ 10' 2 @ 10'	---
Van Ness Avenue at Bush Street	At All Times	Per Caltrans	Per Caltrans	---	---

* No additional turn lanes required.

Street	**Time**	**Northbound**	**Southbound**	**Eastbound**	**Westbound**
Ellis Street at Larkin Street	At All Times	---	---	1 @ 11'	1 @ 11'
Larkin Street at Ellis Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	3 @ 10' 3 @ 10' 2 @ 10'	---	---	---
Francisco Street at Richardson Avenue	At All Times	---	---	1 @ 11'	1 @ 11'
Richardson Avenue at Francisco Street	At All Times	Per Caltrans	Per Caltrans	---	---
Fulton Street at Park Presidio Boulevard	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Full Roadway Full Roadway 2 @ 10'	Full Roadway Full Roadway 2 @10' *
Geary Boulevard at Park Presidio Boulevard	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Full Roadway Full Roadway 2 @ 10'	Full Roadway Full Roadway 2 @10' *
Park Presidio Boulevard at Geary Boulevard and Fulton Street	At All Times	Per Caltrans	Per Caltrans	---	---
Lyon Street at Marina Boulevard	At All Times	1 @ 10' RT	1 @ 10'	---	---
Marina Boulevard at Lyon Street	7-9 AM (M-F) 4-6 PM (M-F) All Other Times	---	---	Per Caltrans	Full Roadway Full Roadway 1 @ 12'

* No additional turn lanes required.

B. Additional Requirements for Maintaining Vehicular and Pedestrian Access

1. The Contractor shall maintain the required travel way for vehicles in any public street or way and a minimum width of 6 feet of clear sidewalk for pedestrians, at all times. The Contractor may be allowed to store materials and/or equipment for a limited time in the parking strip and/or portion of the sidewalk with written permission of the Engineer and appropriate permits from the SFMTA for use of the public right-of-way (Street Space Permits). The Contractor shall maintain adequate signing, barricades, lights, etc., as required at all times. Permission to store the materials shall be limited to the unused materials during working hours from full truck loads, or materials needed to resume the next day's work.
2. All existing traffic movements at the intersection shall be maintained by bridging and/or phasing as required.
3. The Contractor shall erect, and maintain for the duration of the Contract, proper barricades and temporary curb ramps at all closed crosswalks and existing curb ramps. All changes of level in a path-of-travel which are over 1/4 inch in height shall be beveled at 45 degrees to provide a smooth transition.
4. Flashing arrow boards shall be used in conjunction with all lane closures.
5. During periods when the “Full Roadway” requirements are in effect, the Contractor’s operations shall not affect the relative approach including sidewalk in any manner including but not limited to shutdown of the signal (including any signal heads) and/or utilization of the parking strip EXCEPT when performing the following work.
    a. Curb Ramps – Contractor may barricade off this area for up to 4 days to allow for necessary curing time and to provide safe pedestrian paths of travel.
6. Street Car, Cable Car and Trolley Coach operations shall not be disrupted at any time. The Contractor shall provide traffic control personnel during construction to prevent Cable Car and Trolley Coach service interruption.
7. Local access for businesses and/or residences fronting the work areas shall be provided at all times. The Contractor shall work with all of the abutting property owners or lessees, so as not to interfere with their daily activities.
8. The Contractor’s construction operations shall not occupy sidewalks except where pedestrian protection is provided in accordance with the requirements herein and the regulations of public authorities having jurisdiction.
9. The Contractor shall not obstruct free and convenient approach to any fire hydrant, alarm box, or utility box. No debris, materials or equipment shall be placed within 10 feet of any fire hydrant.
10. No street closure shall interfere with the access of ambulances and Police and Fire Departments’ emergency vehicles.
11. The Contractor shall clean public walkways adjoining the construction site of accumulated trash and debris.
12. The Contractor shall not close lanes at more than two (2) intersections at any time. Closure of two (2) one-way streets in the same direction at the same time is not permitted.
13. The Contractor shall apply for a Special Traffic Permit for any work that deviates from the Traffic Lane Requirements as shown in these specifications. Please refer to the Regulations for Working in San Francisco Streets (“Blue Book”) for more information.
14. For all temporary fencing, barricades or other barriers, the Contractor shall provide a solid continuous bottom rail such as 2-by-4s or other material of high contrast attached to the base of barricade and fencing systems to direct visually-impaired pedestrians to and through a temporary path-of-travel.
15. In addition to other access requirements mentioned in this section, the Contractor shall maintain at least one accessible path of travel around the construction site for persons with disabilities that conforms with the requirements of the State of California Title 24, Part 2 Accessibility Standards. The Contractor shall furnish, erect, and maintain all necessary signs, barricades, lighting, fencing, railing, bridging, and

flaggers which conform to the requirements of San Francisco Department of Public Works Guidelines (Order No. 167,840).

16. To protect pedestrians, the Contractor shall close a sidewalk/crosswalk when open trenches are present in the vicinity of the sidewalk/crosswalk area and when using heavy equipment such as ditch witches. However, only one crosswalk can be closed per intersection. Crosswalk shall be closed according to crosswalk closure plan submitted by the Contractor and subsequently accepted by SFMTA.

C. Bridging over Trenches and Excavations

1. The Contractor shall properly barricade or steel plate all the trenches and the excavated roadway at all times. The Contractor shall use reflectorized barricades, traffic cones and/or reflectorized delineators when trenches and excavated roadway are left open overnight.
2. Metal plating and any metal bridging shall be coated with a non-skid and rust-inhibitive product, and shall be Intergard 750HS (formerly 7300 Magna-Prime) Amido-Amine Epoxy or equal, manufactured by Courtaulds Coatings (Division of International), 400 South 13th Street, Louisville, KY 40201-1439; Tel: (800) 332-6270; Fax: (800) 283-0508. This material shall be applied as directed by the manufacturer. Plating shall be installed and maintained in such a manner as to provide a non-skid surface with no edges or corners sticking up and with no bouncing or shifting.
3. The Contractor shall utilize a steel plate cover with a minimum thickness of 1" to cover the trenches on the roadway and to allow vehicular traffic to pass through while the concrete is curing. The Contractor shall do the same for trenches in parking lanes to allow for parking.
4. The Contractor shall schedule the work sequence in one direction only. No work shall be allowed at the same time on opposite sides of the roadway

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D. Temporary Paving over Backfilled Trenches and Excavations

1. Vehicular travel over backfilled but unpaved and unbridged trenches and other excavation will not be permitted. The Contractor shall construct, before use of pavement by vehicular traffic, and thereafter satisfactorily maintain, a smooth, regular, temporary wearing surface, not less than 1 ½ inches thick, over backfilled areas for the safe passage of vehicular traffic. All excess materials shall, at the same time, be removed and the street cleaned. The temporary wearing surface shall be in accordance with the requirements of Section 211 of the SSDPWSF.
2. When pavement is broken prior to trench excavation in a traffic lane, the excavation of such trench must follow within 48 hours from the time the pavement is broken. If the preceding condition cannot be met, the broken pavement fragments must be removed and replaced with temporary wearing surface in accordance with the requirements of Section 211 of the SSDPWSF.
3. Temporary pavement shall be constructed as incidental work.
4. The Contractor shall restore each section of permanent pavement and each flag of sidewalk as soon as practicable following the completion of the work for which the section of pavement or flag of sidewalk was removed.

E. Maintenance of Traffic

1. The Contractor shall cause the least possible interference with traffic and shall not obstruct nor close any roadway to vehicular or pedestrian traffic, except in the immediate vicinity of the work, and then only to the extent allowed by Article II, Chapter XI (Traffic Code), Part II of the San Francisco Municipal Code and any Department Orders adopted pursuant thereto by the Director of SMFTA Sustainable Streets Division or the Director of the Department of Public Works.

2. Those parts of public streets, ways and sidewalks that are occupied by the Contractor shall be immediately vacated and returned to public use when use thereof is no longer necessary for the execution of the work.
3. The Contractor, except as hereinafter provided, shall not impede, at any time, free access for vehicles and pedestrians to warehouses, stores, service stations, dwellings, garages and other properties in the vicinity of the work and on adjacent streets, including those properties fronting on streets allowed or stipulated by the Specifications to be closed to vehicular through traffic. Local access shall be provided by phasing operations, bridging, or employing other procedures accepted by the Engineer.
4. The Contractor shall obtain written permission from each affected property or business owner, or responsible building or business manager, for any proposed period of prohibition or impediment of such access. Prohibition or impediment of access to any building or property for which the Engineer does not have a copy of the specified signed permission will not be allowed.

F. Diverting of Traffic
1. When closing one or more lanes to vehicular traffic or to otherwise divert such traffic from its normal paths, the Contractor shall clearly delineate temporary centerlines separating two-way traffic and dividing lines for other temporary traffic lanes by employing cones, barricades, flags, reflectors, or other accepted methods or devices.
2. Placing of devices shall commence sufficiently in advance of the obstruction or diversion to minimize congestion and shall enable traffic to enter, traverse and leave the site of the work without abrupt or unwarranted changes in direction. Unless otherwise specified or accepted, each temporary traffic lane shall have a minimum clear width of ten (10) feet.
3. When a detour is necessary for full or partial roadway closure, all detour signs needed for the required traffic routing must be in place before the roadway can be closed for construction. Failure to comply with this requirement shall result in liquidated damages associated with improper lane closure.
4. High level warning devices, each displaying three flags mounted at a height of eight (8) feet, will be required in all cases where motorists' visibility of the work is limited or obscured to provide advance warning.

G. Prohibition of Stopping
1. The Contractor may prohibit stopping in parking lanes where and when necessary to gain access to the work or to provide the required traffic lanes.
2. The Contractor shall obtain the approval of the SFMTA for the required prohibition of stopping from the Traffic Bureau (415) 701-2311, at least 72 hours in advance of the effective date and time. The Contractor shall post the signs at least 72 hours in advance of the effective date and time.
3. The Contractor shall furnish and place, not more than 25 feet apart, where accepted by the San Francisco Police Department and the Engineer, signs in accordance with plan A-32,400 Ch.2, on Type II barricades. Each sign shall be placed and attached to a barricade in such a way that it is easily readable by motorists. If "Tow-Away No Stopping" signs are to remain in place for more than five calendar days, such signs shall have a rigid backing (i.e., thin plywood), and be covered with a sheet of clear plastic.
4. The name of the Contractor shall be shown on each sign. The Contractor shall maintain the signs on a continual basis and shall replace damaged or missing signs daily.
5. When a vehicle is removed from a street at the request of the Contractor and a post-storage hearing determines that as a result of the Contractor's improper posting of the required signs, reasonable grounds did not exist for removal, the Contractor shall reimburse the City and County of San Francisco for the cost

incurred for towing and storage. The failure of the Contractor to provide reimbursement or to agree to assume all liability for any improper posting shall result in the Police Department's denial of any future requests by that Contractor for removal of vehicles in violation.

6. The Contractor shall be given timely notice of the vehicle owner's request for a post-storage hearing and the time and place of such hearing.

H. Work Around Parking Meters

1. The Contractor shall notify Joseph Bonilla of MTA at (415) 701-4585, through the City Representative, at least two (2) working days before starting any work that may impact parking meters so that arrangements may be made by the City to have the meters removed at no cost to the Contractor. If no notice is given, the Contractor will be charged for any work performed by SFMTA.
2. Parking meters and parking meter standards damaged or loosened by the Contractor's operations will be repaired or replaced as necessary by the City; however, all expenses in connection therewith shall be borne by the Contractor.

I. Tree Trimming

1. The Contractor shall contact the Bureau of Street Environmental Services of the Department of Public Works (DPW) at (415) 554-6700, two (2) weeks prior to start of work in any particular block, to trim the trees that will be in conflict with the construction job itself or construction equipment or with the traveling public during construction. The Contractor shall not detour any traffic onto the parking lane until all the tree branches are properly trimmed or the Contractor has made sure that these branches will not interfere with the traveling public.
2. The Contractor will not be allowed to trim any trees without any written approval and supervision from the Bureau of Street Environmental Services of the DPW. The Contractor will do all necessary tree trimming as directed at no additional cost to the city.

3.2 MASS TRANSIT VEHICLES

A. The Contractor shall not prevent the functional operation of mass transit vehicles at any time including diesel and electric trolley coaches, light rail vehicles, and cable cars.

B. The Contractor shall be responsible for coordinating with MUNI to keep all MUNI mass transit vehicles in operation at all times during construction.

C. The Contractor is responsible for taking inventory of MUNI markings in the work area prior to construction. These markings include yellow “Coach Stop” bars, yellow circular markings, etc. The Contractor shall notify MUNI Service Planning at (415) 701-4378 as soon as the paving is completed on each block so that MUNI can restore the markings immediately.

D. The Contractor shall be familiar with the routes of transit lines that operate within the limits of the work. The lanes made available for traffic shall be located so as to include an adequate and useable travel path for the transit lines. The extreme touring range of the centerline of a trolley coach is 10 feet from the centerline of the trolley wires.

E. A 45-foot turning radius for Municipal Railway vehicles shall be provided by the Contractor.

F. The Contractor shall notify the SFMTA Superintendent of Special Operations at (415) 923-6058, through the City Representative, at least ten (10) working days in advance of doing any work in existing passenger loading zones for buses on each street, where such work would interfere with passenger loading and unloading operations. The SFMTA may

temporarily authorize the relocation of these zones. The Contractor shall provide and continuously maintain at least one sign at any bus stop that SFMTA has authorized to be closed or relocated. The SFMTA Superintendent will supply the exact wording, size, and location of these signs. Unauthorized bus zone relocations or any other unauthorized use of the temporary bus stop signs will result in liquidated damages per Section 00 73 03.

G. The SFMTA overhead electric wires carry a minimum of 600 volts DC and have a 17 feet +/- vertical clearance from the roadway. The Contractor's attention is directed to Article 37 of General Order 95 of the Public Utilities Commission State of California. CAL OSHA regulations require that any equipment that moves vertically must maintain a 10 feet radial clearance, and any other equipment must maintain a 6 feet clearance from Muni overhead electric wires. The Contractor shall observe these regulations during the entire duration of the construction work including base repair, grinding and paving.

3.3 TEMPORARY CONSTRUCTION EQUIPMENT AND TRAFFIC SIGNS

A. The Contractor shall, as a minimum, furnish at the site or at a convenient location thereto and immediately available, the following signs and equipment:

1. Flashing arrow signs, Type II conforming to Section 12-3.03 of Caltrans Standard Specifications dated May 2006, except as modified herein, placed as shown on the approved Traffic Control Plan. The Contractor shall use solar operated flashing arrow signs;
2. Barricades, as required by Section 21,400 of the State of California Vehicle Code and as specified in the Latest Edition of the State of California's Department of Transportation's MUTCD, in sufficient amount to safeguard the public and the workers;
3. "TOW-AWAY NO-STOPPING" signs as specified herein;
4. Traffic cones, reflectorized temporary pavement removable detour striping tape and/or temporary reflectorized overlay markers shall be used to delineate traffic lanes as required to guide and separate traffic movements as directed by the Traffic Engineer;
5. High level warning devices, to be used in advance of traffic approaching the work, each displaying three (3) flags mounted at a height of 7 feet;
6. "ROAD CONSTRUCTION AHEAD" signs, Code C18, size 48" x 48", to be placed at conspicuous locations, in advance of the work, facing approaching traffic, as directed by the Engineer;
7. "RIGHT/LEFT LANE CLOSED AHEAD" Signs Code C20 (RT/LT), size 48" x 48", to be placed as shown on the approved traffic control plans and/or as directed by the Engineer.
8. All other signs and traffic control devices required by the Engineer as noted on the traffic control plans and as required to safeguard the work and the public.

B. The Contractor shall maintain construction barriers in a sound, neat and clean condition, and shall remove all graffiti to the satisfaction of the City.

C. The Contractor shall remove barriers and enclosures upon completion of the Work, in accordance with applicable regulatory requirements and to the satisfaction of the City.

D. All the signs and/or temporary striping shall be reflectorized. All signs shall be installed so that the bottom of the sign is at least seven (7) feet above the sidewalk or pavement or as directed by the Engineer. Signs shall be securely fastened to pole supports with "Band-it Tape".

E. The signs and equipment shall conform to the requirements of the latest edition of California Department of Transportation's MUTCD.

3.4 TRAFFIC CONTROL BY POLICE OFFICERS

A. The Contractor shall provide, at a minimum, two uniformed San Francisco Police Department Officers (per Administration Code 10-B) (referred to herein as Officers) at each intersection, as required by the Engineer. The Officers shall be required during the connection, testing, switchover or activation of traffic signals.

B. The Contractor shall provide additional Officers as needed to ensure the efficient flow of traffic and pedestrians at all times, as required by the Engineer. If the number of work hours is anticipated to be more than four hours, then a minimum of three officers shall be provided. The Contractor shall provide Officers for the time required by the Engineer, and as specified above. The final locations of the Officers will be determined by the Engineer, and/or the Traffic Engineer.

C. The Officers may perform the following duties:
1. Direct vehicular traffic
2. Direct pedestrian traffic
3. Cite motorists or pedestrians violating traffic regulations.
4. Assist in towing illegally parked vehicles
5. Perform other traffic control duties as directed by the Traffic Engineer through the City Representative.

D. The Contractor shall prepare Instruction Sheet(s) for use by the officers. These Instruction Sheet(s) will be for specific duties the officers will be required to perform, at specific locations. The Contractor shall submit the Instruction Sheet(s) to the City Representative for review and transmittal to the Traffic Engineer, at least five (5) working days in advance of the need for officers. The Contractor shall also give a copy of the Instruction Sheet(s) to each officer and the 10B Coordinator of the SFPD. The Traffic Engineer through the City Representative shall review and make any required changes and transmit the same to the 10B Coordinator of the SFPD. The City Representative will furnish a copy of the revised Instruction Sheet(s) to the Contractor and the 10B Coordinator of the SFPD. The Contractor shall conduct a review of the Instruction Sheet(s) with the officers assigned for traffic control.

E. The Contractor should contact the 10B Coordinator of the SFPD at (415) 553-7900 to obtain the services of officers. The Contractor shall enter into an agreement with the SFPD to provide officers, within 30 days of the official date for commencement of the work. The Contractor shall make a deposit to the SFPD. The deposit will be a minimum of $2,000 or equal to the amount required for providing officers for a period of 2 weeks, whichever is more. The Contractor shall pay the SFPD the amount of each invoice within 30 calendar days of the date of the invoice.

F. The Contractor shall notify the 10B Coordinator regarding the schedule and number of officers required at least 4 calendar days in advance of the scheduled date. The minimum time required to cancel the need of the officers is 24 hours prior to the work.

G. The officers shall be paid a minimum of four hours per day. If the number of work hours exceeds four hours, the officers shall be paid for one additional hour for travel time. For a twelve-hour shift, the officers shall be paid thirteen hours per ordinance.

H. If, due to the complexity of the work or intersection geometry, more than two (2) Officers are required for more than 4 (four) hours at a single intersection, the Contractor shall be reimbursed for additional fees paid for Officer services, as specified above, plus five percent (5%) for administration overhead.

I. If due to any fault of the Contractor (lack of preparation, errors in construction, poor coordination, crew size, etc.) as determined by the Engineer, more than two (2) Officers are required for more than 4 (four) hours at a single intersection, the Contractor shall not be reimbursed or credited for fees paid for the additional Officer services.

J. If the actual total Officer fees paid by the Contractor for the project is less than the calculated minimum (2 Officers multiplied by 4 hours multiplied by hourly rate for Officers multiplied by the number of project intersections), then the City shall be credited an amount equal to the difference between the actual Officer service fees paid and the calculated minimum.

3.5 PAYMENT PROCEDURES

A. No payments shall be made for the work specified in this Section except as noted above. The work shall be done as incidental work to the Bid Item “Traffic Routing Work Including Service Rendered by Two (2) Uniformed San Francisco Police Officers for Traffic Control, as required by the Engineer”.

END OF SECTION

SECTION 26 04 00

GENERAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Division 26, Electrical, covers the work necessary for the complete electrical system. Furnish materials, labor and equipment in accordance with these specifications and the accompanying drawings. Furnish, install, connect and identify conduits and conductors to all equipment, devices, and other items under this contract.

See Division 01 which contains additional information and requirements that apply to the work specified herein and are mandatory for this project.

B. This section covers general requirements applying to all sections included in Division 26, Electrical.

C. The requirements of this section also apply to all electrical work and equipment specified under other divisions of these specifications.

1.2 INSPECTION OF THE SITE AND EXISTING CONDITIONS

A. After award of Contract, verify the location of existing underground utilities. Protect all existing underground utilities during construction.

1.3 RESPONSIBILITY

A. The Contractor shall be responsible for:
1. Complete systems in accordance with intent of these Contract Documents.
2. Coordinating the details of facility equipment and construction for all Specifications Divisions, which affect the work covered under Division 26, Electrical.
3. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: All electrical work shall be performed by experienced electricians or under the direct supervision of a experienced electrician.

B. Manufacturer Qualifications: Unless specifically exempted in the detailed specifications for any specific electrical product, the manufacturer shall have similar products in successful installation under similar installation conditions for at least 3 years, and shall, if requested, submit a list of representative installations.

C. Standard Products: Provide materials and equipment that are products of manufacturers regularly engaged in the manufacture of the products and are the latest standard design.

D. Codes and Regulations:
1. Work shall meet requirements of governing codes and regulations; National Electric Code; the San Francisco Electrical Code; the requirements of the Power Utility; and other national fire codes of NFPA. Advise the Engineer of conflicting codes or conflicts between codes and Drawings and Specifications in

accordance with Section 01 31 13, Coordination. When the requirements of the Drawings or Specifications are more stringent than the codes, regulations, or standards, the Drawings or Specifications shall prevail.

2. The electrical installation shall meet the requirements of National Electrical Contractors Association Standard of Installation, except where otherwise specified.
3. UL Listing: Electrical materials and equipment shall meet requirements of the applicable standards of UL (Underwriters Laboratories), if UL standards exist for such materials and equipment. The UL authorized listing mark is acceptable as evidence that the materials meet this requirement. In lieu of UL authorized listing mark, the Contractor may submit independent proof satisfactory to the Engineer that the materials meet the published standards. Materials and equipment shall be used only for their intended use.

E. Seismic Design: Refer to Section 01 41 00, Regulatory Requirements for seismic loading design requirements for electrical equipment and accessories.

F. For traffic signal work, all electrical work shall be done by qualified electricians. Electricians' qualifications shall be verifiable and provided by the electricians through the Contractor. The minimum experience requirement shall be 4 years of journeyman level equivalent experience. The City reserves the right to reject an electrician if his/her experience cannot be verified.

1.5 INTENT OF CONSTRUCTION DRAWINGS

A. Electrical plan Drawings are diagrammatic and show only general locations of equipment, devices and conduit, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of conduit due to actual field conditions, subject to the approval of the Engineer.

Electrical Drawings do not attempt to show complete details of building/street construction that affect installation. Diagrams are schematic only and do not necessarily show physical arrangement of equipment. Refer to drawings of other trades for additional details, which affect work.

B. Conduit and ground connections are shown diagrammatically only. Layout does not necessarily show total number of conduits or conductors for circuits required and should not be used for obtaining quantities for linear runs of conduits or wires. Locations of indicated runs are only approximate. Provide additional conduits and wire wherever needed to complete installation of specific equipment furnished.

1.6 COORDINATION OF WORK

A. Coordinate electrical work with the work of the various trades on the project.

B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other Sections of these Specifications but to be electrically connected under these electrical Sections.

1. Determine connection locations and requirements.
2. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
3. Sequence electrical connections to coordinate with start-up and cut over schedule for equipment. Refer to Section 34 41 13.

1.7 SUBMITTALS

A. Refer to Section 01 33 00- Submittal Procedures, Section 34 41 13- Traffic Signal.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, provide all first-quality, new materials and equipment, free from any defects, in first- class condition, and to fit the space provided. Provide materials and equipment listed by UL wherever standards have been established by that agency.

B. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.2 STANDARD PRODUCTS

A. Unless otherwise indicated, provide materials and equipment which are standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design modified as required to conform to these specifications.

2.3 EQUIPMENT FINISH

A. Provide materials and equipment with manufacturer's standard finish color, except where specific color is indicated.

2.4 OUTDOOR EQUIPMENT

A. Provide equipment and devices to be installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 20 degrees F to 105 degrees F.

PART 3 EXECUTIONS

3.1 GENERAL

A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work, which has a neat and finished appearance. Carry out work in accordance with NECA Standard of Installation unless otherwise specified.

B. Coordinate electrical work with work of other trades to avoid conflicts, errors, delays and unnecessary interference during construction.

3.2 MATERIAL AND EQUIPMENT INSTALLATION

A. Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between the manufacturer's instruction, codes and regulations and these contract documents, follow Engineer's decision. Keep copy of manufacturer's installation instructions on the job site available for review at all times.

B. Prior to backfilling trenches, the Contractor shall obtain approval from the Engineer so that the Engineer may verify conduit bends and depths.

C. Coordinate with other agencies for trenching and back filling of conduits and inspection as required per the agencies requirements.

3.3 CUTTING AND PATCHING

A. Lay out work carefully in advance. Carefully carry out any cutting, channeling, chasing or drilling of paving or other surfaces required for the installation, support or anchorage of conduit, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition. Use skilled craftsmen of the trades involved.

3.4 CLEANING AND TOUCHUP

A. Keep the site free at all times from accumulation of waste material, litter and rubbish. Upon completion of work, remove all materials, scraps and debris from site and from interior and exterior of all devices and equipment. The interior of all electrical equipment shall be vacuumed and wiped free of dust just before final acceptance. De-energization of equipment shall be approved by the City. Touch up scratches, scrapes or chips in interior and exterior surfaces of devices and equipment with finishes matching the type, color, consistency and type of surface of the original finish.

B. If extensive damage is done to equipment paint surfaces, refinish the entire equipment in a manner that provides a finish equal to or better than the factory finish, that meets the requirements of the Specifications and that is acceptable to the Engineer.

3.5 STANDARD, CODES, PERMITS AND REGULATIONS

A. Perform all work; furnish and install all materials and equipment in full accordance with the latest applicable rules, regulations, requirements and specifications of the following
1. Local Laws, Codes, Ordinances and Regulating Agencies
2. State and Federal Laws
3. National Electrical Code (NEC)
4. Underwriters' Laboratories (UL)
5. National Electrical Safety Code (NESC)
6. American National Standards Institute (ANSI)
7. National Electrical Manufacturer's Association (NEMA)
8. National Electrical Contractor's Association (NECA); Standard Installation
9. Institute of Electrical and Electronics Engineers (IEEE)
10. Caltrans Standard Specification (CTSS);Unless Otherwise Noted
11. Standard Specification Department of Public Works, City and County of San Francisco (SSDPWSF)
12. California Public Utilities Commission General Orders 95 and 128
13. PG&E Greenbook

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 2 - GENERAL

A. 1.1 DESCRIPTION

A. The work of this section consists of electrical materials and methods; and includes but is not limited to conduit wiring and cable, boxes, wiring devices, grounding and bonding, supporting devices, electrical identification, enclosed switches, fuses, utility service entrance and connections to equipment specified elsewhere in these Specifications. Electrical materials that are a part of equipment specified under other Sections shall meet the requirements of this Section.

B. Related work specified in other Sections:

1. Section 26 04 00: General Requirements for Electrical

2. Section 34 41 13: Traffic Signals

B. 1.2 QUALITY ASSURANCE

A. As specified in Section 26 04 00: General Requirements for Electrical

C. 1.3 SUBMITTALS

A. As specified in Section 26 04 00: General Requirements for Electrical

B. Product Data:

1. Conduit, fittings, and conduit bodies.
2. Boxes and wiring devices with dimensions, knockout sizes and locations, materials, fabrication detail, finishes and accessories.
3. Each type of cable used.
4. Manufacturer's catalog information showing dimensions, colors, and configurations.
5. Manufacturer's Installation Instructions, including instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

C. Wire and Cable:

1. Submit one 18 inches length of cable assembly from each reel. Select each length to include complete set of manufacturer markings. Attach tag indicating cable size and application information.

D. 1.4 REFERENCE STANDARDS

A. American National Standards Institute

ANSI C80.1 Rigid Steel Conduit, Zinc Coated.

	ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
ANSI/NFPA 70	National Electrical Code.

B. National Electrical Contractors Association

NECA	"Standard of Installation."

C. National Electrical Manufacturers Association

	NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80). NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
NEMA TC 6	PVA/ABS Plastic Utilities Duct for Underground Installation.
NEMA TC 9	Fitting for ABS and PVC Plastic Utilities Duct for Underground Installation.
NEMA WD 6	Wiring Device Configurations.
NEMA FB 1	Fittings and Supports for Conduit and Cable Assemblies.
	NEMA OS 1 Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports. NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
NEMA WD 1	General Requirements for Wiring Devices.
NEMA FU1	Low Voltage Cartridge Fuses.
	NEMA KS1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. International Electrical Testing Association

IETA ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).

E. The City and County of San Francisco Electrical Code.

F. California Public Utility Commission:

G.O 128	Construction of Underground Electric Supply and Communication System.
G.O 95	Overhead Electric Line Construction.

G. Caltrans Standard Plans and Specifications.

H. California Occupational Safety and Health Administration (CAL/OSHA).

I. Electrical Safety Orders, California Code of Regulations (California Administrative Code) Title 8.

J. Under Writer's Laboratories, Inc. (UL)

UL 6	Rigid Metal Electric Conduits.
UL 514B	Fitting for Conduit and Outlet Boxes.

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as shown on drawings. Verify routing and termination locations of conduit prior to rough-in.

B. Conduit, wire and cable routing as shown on the Drawings is approximate unless dimensioned. Route as required to complete wiring system. Where routing is not shown, and destination only is indicated, determine exact routing and lengths required for a complete installation.

C. Conductor sizes are based on copper.

D. Conduit with wires, provide duct seal to prevent foreign objects or materials entering the conduit.

E. Empty conduit provide PVC end plug with pull tab and pull rope.

1.6 COORDINATION

A. Determine routing to avoid interference with other work and to achieve required separation from other work.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation and start-up schedule for equipment.

PART 2 - PRODUCTS

2.1 RIGID STEEL CONDUIT, GALVANIZED

A. The conduit shall be in accordance with Section 601 and the depth shall be in accordance with Section 601.03 of the SSDPWSF and shall meet the NEC requirements and of ANSI C80.1, NEMA FB1, UL 6, with each length bearing manufacturer's stamp and UL label unless otherwise noted.

B. 1. Provide conduit, couplings, elbows, bends, sealing fittings, and nipples conforming to ANSI C80.1 and UL 6, with each length bearing manufacturer's stamp and UL label.

2. Fittings and Accessories

a. Provide separable watertight hub fittings with a gasket, separate plastic-insulated throat, and a case-hardened locknut.

b. Provide bushings of plastic-insulated metallic and grounding type, with copper grounding lug.

c. Provide conduit straps, clamps backs made of galvanized malleable iron.

d. Rigid steel conduit shall be a minimum of ¾-inch diameter at exposed and embedded portions.

e. Only threaded couplings shall be used.

f. No threadless fittings shall be used. All conduit shall be threaded.

g. Tape for conduit stub-out shall be 40 mil PVC corrosion protection tape, for underground rigid steel conduit wrap tape may be 10 mil.

h. Unilet bodies (condulets) shall be FM7 with clip covers manufactured by Appleton. (In order to obtain a necessary item that is only available from one source.)

3. Manufacturer: Appleton, PWC, Inc. Allied Tube and Conduit Corp. or equal.

2.2 PVC SCHEDULE 80 CONDUIT

A. Traffic signal field PVC conduits contain various traffic signal conductors, service conductors, detector cables and 12-conductor cables, unless otherwise noted.

B. PVC conduit shall be used for all field conduits unless otherwise noted. The minimum size raceway shall be 2 inch unless indicated otherwise on the Drawings. Base and intermediate spacers shall be interlocking plastic type made for the specific sizes of conduits used and installed at maximum 5' on center.

C. PVC Schedule 80 UL listed for direct burial, conforming to NEMA standard TC6 and UL651A and rated at 90° C.

D. All PVC conduits shall have a #6 AWG bare stranded copper ground wire unless otherwise noted.

E. Fittings for use with nonmetallic duct shall be PVC and have solvent-weld-type conduit connections.

2.3 High Density Polyethylene (HDPE)

A. Liquid-tight flexible HDPE SDR-11 shall be used for all interconnect conduits, except runs between pull boxes and traffic signal controllers foundation can be PVC schedule 80. All HDPE conduit depth shall be in accordance with Section 601.03 SSDPWSF. HDPE Conduit runs shall typically consist of four parallel 2-inch diameter sections with conduit spacer. Note that some conduit runs may only require two 2-inch conduits and will be so indicated on the plans.

B. HDPE conduit shall be manufactured from high density, extra high molecular weight polyethylene and shall meet the following requirements:
1. The material shall conform to ASTM D2447 for Schedule 80 and ASTM D3035 for SDR-11.
2. The minimum bend radius shall be 12 times the conduit inside diameter.
3. The conduit shall be able to withstand 95% soil compaction without collapsing.

2.4 PULL BOXES

A. Traffic Signal

Composite box material and slip-resistant cover shall consist of polyester resin, fiberglass and calcium carbonate that is high strength and lightweight to meets or exceed SCTE Tier 8 performance rating,

1. Type I Traffic Signal pull box containing any traffic signal conductors shall be reinforced concrete box with non-skid composite material cover, unless otherwise noted.

2. Type III Traffic Signal pull box shall be composite box and cover.

3. Type IV Traffic Signal pull box shall be reinforced concrete box with two piece non-skid resistant galvanized steel checker plate cover.

4. Type 36X Traffic Signal pull box shall be Composite box 18” high with 6” Composite extension and composite material cover.

5. Type 48X Traffic Signal pull box shall be reinforced concrete box 14” high with 10” reinforced concrete extension and two piece non-skid resistant, galvanized steel checker plate cover.

6. Pull boxes containing any traffic signal conductors shall be denoted by “Traffic” (1st line) “Signals” (2nd line) on the pull box cover. Pull boxes containing traffic signal interconnect shall be denoted by “Traffic Signal” (1st line) Interconnect (2nd line) on the pull box cover.

7. Pull boxes containing automated photo enforcement conductors only shall be fiberlyte material box and cover. Pull boxes containing automated photo enforcement conductors only shall be denoted by “RLC” on the pull box cover.

B. Streetlight

1. Pull boxes containing street lighting conductors only shall be reinforced concrete box with non-skid, non-bolt down reinforced concrete cover unless otherwise noted.

2. Pull boxes containing street lighting conductors only shall be denoted by “Street Lighting” (1st line) 120/240 Volt (2nd line).

C. The conduit shall enter the pull box from the side wall and shall protrude a minimum of 1 inch to a maximum of 2 inches into the pull-box. The top of the conduit shall be a minimum 6 inches to a maximum 9 inches below the base of the pull box cover.

D. All details and dimensions shall be per Contract Drawings.

E. Crushed rock pad and grout in the bottom of pull boxes shall not be allowed in Traffic Signal boxes. Interconnect pull boxes shall be crushed rock, grouted smooth on the bottom and a drain shall be installed per interconnect detail.
Streetlight boxes are allow to have crushed rock per SFDPW standard plan.

2.5 BONDING AND GROUNDING

A. Bonding conductor shall be a continuous length of No. 6 bare stranded copper wire.

B. Ground wire clamps shall have a mechanical bonding attachment to the ground rod.

C. Grounding rods shall be copper-clad steel, 5/8-inch in diameter, and a minimum of 10 feet long.

2.6 GALVANIZING

A. Anchor bolts and other ferrous materials shall be hot-dip galvanized after fabrication.

B. The threads on the conduit shall be coated with rust proof paint.

2.7 EQUIPMENT FOUNDATIONS

A. Concrete for foundation shall be Class 6-3000-3/4. No pre-cast foundations will be allowed.

B. Concrete for foundations shall conform to CTSS Section 90-10 “minor Concrete”, and this Special Provision; shall contain not less than 564 pounds of cement per cubic yard, unless noted otherwise on Contract Drawings.

2.8 DUCT PLUGS, DUCT SEALANT, LOCATING WIRES, PULL TAPE, AND PULL ROPE

A. Duct Plugs

1. All empty PVC conduits 2” and above shall have PVC end plugs with pull tabs. All empty PVC conduits less than 2” shall have PVC end plugs without pull tabs.

2. All interconnect conduits shall be sealed at each pull box with removable and reusable mechanical plugs to prevent the passage of gas, dust, sand, rodents and water. Sealing plugs shall be installed at each pull box conduit end.
   a. All empty interconnect (HDPE) conduits shall be sealed by means of a polypropylene duct plug equipped with a neoprene or polyurethane gasket. Plugs shall be equipped with an attachment to secure the pull tape in the inner duct of the vacant conduit. Sealing capacity shall withstand 30 psi.
   b. At places where interconnect (HDPE) cables enter and exit the conduit, the conduit shall be sealed by means of a split internal expansion plug. Sealing capacity shall withstand 22 psi. Any nuts, bolts, fasteners and

washers shall be fabricated out of stainless steel. Conduit plugs shall be of the simplex or triplex type depending on the amount of pull tape or wires in the conduit.

c. Duct Sealant
Any GRS and/or PVC conduit with wires shall be sealed with duct seal to prevent foreign objects or materials from entering the conduit.

B. Backfeeding and Locating Wires
Where HDPE interconnect conduits are left empty or filled only with non-metallic (optical fiber cable) conductors, two (2) #8 AWG THW or UF stranded copper backfeeding wires shall be furnished and installed in one of the conduits. One wire shall have black insulation and the other shall have white insulation. The wires shall be continuous between pull boxes and left unbounded in the controller cabinets.

One (1) #10 stranded locating wire with green insulation shall be also installed in the same conduits as the above backfeeding wires.

C. Pull Tape
Pull tape shall be used in all empty interconnect conduits. Pull tape shall be a woven multi-fiber polyester ribbon with a minimum width of 3/8-inch. The tape shall be permanently printed with the rated tensile strength (1250 pounds minimum) and sequential footage markings. For empty non-HDPE conduits, pull tape can be used in place of pull rope.

D. Pull Rope
Either pull rope or pull tape shall be used in empty non-PVC conduits. If the Contractor chooses to use pull rope, the rope shall be ¼" polypropylene. If the Contractor chooses to use pull tape, the tape shall be as specified in the previous section. Pull rope shall not be used in HDPE conduits.

2.9 CONDUCTORS AND FIELD WIRING

A. Traffic Signal and Street Light Conductor

1. Conductors for all traffic signals running between the traffic signal controller and the termination point shall be Type UF. The termination point is either a terminal block inside the terminal compartment of a traffic signal assembly or the signal head itself if no terminal compartment is used. Conductors within traffic signal framework shall be UF or THW and may be either solid or stranded provided that such framework contains a terminal compartment (otherwise Type UF wire shall terminate at the signal head). Conductors for street or site lighting shall be Type THW. Traffic signal service wire shall be THW. Wire #8 and larger shall be stranded; #10 through # 14 shall be solid.
2. Each conduit that contains traffic signal conductors shall include one bare #6 AWG copper stranded conductor that is bonded at each end.
3. The installation of any conductors in conduits shall not take place until the Contractor has demonstrated to the Engineer's satisfaction and approval that the contractor has employed all means necessary, or required, to clean and prepare the conduits for the installation of conductors therein.
4. If the existing grouping, taping, or lacing of conductors is disturbed in the course of work, the Contractor shall regroup, tape, or lace as applicable.
5. All conductors terminating in a metallic enclosure shall terminate on a terminal board equipped with screw-type or box-type terminals fabricated from the copper or copper-alloy material.
6. Conductors terminating in screw type termination shall be equipped with self-insulated self-locking spade-type terminals.
7. Conductors terminating on box-type terminals shall be connected directly without using spade-type pressure terminals attached to the conductor ends.

8. Ends of all unused conductors shall be individually taped prior to intersection turn-on or switchover.
9. Traffic Signal and Service Conductor Color Codes, Labels, and Grouping
   a. Conductor labeling material shall Self Laminating Labels. Labeling and grouping requirements apply to all new and all existing conductors to remain at a given intersection. Old nylon tags shall be removed from all existing conductors to remain.
   b. Wires shall be sized, color-coded and labeled in accordance with the following schedule:

CIRCUIT	AWG	PHASE	BASE COLOR	STRIPE	LABEL
Vehicle Signals	#14	2, 6 (A) 4, 8 (B) 1, 5 (C) 3, 7 (D)	Red, Yellow, Brown Red, Yellow, Brown Red, Yellow, Brown Red, Yellow, Brown	None White Black Orange	Head # Head # Head # Head #
Bicycle Signal	#14	All	Red, Yellow, Brown	Green	Head #
Pedestrian Signals	#14	2p, 6p 2p, 6p 4p, 8p 4p, 8p 1p, 5p 1p, 5p 3p, 7p 3p, 7p	"DON'T WALK" Red "WALK" Brown "DON'T WALK" Red "WALK" Brown "DON'T WALK" Red "WALK" Brown "DON'T WALK" Red "WALK" Brown	None None White White Black Black Orange Orange	Head # Head # Head # Head # Head # Head # Head # Head #
Pedestrian Push Buttons Pedestrian Push Button's Return Wire	#14 #14	2p, 6p 4p, 8p 1p, 5p 3p, 7p All	Blue Blue Blue Blue White	None White Black Orange Black	Ped. Head # on same corner and same phase as button
Spare Signal Wire	#14	N/A	Black	None	None
Signal (Vehicle and Ped) Neutral	#10 or #14	N/A	White Use # 10 only when crossing Roadways.	None	None
Trolley & preempt Switches Both Wires	#14	PE 1 PE 2 PE 3	Orange Orange Orange	None White Black	TS # or PE #
12-Conductor Cable	#14	N/A	Black (jacket)	None	Per plans
Detector Cable	#12	All	Black (jacket)	None	Per plans
Detector Loop Wire	#14	N/A	Black	None	Per Plans
Service (AC+)	#8	N/A	Black	None	None
Service (AC neutral)	#8	N/A	White	None	None

* Install labels on 12-Conductor cable near each conduit end. For example, a single cable in a pull box requires two labels – one label near each conduit end. 12-Conductor Cable labels shall identify where cable is headed, i.e. north, south, east, west, controller, etc.

c. In all pull boxes and the controller cabinets, all traffic signal conductors shall be grouped by signal head with electrical tape and labeled by signal head number as designated on plan sheets.

d. In all pull boxes, all conductors running between the same two conduits shall be further grouped and wrapped in at least one location with electrical tape near the center of the slack.

e. In the controller cabinet, all conductors shall be further grouped and labeled by phase in an orderly manner.

10. Splicing

a. In general, splicing shall not be permitted except for mast arm heads as detailed below, unless otherwise noted on the contract plans, or as directed by the Engineer. The Contractor shall install the specified wiring throughout the conduits without unnecessarily splicing the wires in an adjacent pull box or hand hole. The wiring, once connected to the relative signal head, shall form a continuous run from the relative signal head to the controller. The Contractor shall pull new wiring, at the Contractor's expense, when it is determined that unnecessary splicing has occurred. Traffic signal multi-conductor cable shall be jacketed with twelve (12) 600-volt insulated, No. 14 AWG, solid, copper conductors. Cable shall meet the requirements of International Municipal Signal Association, Inc., Specification No. 19-1 latest specification.

b. In cases where splicing is required, it shall be completed in pull boxes, hand holes or manholes or as directed by the Engineer. Splices shall conform to the details shown on the SSDPWSF plan 87,204.

c. All splicing devices shall be UL approved. All splicing devices shall be of the correct size range for the wires being spliced. All splices shall be wrapped with one wrap of rubber splicing tape, taped with a minimum of four wraps of all weather 7-millimerer thick UL listed and ASTM approved plastic electrical tape and coated with a waterproofing electrical rubberized exterior liquid splice coating. See Section 34 41 13 for additional 12-conductor and fiber optic cable splice requirements. Where 12-Conductor splices are specified, provide12-conductor splice kits that are UL listed. The spice tape noted above shall be supplied without a liner, be based on ethylene propylene rubber and be capable of emergency operating cable temperature of 130 degree C. The tape must be capable of being applied in either stretched or un-stretched conditions without resulting in loss of either physical or electrical properties. The tape shall not split, crack, slip or flag when exposed to various environments (indoor or outdoor). The tape shall be compatible with all synthetic cable insulations and have a shelf life of five years.

d. Butt splices: Only non-insulated butt splices shall be used. Butt splices shall be tinned coppers. Crimping shall be performed using the correct tool and shall result in a deeply dimpled cross section or hex shaped cross section (no flat shaped crimp cross sections shall be accepted). Butt splice must be mechanically and electrically secure -soldering is required if splice is below grade.

e. Split bolt type splice: Split bolt type splicing devices shall be copper. Splice must be mechanically and electrically secure, insulated, and coated with a waterproofing electrical rubberized exterior liquid splice compound.

f. Twist Splices: Splices shall be twisted as tightly as possible without kinking the splicing area. Twist splices shall be 50/50 solder. "Wire nuts" or similar splicing methods shall NOT be used.

g. Slack loop for each conductor in hand holes on standards shall not be less than 2 feet long on each side of a splice. Slack loop for each conductor in pull boxes shall not be less than 6-feet long in total.

B. INTERCONNECT CABLE/COMMUNICATIONS NETWORK MEDIA

1. 12-CONDUCTOR CABLE

a. Traffic signal multi-conductor cable shall be jacketed with twelve (12) 600-volt insulated, No. 14 AWG, solid, copper conductors. Cable shall meet the requirements of International Municipal Signal Association, Inc., Specification No. 19-1 latest specification. The function of each conductor and corresponding insulation color code shall be as follows:

Color & Terminal Strip Order	FUNCTION
Green	Offset 1
Blue w/ black stripe	Offset 2
Green w/ black stripe	Offset 3
Black	Dial 2
Blue	Dial 3
Orange w/ black stripe	Flash
Red	Split 2
Orange	Split 3
White w/ black stripe	Spare
Red w/ black stripe	Spare
Black w/ white stripe	Spare
White	Interconnect Common

b. The Contractor shall identify the direction of all existing interconnect cable at the intersection. The Contractor shall label all existing and new interconnect cable at the intersection in every pull box and the controller cabinet prior to intersection turn-on or switchover.

c. Install labels on 12-Conductor cable near each conduit end. For example, a single cable in a pull box requires two labels – one label near each conduit end. 12-Conductor Cable labels shall identify where the cable is headed, i.e. north, south, east, west, controller, etc.

d. All splicing devices shall be UL approved. All splices shall be wrapped with one wrap of rubber splicing tape, taped with a minimum of four wraps of plastic electrical tape and then coated with a waterproofing coating with 12-Conductor splice kits that are UL listed.

C. TWISTED PAIR COPPER

1. Twisted Pair Cable shall be International Municipal Signal Association (IMSA) Specification number 60-2 including the following characteristics:
   a. Contains 12 twisted pairs, each 19 AWG solid copper conductors
   b. Rated for 300V
   c. Black polyethylene (PE) jacket
   d. Shielded with copper tape
   e. Filled with translucent petroleum-polyethylene gel compound
   f. IMSA twisted pair color code with tip/ring combination: white/blue, white/orange, white/green, white/brown, white/slate, red/blue, red/orange, red/green, red/brown, red/slate, black/blue, and black/orange. Specific pair jacket color coding is found in the table below:

Pair	Wire 1	Wire 2	Description
1	Blue	Red	Intersections 1, 2, 3 & 4
2	Blue	White	Intersections 1, 2, 3 & 4
3	Brown	Red	Intersections 5, 6, 7 & 8
4	Brown	White	Intersections 5, 6, 7 & 8
5	Green	Red	Intersections 9, 10, 11 & 12
6	Green	White	Intersections 9, 10, 11 & 12
7	Grey	Red	Intersections 13, 14, 15 & 16
8	Grey	White	Intersections 13, 14, 15 & 16
9	Orange	Red	Intersections 17, 18, 19 & 20
10	Orange	White	Intersections 17, 18, 19 & 20
11	Black	Blue	Spare
12	Black	Orange	Spare

2. Filled cable
   a. Filled cable refers to a petroleum-polyethylene translucent gel compound applied in liquid state to twisted pair cable core assemblies and to both sides of the overall metal shielding tape(s). Thus, the entire cable assembly under the outer cable jacket is 100% flooded (filled); thereby eliminating possible moisture migration or humidity changes due to ingress and/or outer jacket damage.

D. VEHICLE TAGGING SYSTEM AND OVERHEAD LINE SIGNAL CONTROL SYSTEM

1. Wire sizes indicated conform to American Wire Gage (AWG) standard sizes. THW-2, XHHW-2 wire size shall be #12 AWG minimum and stranded copper except as noted. Wire shall be rated 600 volts except as noted.
2. Grounding and bonding jumper wiring shall be bare stranded copper wires, No. 6 AWG minimum unless otherwise required to be larger by Codes.
3. VTS controller cable shall be rated 600 volts, stranded, PVC jacketed and shielded 2 conductor No. 14 AWG cable.
4. VTS loop wire shall be No. 12 AWG copper, stranded with XHHW cross linked polyolefin insulation.
5. Overhead line signal control cable shall be rated 2000 volts, stranded, with # 10 AWG minimum, RHH-RHW, type DLO, extra flexible tinned copper cable.

2.10 CONDUIT SEALANTS

A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.

B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with minimum an hour rating in accordance with UL Classification 35L4.

C. Hazardous Locations gas conduit seal by Appleton or Crouse-Hinds.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical materials, equipment, and accessories in locations as indicated, rigid and secure, plumb and level, and in alignment with related and adjoining work to provide a complete and operable system. Do not weld electrical materials for attachment or support.

B. Conduit alignments shown on plans are schematic. Where obstructions are encountered and with prior approval of the Engineer, location of conduit may be changed or alignment be curved according to the conduit-bending restrictions specified in the detail plans.

C. The Contractor shall be responsible for field locating existing facilities that may be in conflict with new conduits, including existing detector loops. The Contractor shall maintain existing facilities in the vicinity of new conduit, and shall repair all damage resulting from the Contractor's operations within a 48 hour period at the Contractor's expense. Where new conduits conflict with an existing utility or other underground installation, the depth of the new conduit shall be increased to avoid the conflict. The Contractor is responsible for avoiding damaging or removing curb ramps and traffic detector loops and will be responsible for repairing them at his own expense. Minimum clearances from existing utilities shall conform to utility owner requirements.

3.2 CONDUIT

A. The conduit shall be installed in accordance with Section 601.03 of SSDPWSF except as specifically modified herein.

B. The trade size, type, and general routing and location of conduits, raceways, and boxes shall be as indicated or specified.

C. Install individual conductors and multiple-conductor sheathed cables in conduits, unless otherwise indicated.

D. Use of explosive fasteners is prohibited.

E. After conductors have been installed, the end of conduits terminating in pull boxes and controller cabinets shall be sealed with an approved type of sealing compound for conduit with wires.

F. Conduit bend radius at foundations or other underground structures shall be 12 times internal diameter of the conduit, minimum. Conduit coming out of foundation shall be straight and have 3" (+/-) above foundation.

G. The maximum number of bends in any one conduit run shall be as follows for rigid steel conduits: A run of conduit between the bases of standards and controller pedestals shall not contain more than the equivalent of two 90 degree and one 45 degree bends; a run of conduit between pull or junction boxes shall not contain more than the equivalent of four 45 degree bends; a run of conduit between the base of a standard or controller pedestal and pull or junction box shall not contain more than the equivalent of one 90 degree and one 45 degree bend. Only large radius elbows shall be allowed per SSDPWSF 601.03. NOTE: The above required bends include both the cumulating of horizontal and vertical bends. THIS MAXIMUM ALLOWABLE CUMULATION OF BENDS WILL BE STRICTLY ENFORCED. ANY DEVIATIONS FROM THIS SPECIFICATION WITHOUT THE PRIOR APPROVAL OF THE ENGINEER SHALL BE CONSIDERED INCORRECTLY INSTALLED AND ANY DEVIATIONS WILL RESULT IN THE CONTRACTOR REINSTALLING THE CONDUIT AT THEIR OWN COST.

H. Conduit shall not be installed at a depth greater than 48 inches below pavement surface; and minimum depth of conduit shall be 24 inches in roadway areas and 18 inches in sidewalk and unpaved areas. See SSDPWSF Section 601.03 for further details.

I. Where parallel runs of conduit are installed in a common trench, such conduits shall have a minimum separation of 2-inches or with conduit spacer.

J. A minimum of 6" shall be maintained between conduit and steam or hot water lines.

K. SSDPWSF Section 601.03 for Underground Conduit on page 6-13 number five (5) shall be modified to read as follows:

"If an existing pipe, duct or duct bank is in the path of new conduit, the laying of underground conduit at normal depth, and if such obstacle extends to a depth greater than 4 feet, the conduit shall cross over the obstacle as directed by the Engineer. If such obstacle extends only to a depth of 4 feet or less, the conduit shall cross one foot below the obstacle".

L. Installing conduit by jacking conduit or pulling and pushing conduit in the ground will not be allowed, except when specifically noted on plans.

M. Zinc primer paint on conduit threads and damaged conduit surfaces shall conform to Section 86-2.05C, "Installation," of the CTSS, except that the use of spray cans will be permitted.

N. Existing conduit, when required, shall be cut, threaded, fitted with extension and grounding bushings. The Contractor shall couple existing conduit to new conduit where required.

O. Prior to backfilling trenches and covering buried conduit, the Contractor shall have the Engineer verify that conduit bends and depths are in compliance with these Specifications.

P. All empty conduits shall have a 1/4" polypropylene pull rope provided inside. Provide PVC end plug with pull tabs for tying the pull rope for two inches conduit and above. For conduit below two inches, the pull rope shall be tied outside the conduit with knots to prevent slippage. Plug shall be provided on both end of the conduits.

Q. Methods

1. The Contractor may elect, at his or her option, to install conduit by either trenching or by directional boring. However, this option in no way constitutes City's approval of directional boring for this contract. Prior to exercising either option, the contractor shall obtain the written approval from the Bureau of Street Use and Mapping (BSM) and secure all required permits to perform said work. The bid item for furnishing and installing polyethylene conduits shall be for trenching and/or directional boring. Payment for this bid item shall be at the same price regardless of the method used for installation (trenching or directional boring). If directional boring is chosen, no additional cost will be granted for unforeseen conditions resulting from said operations. When site conditions prevent conduit installation utilizing the directional boring method or BSM denies approval of directional boring, trenching shall be used. All potholing required as a condition of permit approval to utilize directional boring shall be performed as incidental work.

2. Trenching

a. The pavement cutting, street excavation and trench backfill shall be in accordance with this Project Manual and Section 11 - Pavement Base Restoration Requirements of DPW's Regulations for Excavating and Restoring Streets of San Francisco (Order No. 176, 707).
b. Conduits shall be fastened together with spacers at five-foot intervals, and maintain a minimum separation of three-quarters of one inch (3/4") between each.
c. Conduit shall have a minimum 6-inch thick bedding of sand, measured from the center of conduit system, at top, bottom and sides of the conduit bundle. Four (4) inch red colored warning tape shall be placed between six (6) inches and twelve (12) inches above the top of the conduit bundle longitudinally for the entire length of the trench. The red warning tape shall be extrusion laminated, rated for direct burial, chemically inert with most typical substances in soil, and with tape color form 100% pigmented plastic.

3. Directional Boring
a. All interconnect conduits in the same block shall be installed with directional boring, unless otherwise accepted by the Engineer.
b. The contractor shall obtain excavation permit(s) and a temporary occupancy permit(s) issued by BSM before commencing work. The contractor shall be responsible to ascertain if BSM will allow the use of directional boring for the project streets. If the permits are issued, it is the contractor's sole responsibility to comply with all requirements of the permit.
c. The contractor shall use the technique of creating and directing a borehole along a predetermined path to a specified target location. The directional drilling technique shall involve the use of mechanical and hydraulic equipment to change the boring course and shall use instrumentation to monitor the location and orientation of the boring head assembly along the predetermined course.
d. Directional boring shall be accomplished with fluid-assisted mechanical cutting. Unless otherwise accepted, boring fluids shall be a mixture of bentonite and water or polymers and additives. Bentonite sealants and water shall be used to lubricate the drilling head. It is mandatory that minimum pressures and flow rates be used during boring operation so as not to fracture the subgrade material around and/or above the bore. Uncontrolled jetting (where the primary purpose is to use fluid force to erode soil for creation of the final bore hold diameter) is prohibited.
e. The directional boring system shall utilize small-diameter fluid jets to fracture, and mechanical cutters to cut and excavate the soil as the head advances forward. After installation of conduits in the bored hole, voids in the hole shall be sealed with bentonite slurry.
f. No additional payment will be made to the contractor for encountering underground obstructions and/or problems resulting from said operation of directional boring.
g. Conduit used for fiber optics shall be installed as straight as possible to protect fiber optic quality.

R. When underground conduit passes through concrete walls, concrete envelopes shall be extended through and finished flush with inside surfaces. Watertight construction joints of an approved type shall be provided.

S. Where coring or cutting of existing structure in basement walls or tunnels is required for installation of new conduit, the refinishing of the wall shall be made watertight and all work shall conform to Division 3, Concrete.

T. Galvanized Rigid Steel (GRS) Conduit

1. Metallic conduits shall be electrically and mechanically continuous and connected to ground by bonding to the grounding system for all underground conduit and where required. Insulated bonding bushings are required with copper grounding lug.

2. Apply zinc primer conductive compound to the threads of threaded rigid conduit joints. Do not use compounds containing lead. Do not use spray cans. Terminate the conduit in appropriate boxes, and junction points.

3. When field cutting of conduit is required, thread and ream the conduit to remove rough edges. Where a conduit enters a box or other fitting, provide a bushing to protect the wire from abrasion. Provide insulation type bushings and double locknuts on ends of rigid conduits terminating at steel boxes, panelboards, cabinets, and similar enclosures.

4. Support individual horizontal conduits not larger than 1-1/2 inches in diameter by means of one-hole conduit strap with back spacers or individual conduit hangers.

5. Support individual horizontal conduits larger than 1-1/2 inches in diameter by individual hangers and forged steel conduit strap for vertical runs.

6. Space conduits installed against concrete surfaces ¼ inch away from the surface by clamp backs or other approved means.

7. Exposed conduit shall be supported at intervals as required by the N.E.C. or at a closer spacing as directed by the Engineer to eliminate sagging.

8. Conduit terminating in enclosures other than NEMA 1 shall be terminated with Meyers type gasketed conduit hubs.

9. Terminate conduit installed for future extension with flush threaded couplings set to finished floor level or wall, unless otherwise indicated. Provide pull cord/tape and plug for open end.

10. The installation of nonferrous, nonthreaded conduit fittings, running threads and single-bolt split type conduit couplings is prohibited.

11. Tape-wrap all rigid steel conduit installed underground continuous over entire buried length and 6” above penetration.

3.3 PULL BOX

A. Pull box notches shall be saw cut. Cracked pull boxes will not be acceptable

B. Crushed rock pad and smooth grout in the bottom of pull boxes shall not be allowed in traffic signal boxes except for interconnect boxes. Streetlight boxes shall have crushed rock per SFDPW standard plan

C. Abandoned conduits inside pull boxes that are modified or replaced shall be cut or removed six inches beyond the exterior wall.

D. All debris, soil, sand and mud shall be removed to expose all cables in all new, adjustable and relocated boxes.

E. INTERCONNECT PULL BOXES

1. General

a. Interconnect pull box notches shall be saw cut. Cracked interconnect pull boxes will not be accepted.

2. Bending Restrictions
   Interconnect (HDPE) conduit must meet the following bending restrictions:
   a. For outdoor installations:
      i. Entering a pull box or vault, individual conduit bends shall not exceed 30 degrees.
      ii. Conduit bends for rise of elbows into pull boxes shall not exceed 30 degrees maximum, as measured from the extended horizontal plane.
      iii. The total cumulative bending angle shall not exceed 120 degrees between pull boxes. That is, the conduit run between pull boxes shall contain no more than 2 horizontal and 2 vertical bends (of 30 degrees each).
   b. For indoor installations:
      i. The minimum conduit sweep radius shall be five times the outside diameter of the conduit.
      ii. No sweeps will be allowed into indoor junction boxes.
3. Conduit Entrance into Pull Boxes
   a. To gain maximum bending radius inside of a pull box, conduits shall enter on the opposite sides of the box extension near the bottom of the extension box aligning on the same long side of the box, or enter on the diagonally opposite corners of the box extension per interconnect pull box detail drawing.

3.4 WIRING

A. The installation of any wiring in conduits shall not take place until the Contractor has demonstrated to the Engineer's satisfaction and approval that he, the Contractor has employed all means necessary, or required to clean and prepare the conduits for the installation of wiring therein.

B. If the existing strapping or lacing of wiring is disturbed in the course of work, the Contractor shall replace or re-strap as applicable.

C. All wires terminating in a metallic enclosure shall terminate on a terminal board equipped with screw-type or box-type terminals fabricated from the copper or copper-alloy material. Wires terminating on screw type terminations shall be equipped with self-insulated self-locking spade-type terminals. Wires terminating on box-type terminals shall be connected directly without using spade-type pressure terminals attached to the wire ends.

D. Wiring shall be installed so that no cuts or abrasions in the insulation or protective covering or kinks in the conductor occur.

E. Lubricant shall be applied as an aid in pulling, only UL approved material as recommended by wire manufacturer and no injurious to the wire sheath or insulation shall be used.

F. Any wire damaged during installation shall be removed and replaced with the equivalent wire at the Contractor’s expense.

G. No splicing of conductors shall be allowed except where specifically indicated.

H. VTS wires shall not be spliced. VTS wire runs shall be continuous from loop connector unit to VTS cabinet.

I. All new wirings shall be identified at their terminations with approved wire markers indicating the originating panel and circuit letter or number.

J. Wiring of different systems installed in a common enclosure shall be separately assembled within such enclosures and laced or tied in cable form.

K. Install wire and cable in conduit as indicated. Do not pull wiring into conduit until conduits have been thoroughly cleanly and swabbed. Do not use block and tackle or other mechanical means for pulling conductors smaller than No. AWG in raceways.

L. Provide suitable installation equipment to prevent cutting and abrasion of conduits and wire during the pulling of cables.

M. All wires terminating in a metallic enclosure shall be terminated on terminal board(s) with screw-type or box-type terminals fabricated from copper or copper alloy material.

N. All splice in 600 volts insulated power wiring shall be permitted only in pull boxes.

O. Where splices are required, the procedures shall be mechanically secure the wires, tape, waterproof and in accordance with manufacturer's recommendation.

P. Clear plastic tubing may be applied over each energized conductor, as a temporary insulation, which shall be removed when the Engineer is prepared to test each splice.

3.5 INTERCONNECT CABLE/COMMUNICATIONS NETWORK MEDIA

A. 12 CONDUCTOR CABLE

1. 12-conductor cable splices shall be performed as directed on the plans. Where 12-conductor splices shall be heat-shrinkable, butt type connectors and 12-conductor splice kits shall be UL listed.

B. TWISTED PAIR COPPER

1. Twisted pair 12 pair cable Installation Procedures Needed.

3.6 DUCT PLUGS, DUCT SEALANT, LOCATING WIRES, PULL TAPE, AND PULL ROPE

A. Sealing Ducts, Locating Wires, and Pull Tape

1. All exposed conduit ends shall be temporarily and securely capped at all times during construction, including on-site storage, and until conductor installation by an accepted method. The contractor shall be responsible for the removal of any foreign material inside conduits at no additional cost to the City.
2. All interconnect conduits shall be sealed at each pull box with removable and reusable mechanical plugs to prevent the passage of gas, dust, sand, rodents and water. Sealing plugs shall be installed at each pull box conduit end. Empty conduits shall be sealed by means of a polypropylene duct plug equipped with a neoprene or polyurethane gasket. At places where interconnect cables enter and exit the conduit, the conduit shall be sealed by means of a split internal expansion plug.
3. Where HDPE interconnect conduits are left empty or filled only with non-metallic (optical fiber cable) conductors, two (2) #8 AWG THW or UF stranded copper locating wires (one with black and one with white insulation) shall be installed in one of the conduits.
4. Continuous pull tape shall be furnished and installed in each individual empty HDPE conduit. A minimum of 5 feet of slack shall be provided in the pull box at each end of the pull tape. Although pull rope can be used as an alternative in

non-HDPE conduits, pull rope shall not be used in HDPE conduits. Pull tape shall be installed in continuous lengths without any cuts or ties.

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

6. Where conduit is exposed to different temperatures, seal the conduit to prevent condensation and passage of air from one area to the other.

7. All penetrations through concrete walls shall be core-drilled, non-shrink epoxy grouted and sealed openings with approved duct seal to prevent circulation of air or moisture and leakage into the building, constructed as Incidental Work. Provide UL listed fie-rated seals for all conduit and raceway penetrations through fire-rated walls and floors. Seal and maintain fire separation rating.

3.7 GROUNDING AND BONDING

A. Steel standards with hand holes, controller cabinets and other enclosures providing access to the conduit ends shall be bonded to the conduit with a grounding conductor terminated in a screw-type copper box-shaped terminal. The terminal shall be secured to the interior surface of the equipment near the foundation with a stainless steel screw equipped with a stainless steel internal tooth-lockwasher or to the neutral bus provided in such enclosures unless otherwise noted or directed. The head of the screw shall be installed on the interior surface of the equipment and the end of the screw shall be terminated with the exterior surface of the equipment.

B. Pole standards shall be bonded to a conduit in the nearest pull box. Bonding and grounding jumpers shall be a continuous length of No. 6 AWG bare stranded copper wire.

C. In multiple face signal heads, bonding conductor shall run to one face only. The bonding conductor shall be attached to the bottom section of the signal face, using a screw-type copper box-shaped terminal, secured to the housing of the signal face with a roundhead stainless steel machine screw, a stainless steel internal tooth lockwasher and a stainless steel nut.

D. The service equipment shall be bonded to the ground rod with a ground clamp and No. 6 AWG bare stranded copper wire. Grounding conductors shall terminate in box-shaped terminal.

E. Ground wires shall be effectively bonded at controller ground bus bar.

F. Install the grounding system in accordance with National Electrical Code, as indicated on the Drawings and as specified herein.

G. The continuity of metallic conduit through concrete pull boxes and metallic enclosures shall be preserved by installing appropriate ground fittings and grounding conductors.

H. Where grounding conductors are shown in Drawings or required, bond the wires to metallic enclosures at each end and to all intermediate metallic enclosures.

I. Steel poles with hand holes and other enclosures providing access to conduit ends, shall be bonded to the conduit with grounding conductor terminated in a screw-type copper box-shaped terminal. The terminal shall be secured to the interior surface of the equipment near foundation with a stainless steel screw equipped with a stainless steel internal tooth-lockwasher or to a neutral bus provided in such enclosure unless otherwise

noted or directed by Engineer. The head of the screw shall be terminated with the exterior surface of the equipment.

J. The bonding conductor shall be attached to the bottom section of the signal face, using a screw type copper box-shaped terminal, secured to the housing of the signal face with a roundhead stainless steel machine screw, a stainless steel internal tooth lockwasher and a stainless steel nut.

K. For Buried and Embedded Ground Connections: Prior to backfilling, cleaning and coat welded connections with bitumastic epoxy coating. Make weld in accordance with the manufacturer's requirements. Compression-type mechanical connectors are not acceptable.

L. Grounding Conductors: Continuous grounding conductors without splices, or splice by exothermic weld only.

M. Ground all exposed non-current carrying metallic parts of electrical equipment, controller cabinet, raceway system and the neutral of all wiring systems.

N. Inspect all ground connections for tightness and assure connections shown on Drawings have been completed.

O. Test grounded equipment enclosures, raceways, conduits, exposed expansion joints, trolley poles for continuity to ground rod system.

P. All test shall be performed by City certified, independent testing agency and in accordance with NETA recommended test procedures and standards.

3.8 ELECTRICAL TESTING

A. Carry out tests specified in this Section and in DPW Standard Specifications, and as specified under individual sections of this Division. If remedial measures or replacement of equipment or materials are required as a result of the tests, they shall be made by the Contractor without additional cost to the City.

B. Contractor shall test all conductors for continuity, after installation.

C. Grounds: Test all wiring connections for continuity and grounds before any loads are connected.

D. Contractor shall test the insulation resistance of each wire, after installation, and prior to connecting to equipment. Wire insulation resistance shall not be less than one (1) mega-ohm to ground.

E. Operations: After the electrical system installation is completed and at such time as the Engineer may direct, conduct an operating test for approval. Demonstrate that the equipment (such as Voltage Contactors, Signal Control Boxes, Push Button Stations and VTS etc.) operates in accordance with the requirements of these Specifications. Furnish all instruments and personnel required for the tests.

F. Perform all tests in the presence of the Engineer.

G. For all applicable sections where electrical testing is required, Contractor shall submit procedures and schedules to the Engineer for approval 10 working days prior to the actual date of the test.

H. Contractor shall maintain a written record of all tests.

I. Contractor shall provide all testing and recording devices which may be required for specified tests.

J. Contractor shall maintain the testing instruments in calibration per the requirements of NETA 5.3.

K. Step-by-step procedure including set point check, system testing parameters shall be specified.

L. Safety procedures per NETA 5.1 shall be adhered to.

M. All tests shall be non-destructive. Any damage caused to devices and equipment during testing shall be corrected at the Contractor's expense.

N. Upon completion of all work, individual testing, submittal of Operation and Maintenance Manuals, and prior to proceeding with the acceptance test, Contractor shall demonstrate to the Engineer proper and complete operation of all installed systems.

3.9 NOTIFICATION OF OTHER PARTIES

The Contractor shall notify Outdoor Systems at (415) 882-4949 a minimum of 72 hours in advance of working at an intersection near a MUNI bus shelter.

END OF SECTION

SECTION 31 23 34

PAVEMENT CUTTING AND EXCAVATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included: The work specified in this Section includes pavement cutting, pavement excavation, backfilling and compaction.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Other contract documents, including Contract Drawings, Relevant Sections of the Standard Specifications and Special Provisions apply to the work specified herein.

B. Division 1, General Requirements.

1.03 REFERENCES

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF) Revised November 2000.

B. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.

E. ANSI/ASTM D5195 – Nuclear Test Method for Density of Soil.

F. SFDPW Order No. 176,707, 'Regulations For Excavating and Restoring Streets in San Francisco".

G. Article 2.4 of the Public Works Code, "Excavation In The Public Right-Of-Way".

1.04 SUBMITTALS

A. Imported Backfill: Samples approximate 50 pounds weight shall be submitted to and approved by the Department of Public Works' Material Testing Laboratory, 2099 Kearny Street, San Francisco prior to placement.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. All fill materials shall be free of organic and deleterious materials and stock piling shall comply with the provisions of Section 700.06 of the SFDPW Standard Specifications.

B. Imported sand type or equivalent backfill shall be free from rock, concrete, organic material and other objectionable material. Backfill material shall conform to the following grading:

Sieve Size	Percentage Passing
3/8-inch	100
No. 4	93-100
No. 200	0-10

C. Unacceptable material shall be immediately removed from the site of work.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that fill material to be reused is acceptable.

3.02 PREPARATION

A. Identify required base repair limit lines, levels, contours and datum shown in the contract drawings. Actual limits of base repair work may vary as directed by the Engineer in the field.

B. Protect survey bench marks or monuments, existing structures, utility poles, sidewalks and curbs from excavation equipment and vehicular traffic.

3.03 PAVEMENT CUTTING AND STREET EXCAVATION

A. Pursuant to Section 373 of the San Francisco Public works Code, Contractor may use concrete saw cutting or vibratory pavement breaker or equal.

B. The Contractor shall not use any machine or device that breaks pavement by blows struck by a falling or driven hammer or weight. Hoe-ram and trenching machines shall not be used for concrete street at edge of pavement restoration. Such prohibition, however, shall not be construed as barring the use of hand tools or manually operated air tools such as jackhammers.

C. Rock Cutter: The use of the rock wheel cutter for street excavation is prohibited unless permitted by special order of the Director of Public Works for specific locations. If permitted, rock wheel cutter shall only be used to remove the pavement (concrete base and asphalt wearing surface), and only after potholing has been done to determine the pavement thickness. Rock wheel cutters shall not be used on concrete streets; shall not be used as a trenching device and shall not be used within 10 (ten) feet of a signalized intersection.

D. All areas of pavement to be cut shall be in neat and straight lines and overcutting of lateral trenches shall not be allowed. Dust control shall be provided by using non-potable water with the rockcutting wheel. Protection from flying rocks, debris, etc. shall be provided

E. The excavation and backfill shall be in accordance with the applicable requirements as set forth in Part 7 of the SFDPW Standard Specifications.

F. The pavement shall be restored in accordance with the applicable requirements as set forth in Part 2 of the SFDPW Standard Specifications and in these specifications.

G. All city noise requirements shall be observed at all times.

H. Water used for cutting machines shall be removed by vacuum pump or equivalent means immediately following the cutting machine. Cut residues shall not be removed and not allowed to form slurry. The slurry collected in the vacuum pump's tank shall not be discharged to City sewers.

3.07 BACKFILLING AND COMPACTION

A. Backfilling excavations as promptly as progress of work permits and in accordance with all relevant requirements of Section 703, 712 and all other applicable sections of the SFDPW Standard Specifications.

B. Compaction of fill and backfill materials shall be in accordance with the requirement of Section 707 and all other applicable sections of the SFDPW Standard Specifications.

C. Compact all materials by mechanical means in lifts not to exceed 8" unless permitted otherwise in writing by the Resident Engineer. Flooding or jetting will not be permitted. If compaction tests indicate that compaction or moisture content is not as specified, material placement shall be terminated and corrective action shall be taken by the Contractor prior to continued placement.

D. Compact all fill materials to the following relative dry densities per ASTM D1556, D1557, D2922 or other reference standard acceptable to the Resident Engineer:

1.	Asphaltic Concrete Pavement Subgrade Areas	95%
2.	Landscape Planting Areas	85%
3.	Structural Fill	95%
4.	Trench Backfill	95%

3.09 FIELD QUALITY CONTROL

A. Secure the Engineer's inspection and approval of subgrades and fill layers before proceeding with construction thereon.

B. Fill and backfill materials shall be compacted to densities specified in the applicable provisions of Sections 703, 706, 707 and 709 of the SFDPW Standard Specifications.

C. If, based on reports from a Testing Laboratory, Subgrade or fills which have been placed are below specified requirements, provide additional compacting and retest at no cost to the City.

3.10 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.

2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

END OF SECTION

SECTION 32 01 16.71

COLD MILLING ASPHALT PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes provisions for milling asphalt concrete pavement at the locations and to the dimensions shown on the Drawings, in accordance with the Project Manual and as directed by the City.

1.2 REFERENCE STANDARDS

A. DPW Standard Specifications (SSDPWSF), revised November, 2000.

B. San Francisco Police Code: Article 29 Regulation of Noise.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Cold planer machine: In accordance with the requirements of Section 214.02 of the DPW Standard Specifications.

PART 3 – EXECUTION

3.1 MILLING EXISTING ASPHALT CONCRETE SURFACES

A. General: In accordance with the requirements of Section 214.01 of the DPW Standard Specifications.

B. Conduct of the Work: In accordance with the requirements of Section 214.03 of the DPW Standard Specifications.

3.2 PROTECTION

A. A temporary 1:18 slope of hot asphalt concrete wedge will be constructed along any longitudinal and/or transverse drop off exceeding ¾ inches during the same day that the milling is accomplished.

B. Asphalt concrete for temporary asphalt concrete wedge will be as approved by the City.

3.3 SURFACE PREPARATION

A. The temporary asphalt concrete wedges will be removed by the Contractor before placing the asphalt concrete wearing surface.

B. Full compensation for installing and removing the temporary asphalt concrete wedges before the placing of asphalt concrete wearing surface will be considered as Incidental Work to cold milling.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes provisions for constructing new asphalt concrete wearing surface, Type A, 1/2–inch maximum with medium grading at the locations and to the dimensions shown on the Drawings, in accordance with the Project Manual and as directed by the City.

1.2 REFERENCE STANDARDS

A. DPW Standard Specifications (SSDPWSF), revised November, 2000.

B. Caltrans Standard Specifications (CTSS), revised July, 2013.

C. Caltrans Standard Special Provisions, dated 2010.

1.3 PERFORMANCE QUALITY CONTROL

A. Compaction: In accordance with the requirements of Section 212.09 of the DPW Standard Specifications.

B. Pavement Finish Irregularity Requirements

1. The Contractor shall spread and compact the asphalt concrete wearing surface such that when a City furnished 10–foot rolling straight edge is rolled over the finished pavement surface, it will disclose no more than the following irregularities per lane mile:

Irregularity Range Per Lane Mile	Maximum Allowable Irregularities Per Lane Mile
3/16 inch to less than 1/4 inch	200 irregularities
1/4 inch to less than 5/16 inch	100 irregularities
5/16 inch or greater	0 irregularities

2. In addition, the above criteria will be used as a basis for calculating the maximum allowable amount of irregularities for each lane for each block throughout the Work limits. The maximum allowable amount of irregularities per lane block will be calculated by multiplying the maximum allowable number of irregularities per lane mile by the length of the block in feet and dividing by 5,280 feet.

3. The Contractor shall give the City 24 hours advance notice for the rolling straight edge tests.

4. The Contractor shall transport the said City furnished straight edge from 2099 Kearny Street, San Francisco, or other place of storage, to the site and return said equipment to the place of storage when the need has ended.

5. City forces will perform the rolling straight edge operation at no cost to the

Contractor. As City forces perform the rolling straight edge operation, the City Representative will observe same and the Contractor shall provide the necessary or required labor, flagman and equipment to complete said operation.

6. The Contractor shall furnish the City Representative with all the necessary or required labor, flagman and equipment, other than the 10–foot rolling straight edge, to complete the inspection of the finished pavement.

C. The City will have the option of requiring correction of pavement irregularities in excess of the maximum allowable or a reduction of payment due to the Contractor, based on the official rolling straight edge report. The reduction of payment will be as follows:

Irregularity Range	Payment Reduction Per Each Excess Irregularity
3/16 inch to less than 1/4 inch	$ 20.00
1/4 inch to less than 5/16 inch	$ 100.00
5/16 inch or greater	$ 200.00

1.4 SUBMITTALS

A. Prior to starting construction, the Contractor shall submit the asphalt concrete mix design, including the amount of asphalt binder to be mixed with the dry aggregate to the City Representative for approval. No resurfacing work will be allowed prior to the approval of the mix design. Asphalt concrete mix design will conform to Section 39 of the Caltrans Standard Specifications and as modified below under Article “Materials”.

B. The Contractor shall submit (8) copies of the manufacturer’s literature, Specifications, applications and installations for filler and/or sealer material to the City Representative for approval at least five (5) calendar days in advance of performing the filling and/or sealing work.

PART 2 – PRODUCTS

2.1 MATERIALS

A. The Contractor is encouraged to use Reclaimed Asphalt Pavement (RAP) in accordance with the Caltrans Standard Specifications and Standard Special Provision (SSP) 39-010. Specifically, refer to CTSS Section 39-1.02F outlining current maximum RAP substitution rate. Minimum RAP substitution rate shall be 15% of the aggregate blend.

B. Asphalt: In accordance with the requirements of Section 39–1.02C of the Caltrans Standard Specifications, except that asphalt will be either PG 64–10 or AR–4000.

C. Aggregate: In accordance with the requirements of Section 39–1.02E of the Caltrans Standard Specifications, except that aggregate grading will be as follows:

Sieve Sizes	Limits of Proposed	Operating Range	Contract Compliance
3/4"	–	100	100
1/2"	–	95–100	89–100
3/8"		80–95	75–100
No. 4	59–66	$X^{\pm}5$	$X^{\pm}8$

No. 8	43–49	X±5	X±8
No. 30	22–27	X±5	X±8
No. 200	–	3–8	0–11

Minimum Durability Index: When tested in accordance with Caltrans Test Method 229, will be 50.

D. Paint Binder: In accordance with the requirements of Section 212.06 of the DPW Standard Specifications, except that paint binder shall be emulsified asphalt Type SS-1 or SS-1h.

E. Sealer: It will be a combination of polymeric compounds, cures to a soft, highly flexible, rubber like material that is capable of maintaining a sealed joint or crack over a wide temperature range. Sealer will be cold applied SOF–SEAL, low modulus horizontal sealant, manufactured by:

W.R. Meadows, Inc.
865 Teal Drive
Benicia, CA 94510
Phone (707) 745-6666

or equal (no known equal).

2.2 EQUIPMENT

A. Spreading Equipment: In accordance with the requirements Section 212.07 of the DPW Standard Specifications.

B. Compacting Equipment: In accordance with the requirements of Section 212.09 of the DPW Standard Specifications.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. Immediately before resurfacing, the Contractor shall, as Incidental Work, clean, repair cracks and apply paint binder in areas to be paved.

B. Cracks larger than one inch will be filled or sealed with hot asphalt concrete as directed by the City.

C. All cracks equal to or smaller than one inch and not smaller than 1/4 inches will be filled or sealed with approved sealer.

D. Placement of asphalt concrete wearing surface is to be completed within 120 hours after asphalt planing or placement of concrete base.

E. The Contractor shall not proceed with paving work until given written approval from the City.

F. The temporary asphalt concrete fill or wedges on the concrete base repair areas will be removed by the Contractor before placing asphalt concrete wearing surface.

3.2 INSTALLATION

A. Paint Binder: In accordance with the requirements of Section 212.06 of the DPW Standard Specifications.

B. Conform Areas: In accordance with the requirements of Section 212.10 of the DPW Standard Specifications.

C. Spreading: In accordance with the requirements of Section 212.08 of the DPW Standard Specifications.

D. Compaction: In accordance with the requirements of Section 212.09 of the DPW Standard Specifications.

3.3 SURFACE CONDITIONS

A. The Contractor shall examine the areas and conditions under which Work of this Section will be performed. Conditions detrimental to the timely and proper completion of the Work will be corrected. The Contractor shall not proceed until unsatisfactory conditions have been corrected.

B. The Contractor shall notify the County Surveyor at (415) 554-5833 to report any monuments in danger of disturbance, destruction or removal. All City monuments are to be protected per State Land Surveyors Act and Section 01540 – Protection of Property. The Contractor shall not disturb, destroy or remove any survey monuments without the approval from the County Surveyor. The Contractor shall salvage any monuments removed during construction and deliver these monuments to the Survey Department at 1155 Market Street, 3rd Floor, San Francisco.

3.4 FIELD QUALITY CONTROL

A. The Contractor may be required to perform water tests to satisfactorily demonstrate the proper drainage of the constructed asphalt pavement. The Contractor shall flush with water approximately 50 feet of the upstream end of each gutter for 2 minutes with minimum flow rate of 0.02 cubic feet per second or approximately 20 gallons equivalence. After 5 minutes, the City Representative and the Contractor shall make visual inspection of the gutter to demonstrate proper drainage and no ponding. All water tests will be considered Incidental Work.

B. The Contractor shall make corrections necessary to demonstrate proper drainage with no ponding, and no separate payment will be made. The Contractor's correction method will be approved by the City. The City's approval does not release the Contractor from the successful execution of the remedy and the requirement to demonstrate proper drainage of the constructed gutter.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes provisions for constructing concrete base, concrete pavement, concrete parking strip, reinforced concrete bus pad, concrete gutter, concrete curb, concrete sidewalk and concrete curb ramps at the locations and to the dimensions shown on the Drawings, in accordance with the Project Manual and as directed by the City Representative.

B. Preparation of subgrade to proper elevation, including excavating, backfilling, removal of existing pavement, existing gutter, existing curb, existing sidewalk, existing curb ramp, and compaction as required will be done as Incidental Work to the above mentioned new concrete work.

C. Tree roots under pavement and sidewalk areas will be removed with a sharp edge instrument to a depth of 8 inches below finished grade as Incidental Work. Feeder roots greater than 2 inches in diameter will be checked by the Bureau of Urban Forestry. Call the 311 Customer Service, prior to removal by the Contractor.

1.2 REFERENCE

A. DPW Standard Specifications (SSDPWSF), revised November, 2000.
B. DPW Standard Plans, dated April, 2007.
C. ACI 318 Building Code Requirements for Structural Concrete.

1.3 SPECIAL INSTRUCTIONS

A. Notifications

1. Underground Service Alert
   a. Before commencing any excavation, the Contractor shall obtain an Underground Service Alert (USA) inquiry identification number by calling (800) 642-2444.
   b. The Contractor shall allow four (4) calendar days after the identification number is obtained and before excavation work is started so that utility owners can be notified by the Contractor.
   c. Identification numbers will not be given more than ten (10) calendar days prior to starting excavation work.

B. Curb Ramps

1. Curb ramps will be constructed in accordance with the details shown in the DPW Standard Plans.
2. The Contractor shall investigate subsidewalk basement in sidewalk areas prior to saw cutting and excavation for curb ramps. If there is a subsidewalk basement and there is sufficient cover to construct the curb ramp, saw cutting and excavation will proceed with care. If there is not sufficient cover to construct the curb ramp, the Contractor shall notify the City Representative and stop the construction of the curb ramp.
3. The Contractor shall notify the County Surveyor at (415) 554-5833 to report any monuments in danger of disturbance, destruction or removal. All City monuments are to be protected per State Land Surveyors Act and Section 01 71 33 – Protection of Adjacent Construction. The Contractor shall not disturb, destroy or remove any survey monuments without the approval from the County Surveyor. The Contractor shall salvage any monuments removed during construction and deliver these monuments to the Survey Department at 1155 Market Street, 3rd Floor, San Francisco.

4. The Contractor shall complete the construction of curb ramps, sidewalk, curb and gutter within 72 hours from the commencement of excavation work, so as not to obstruct pedestrian traffic or travel thereon more than is reasonably necessary.

C. Broken Water Meter Boxes
   1. Broken San Francisco Water Department (SFWD) meter boxes will be replaced before placing new sidewalk. Call SFWD at (415) 550-4945 to pick up the meter boxes free of charge.

D. Temporary Wearing Surface for Restored Concrete Base
   1. After achieving the concrete base depth as shown on the plans or stated in the specifications, the Contractor may use temporary asphalt on the restored concrete base. The temporary asphalt concrete on the restored concrete base shall be removed by the Contractor before placing the final asphalt concrete wearing surface.
   2. The final asphalt concrete wearing surface and restored base depths shall be as shown on the cross sections in the plans.
   3. Installing temporary asphalt concrete surface on the concrete base areas will be considered as Incidental Work to the Concrete Base bid item. Refer to 01 55 26 Special Instructions for temporary ramp requirements.

E. California Code and Regulations
   1. The Contractor shall comply with all Cal–OSHA Code requirements during this Contract – Article 37, Section 2946 “Provisions for Preventing Accidents Due to Proximity to Overhead Lines” and Article 37, Section 2947 “Warning Signs Required”.

F. MUNI Railway
   1. If MUNI overhead wires are encountered, the overhead wires will be kept energized at all times. The overhead trolley wires carry a minimum of 600 Volts DC and have an 18 +/- feet clearance from the existing roadway. The Contractor shall adapt its methods and equipment to this condition, and take precautions against accidents and damage to the overhead wires and feeder cables when performing paving work and/or concrete work with overhead wires and feeders energized.

G. Local Access
   1. The Contractor shall provide local access to garages by the end of each work shift by placing steel plate(s) over excavated area(s). It is the responsibility of the Contractor to notify residents of the Construction Schedule prior to any Work that may disrupt access to garages or other entrances and provide access during construction where as needed or requested by the City.

H. Spray Paint
   1. Prior to the start of construction, the Contractor shall provide the City Representative with sufficient spray paint, at no cost to the City, for markings necessary for this Contract.

I. Limit Construction Activities
   1. Excavation site may not exceed two (2) consecutive blocks at any time.

J. Survey Control
   1. Where roadway pavement reconstruction occurs, the Contractor is responsible for providing primary control, with control line and grades, from existing off site monument markers and lines. The Contractor shall maintain and preserve all lines, grades and benchmarks and provide for all other survey control work. The Contractor shall establish construction control line with hubs every 25 feet prior to construction work.
   2. The Contractor shall replace or reestablish hubs missing or displaced during construction at no cost to the City.
   3. The Contractor shall retain the services of a State of California registered Land Surveyor

with a minimum of one year experience in engineering surveying and control procedure for public works construction, who will establish horizontal and vertical controls as needed by the Contractor.

4. The survey control work will be considered Incidental Work and no separate payment will be made.

K. Granite Curb

1. In the event granite curb is to be replaced with concrete curb, the Contractor shall remove them from the site as City property. All delivery must be initiated and authorized by City Representative. Only granite curb greater than 4 feet in length will be accepted. The granite curb will be neatly and securely placed on pallets so they can be moved about safely after delivery. The granite curb will be delivered, including off loading, to the Treasure Island Maintenance Yard at 701 14th Street at Avenue I, Treasure Island, or where directed by the City Representative within the City.

    a. Contact Mike Kelly of the Bureau of Street and Sewer Repair at Mike.Kelly@sfdpw.org

    b. Provide a minimum of 48 hour notice for delivery / cancellation via written notification with the following information:
    Project Name
    Project Number
    City Representative Name
    Contractor Contact Number
    Estimated Delivery Quantity

2. The Contractor shall clean the granite curb of dirt, debris, and other construction material and exercise care in transporting the granite curb so as to minimize damage.

3. Salvage, hauling and delivery of existing granite curb to the designated areas from the site will be done as Incidental Work.
    a. Delivery is to be made between 8am to 3pm, Monday through Friday.
    b. During delivery, driver is to check in with the Yard Master for designated deliver location.
    c. Yard Master may reject mix and/or unclean load.
    d. Additional charges will be incurred for:
        1) Cleaning and Sorting, if Yard must double-handle load to sort, clean and stack delivery
        2) Yard Opening and Operation during non-operation hours and unscheduled deliveries

L. Cobblestones

1. In the event cobblestones are encountered in any street under construction, the Contractor shall remove them from the site as City property. All delivery must be initiated and authorized by City Representative. Only granite curb greater than 4 feet in length will be accepted. The granite curb will be neatly and securely placed on pallets so they can be moved about safely after delivery. The granite curb will be delivered, including off loading, to the Treasure Island Maintenance Yard at 701 14th Street at Avenue I, Treasure Island, or where directed by the City Representative within the City.

    a. Contact Mike Kelly of the Bureau of Street and Sewer Repair at Mike.Kelly@sfdpw.org

    b. Provide a minimum of 48 hour notice for delivery / cancellation via written notification with the following information:
    Project Name

Project Number
City Representative Name
Contractor Contact Number
Estimated Delivery Quantity

2. The Contractor shall clean the cobblestones of dirt, debris, and other construction material and exercise care in transporting the cobblestones so as to minimize damage.

3. Salvage, hauling and delivery of existing cobblestones to the designated areas from the site will be done as Incidental Work.
   a. Delivery is to be made between 8am to 3pm, Monday through Friday.
   b. During delivery, driver is to check in with the Yard Master for designated deliver location.
   c. Yard Master may reject mix and/or unclean load.
   d. Additional charges will be incurred for:
      1) Cleaning and Sorting, if Yard must double-handle load to sort, clean and stack delivery
      2) Yard Opening and Operation during non-operation hours and unscheduled deliveries

1.4 SUBMITTALS

A. The Contractor shall submit concrete mix design(s) for all intended applications in accordance with project specifications, DPW Standard Specifications Section 800.01, and ACI 318.

B. The Contractor shall submit manufacturer's literature, specifications, applications and installations for color pigment to be used in curb ramps for the Engineer's approval: L.M Scofield "C–24 Charcoal Gray", QC Integral Colors "IC–3 Ash Gray", Solomon Colors "Charcoal Gray 920", or approved equal.

C. Shop Drawings (Reinforced Bus Pads Only)
   1. Contractor shall submit the reinforcing steel shop drawings to City Representative for review and approval, prepared in accordance with ACI SP-66, showing list of materials, sizes, dimensions, cutting, placement details, and splicing, and lapping.
   2. Reinforcing steel shall not be fabricated or placed before the shop drawings are reviewed and approved by the City Representative, and returned to the Contractor. Such review does not relieve the Contractor from the full responsibility for both the accuracy of the shop drawings, and the accurate and complete placing of the work.
   3. Shop drawings shall not be reproductions of the Contract Documents, nor shall they use or incorporate reproductions of parts of the Contract Documents.

D. Mill Test Reports
   1. Certified mill test reports (tensile and bending), for each heat or melt of steel, showing physical and chemical analyses, shall be submitted to the City Representative for review and approval before the material delivery to the job site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Concrete Batching: A concrete batching ticket specifying mix design information shall accompany all concrete deliveries subject to verification by City Representative.

B. Reinforcement shall be shipped and stored with reinforcement of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings

showing the same designations as shown on the submitted placing drawings.

C. Reinforcement shall be stored off the ground and be protected from moisture. Keep free from soil, oil, or other injurious contaminants. All steel, which cannot be properly identified, will be rejected, and shall be immediately removed from the job site.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Portland Cement: In accordance with the requirements of Section 800.02 of the DPW Standard Specifications. The Contractor may substitute supplementary cementitious materials such as fly ash or natural pozzolan; silica fume; or ground granulated blast furnace slag (GGBFS) such that the total amount of portland cement shall not be less than 40% by weight of the total amount of cementitious material. The minimum amount of portland cement shall not be less than 225 pounds per cubic yard. Supplementary cementitious materials can be used in all concrete products with the exception of concrete base.

1. If fly ash or natural pozzolan is used, the total amount of fly ash or natural pozzolan shall not exceed 30% by weight of the total amount of cementitious material.
   a. Fly ash shall conform to AASHTO M 295, Class F. The available alkali, as sodium oxide equivalent, shall not exceed 1.5% when determined in conformance with ASTM C311 or the total alkali, as sodium oxide equivalent, shall not exceed 5% when determined in conformance with AASHTO T105.

2. If silica fume is used, the total amount of silica fume shall not exceed 10% by weight of the total amount of cementitious material.
   a. Silica fume shall conform to AASHTO M307 with reduction in mortar expansion of 80% minimum using the cement from the proposed mix design.

3. If ground granulated blast furnace slag is used, the total amount of GGBFS shall not exceed 50% by weight of the total amount of cementations material.
   a. GGBFS shall conform to AASHTO M302, grade 100 or grade 120.

B. Aggregate: In accordance with the requirements of Sections 800.03, 800.04, 800.05 and 800.06 of the DPW Standard Specifications. The Contractor shall substitute recycled concrete for a portion of the virgin aggregate in an amount no less than fifteen percent (15%) of the total dry aggregate mass. The recycled concrete material will meet or exceed the specified requirements. When recycled material is used for concrete base, exposed concrete applications such as gutter, curb, sidewalk and curb ramp, the Sodium Sulfate Soundness Test (ASTM C88) is waived. Recycled concrete material will not be allowed in structural concrete or decorative concrete with an exposed aggregate finish.

C. Concrete Curb Ramps: Color pigment will be extra high strength, non–floating, dispersible, non–glare, permanent and unaffected by sunlight. It will be composed of extremely fine sub–micron particle size and will not create the loss of concrete strength.

D. Cast-In-Place Detectable Surface Tiles: In accordance with the requirements of Section 32 17 33 – Cast-In-Place Detectable Surface Tiles.

E. Reinforcing Bars: Reinforcing bars shall be deformed.
   1. Reinforcing bars shall conform to ASTM A615, Grade 60, unless otherwise indicated.

F. Accessories
   1. Tie wire: Minimum 16 gage black annealed wire.

2. Supports and spacers: Provide spacers, chairs, bolsters, and other devices to support and secure the reinforcement in place. Supports for reinforcing bars on ground, aggregate base or sand over vapor barrier shall be precast concrete blocks of sufficient strength, size and spacing to support the bars in proper locations.

2.2 MIXES

A. Concrete Mix Design Requirements (Concrete Base and Reinforced Concrete Bus Pad): Proportioning for concrete mix designs shall be in accordance with ACI 318 Section 5.3- Proportioning on the basis of field experience or trial mixtures, or both. The target concrete slump shall be 4 inches and the maximum allowed water-cementitious materials ratio shall be 0.5.

1. **Concrete Base:** Concrete base shall have a minimum compressive strength of 5,000 psi at 28 days and contain calcium chloride with a dosage between 1.7 and 2.1 percent by weight of cement to accelerate the setting of the concrete in accordance with the requirements of Section 800 of the DPW Standard Specifications.

2. **Reinforced Concrete Bus Pad:** Concrete for reinforced concrete bus pad shall have a minimum strength of 5,000 psi at 28 days and be in accordance with the requirements of Section 210.04 of the DPW Standard Specifications. Also, following admixture requirements shall be met:
   a. Admixtures shall be compatible and contain no chlorides, sulfides, or nitrides.
   b. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
   c. Admixtures for use in producing flowing concrete shall conform to ASTM C 1017.

B. **Concrete Pavement, Concrete Parking Strip:** In accordance with the requirements of Sections 210.04, 800.08 and 800.11 of the DPW Standard Specifications.

C. **Concrete Curb:** In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.

D. **Combined Concrete Curb and Gutter:** In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.

E. **Concrete Sidewalk:** In accordance with the requirements of Sections 204.01 and 800.11 of the DPW Standard Specifications. Also, following admixture requirements shall be met:

1. Admixtures shall be compatible and contain no chlorides, sulfides, or nitrides.
2. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
3. Admixtures for use in producing flowing concrete shall conform to ASTM C 1017.

F. **Curb Ramps**
1. Curb Portion of Work: In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.
2. Sidewalk Portion of Work: In accordance with the requirements of Sections 204.01 and 800.11 of the DPW Standard Specifications.
3. Curb Ramp Color: To obtain the approved permanent dark visual color contrast of 70 percent between the ramp and the adjacent sidewalk, use one of the following approved manufacturers and color types, or approved equal:
   a. L.M. Scofield “C–24 Charcoal Gray”.
   b. QC Integral Colors “IC–3 Ash Gray”.
   c. Solomon Colors “Charcoal Gray 920”.

PART 3 – EXECUTION

3.1 PREPARATION

A. Preparation and Compaction of Subgrade: In accordance with the requirements of Section 200 of the DPW Standard Specifications.
   1. Concrete Base: In accordance with the requirements of Section 207 of the DPW Standard Specifications.
   2. Concrete Pavement, Concrete Parking Strip and Concrete Bus Pad: In accordance with the requirements of Section 210 of the DPW Standard Specifications.
   3. Concrete Curb: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
   4. Combined Concrete Curb and Gutter: In accordance with the requirements of Section 203 of the DPW Standard Specifications.
   5. Concrete Sidewalk: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
   6. Concrete Curb Ramps
      a. Curb Portion of Work: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
      b. Sidewalk Portion of Work: In accordance with the requirements of Section 204 of the DPW Standard Specifications.

B. Preparation of subgrade to proper grade, excavating, backfilling and compacting will be considered as Incidental Work to the applicable bid items where excavation is required to perform the Work.

C. Asphalt shaving or grindings will not be used as fill material.

D. Saw cutting and removal of concrete base, concrete pavement, concrete parking strip, concrete gutter, concrete curb, concrete sidewalk and concrete curb ramps to construct and/or reconstruct curb ramps, and to remove existing curb ramps will be considered as Incidental Work to the applicable bid items where removal of the said items are required to perform the Work.

3.2 INSTALLATION

A. Concrete Installation (All Applications): The Contractor shall install concrete in accordance with proportioning, mixing, transporting, and placing requirements identified in DPW Standard Specification Sections 800.13 and 800.14.

B. Concrete Base
   1. Concrete Base: In accordance with the requirements of Section 207 of the DPW Standard Specifications.
   2. Placing Concrete: In accordance with the requirements of Section 207.05 of the DPW Standard Specifications.
   3. Construction Joints: In accordance with the requirements of Section 207.06 of the DPW Standard Specifications.
   4. Dummy Joints: In accordance with the requirements of Section 207.07 of the DPW Standard Specifications.
   5. Protection and Curing: In accordance with the requirements of Section 207.08 of the

DPW Standard Specifications.

C. Concrete Pavement and Concrete Parking Strip
   1. Concrete Pavement and Concrete Parking Strip: In accordance with the requirements of Section 210 of the DPW Standard Specifications, except that the thickness for concrete pavement and concrete parking strip will be 8 inches unless otherwise noted.
   2. Placing Concrete: In accordance with the requirements of Section 210.05 of the DPW Standard Specifications.
   3. Construction Joints: In accordance with the requirements of Section 210.07 of the DPW Standard Specifications.
   4. Dummy Joints: In accordance with the requirements of Section 210.08 of the DPW Standard Specifications.
   5. Protection and Curing: In accordance with the requirements of Section 210.09 of the DPW Standard Specifications.

D. Reinforced Concrete Bus Pad
   1. Placing Concrete: In accordance with the requirements of Section 210.05 of the DPW Standard Specifications.
   2. Construction Joints: In accordance with the requirements of Section 210.07 of the DPW Standard Specifications.
   3. Dummy Joints: In accordance with the requirements of Section 210.08 of the DPW Standard Specifications.
   4. Protection and Curing: In accordance with the requirements of Section 210.09 of the DPW Standard Specifications.
   5. Reinforced Steel Bars: In accordance with the requirements of Standard Plan 96,607.
      a. Before placing concrete, reinforcement shall be cleaned of oil, grease, soil, loose mill scale, loose rust, and any other coating of a character that would destroy or reduce the bond.
      b. Reinforcing bars shall be secured firmly in position. Use No. 16-gauge black annealed wire at each steel intersection. Use precast mortar blocks, metal chairs, spacers, metal hangers, supporting wires, and other approved devices to set steel in position with sufficient strength to resist crushing under full load and to prevent displacement during concrete placing operations.
      c. Precast Concrete Blocks: Precast concrete blocks shall not be less than 3 inches square with embedded wires and shall have at least the same 28-day compressive strength as the surrounding concrete. Space concrete blocks no less that 1’-6” and no more than 3 feet apart.
      d. Minimum concrete cover for reinforcement and minimum clear bar spacing shall be as specified on Contract Drawings, but in no case shall be less than values specified in ACI 318.
      e. Placing bars on layers of fresh concrete as the work progresses, or adjusting bars during the concrete placement, will not be permitted.
      f. Splicing: In accordance with the “Building Code Requirements for Reinforced Concrete,” (ACI 318) of the American Concrete Institute.
      g. Reinforcement Around Opening: Whenever conduit, piping, sleeves, bolts hangers, boxes or other embedded items interfere with the proper placement of reinforcing steel as detailed, the Contractor shall submit to the City Representative the proposed reinforcement adjustment for review. Reinforcing bars shall not be bent around openings or sleeves, except with the City Representative’s prior approval.
      h. Inspection: No concrete shall be deposited until the Engineer has inspected the reinforcement and given permission to place concrete.

E. Concrete Curb
   1. Concrete Curb: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
   2. Placing Concrete: In accordance with the requirements of Section 202.07 of the DPW

Standard Specifications.

3. Construction Joints: In accordance with the requirements of Section 202.08 of the DPW Standard Specifications.
4. Finishing: In accordance with the requirements of Section 202.09 of the DPW Standard Specifications.
5. Protection and Curing: In accordance with the requirements of Section 202.10 of the DPW Standard Specifications.
6. Repair and Replacement: In accordance with the requirements of Section 202.12 of the DPW Standard Specifications.
7. Painting: In accordance with the requirements of Section 202.13 of the DPW Standard Specifications.

F. Combined Concrete Curb and Gutter
   1. Concrete Curb and Gutter: In accordance with the requirements of Section 203 of the DPW Standard Specifications.
   2. Placing Concrete: In accordance with the requirements of Section 202.07 of the DPW Standard Specifications.
   3. Construction Joints: In accordance with the requirements of Sections 210.07 and 210.08 of the DPW Standard Specifications.
   4. Finishing: In accordance with the requirements of Section 202.09 of the DPW Standard Specifications.
   5. Protection and Curing: In accordance with the requirements of Section 202.10 of the DPW Standard Specifications.
   6. Repair and Replacement: In accordance with the requirements of Section 202.12 of the DPW Standard Specifications.
   7. Painting: In accordance with the requirements of Section 202.13 of the DPW Standard Specifications.

G. Concrete Sidewalk
   1. Concrete Sidewalk: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
   2. Placing Concrete: In accordance with the requirements of Section 204.05 of the DPW Standard Specifications.
   3. Joints: In accordance with the requirements of Section 204.07 of the DPW Standard Specifications and Standard Plan 87,173.
   4. Reinforced Steel Bars: In accordance with the requirements of Standard Plan 96,608.
   5. Finishing: In accordance with the requirements of Section 204.06 of the DPW Standard Specifications.
   6. Protection and Curing: In accordance with the requirements of Section 204.09 of the DPW Standard Specifications.
   7. Sidewalk will not be constructed monolithic with curb.
   8. Street Names: In accordance with the requirements of Section 204.08 of the DPW Standard Specifications.
   9. Installation of Reinforced Steel Bars at re-entrant corners on a diagonal: In accordance with the requirements of Standard Plan 96,608.

H. Concrete Curb Ramps
   1. Curb Portion of Work: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
   2. Sidewalk Portion of Work: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
   3. All curb ramps will be poured separately from any adjacent construction such as, gutter, curb or sidewalk.
   4. Curb ramps will be constructed in accordance with the requirements of the DPW Standard Plans.

3.3 FIELD QUALITY CONTROL

C. The Contractor shall perform water tests to satisfactorily demonstrate the proper drainage of the constructed curb and gutter, including curb and gutter at constructed curb ramps. The Contractor shall flush with water approximately 50 feet of the upstream end of each curb and gutter, including curb and gutter at curb ramps, for 2 minutes with a minimum flow rate of 0.02 cubic feet per second or approximately 20 gallons equivalence. After 5 minutes, the City Representative and the Contractor shall make visual inspection of the gutter to demonstrate proper drainage and no ponding. All water tests will be considered Incidental Work.

D. The Contractor shall make corrections necessary to demonstrate proper drainage with no ponding, and no separate payment will be made. The Contractor's correction method will be approved by the City. The City's approval does not release the Contractor from the successful execution of the remedy and the requirement to demonstrate proper drainage of the constructed curb and gutter work, including curb and gutter at constructed curb ramps.

END OF SECTION

SECTION 34 41 13

TRAFFIC SIGNALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The section covers most work related to traffic signals including signal heads, field wiring, conduits, signal controller, cabinet assemblies, battery back-up systems, and red-light running cameras. Installation and testing specifications are included in Part 3: Execution for some of the equipment.

1.

B. The Contractor shall perform all traffic signal and related work shown on the Drawings in accordance with the workmanship requirements of SSDPWSF Part 6 and related sections and 2010 CTSS Section 86.

1.2 OTHER SECTIONS WITH RELATED WORK

A. Section 01 55 26 – Traffic Control

B. Section 31 23 33 – Trenching and Backfilling

C. Section 34 41 14 – Communications Network and ITS Equipment

D. Section 26 04 00 – Electrical General Provisions

E. Section 26 05 00 – Electrical Materials and Methods

F. Section 26 56 19 – Roadway Lighting

1.3 EFFECT OF CHANGE ORDERS

In the event that a time extension is granted or agreed upon due to a change order to this contract, the Contractor shall be required to complete, switchover, and/or turn on all traffic signals that are not directly affected by the change order within the original Contract Time specified in Section 00 73 02 Contract Time and Liquidated Damages of this Project Manual. In such a case, the original Contract Time would create a milestone date for completion of signal work not directly affected by the change order.

1.4 PROCUREMENT OF TRAFFIC SIGNAL EQUIPMENT, NO TIME EXTENSIONS

No extension of contract time will be granted to the Contractor due to late delivery of traffic signal equipment. For this purpose, traffic signal equipment shall include all poles (Muni, traffic signal, street light, etc.) and all materials listed in Part 2 Products of this Section and Section 34 41 14. This specific provision for traffic signal equipment supersedes the definition for Unavoidable Delay in the General Conditions, subparagraph 7.02A.1 of this Project Manual. Inability of Contractor to procure these materials will not be considered an Unavoidable Delay, and no time extension will be granted therefore.

1.5 SUBMITTALS

A. General

1. Furnish submittals for work included in this Section per the requirements of Section 01 33 00 Submittals except as modified or added to in this Section. See

Section 01 33 00 for definitions of “shop drawings”, “product data”, and “samples”.

2. Submittals are only necessary for products which are being procured through this contract.

B. Product Data and Shop Drawings

Submit seven copies of product data or shop drawings for all products in this Section including but not limited to the following items within the time allowance provided in Appendix B, Table 1. Submit all copies to the BCM Engineer, 30 Van Ness Avenue, 5th Floor, San Francisco, CA 94103.

1. Traffic signal controller, cabinets, and network equipment. Cabinet and wiring diagrams shall be provided on paper and on a computer disc in AutoCAD format. The cabinet diagram shall include all details and dimensions of the cabinet enclosure, door, shelves, and internal features.
2. Conduit (GRS, PVC, and HDPE), pull boxes, conductors, vehicle signal heads, pedestrian signal heads, signal mounting assemblies (framework and mounting hardware), poles, mast arms, push buttons, loop sealants, conduit, pull tape, pull boxes, conduit/duct plugs and caps, LED signal modules, and paint.
3. Concrete mix design for foundation concrete.

C. Samples

All samples shall be submitted within the time allowance provided in Appendix B, Table 1.

1. Submit to the BCM Engineer 3 samples of each of the following items (each size and/or type): All conductors (loop wire, UF wire, THW wire, other), pedestrian push button tape (yellow), electrical conduit, and paint (dry). Submittals shall include a cover sheet and copy of appropriate specifications section. Deliver to BCM Engineer at 1680 Mission Street, 4th Floor, San Francisco, CA 94103.
2. Submit one sample for each of the following signal assemblies (heads, framework, and all mounting hardware) within the time allowance provided in Appendix B, Table 1:
    a. 3S12” signal assembly with LED units; and
    b. Pedestrian head assembly.
        i. The 3S12” head shall include red, yellow and green LED units; an SV-1-T mounting and u-bolts as required to mount on a street light pole. The 3S12” head shall include mast arm mounting hardware. LED arrow unit samples shall also be submitted if they are part of the Contract work. The pedestrian head shall include a SP-1 mounting and u-bolts as required to mount on a 10-foot 1-A pole. The sample framework shall be submitted with the required zinc primer paint applied to cut pipe threads, but no other paint applied.
        ii. If a contract does not include a 12-inch and/or pedestrian signal head, then the contractor is not required to submit the relative sample. If the sample signal head configurations and mounting types specified above are not appropriate for a particular contract, they may be changed with the approval of the Traffic Engineer.
        iii. No signal assemblies shall be installed until the samples are accepted by the Traffic Engineer. The City shall inspect samples within the time allowance provided in Appendix B, Table 1. Signal assembly samples shall become the property of SFMTA and shall be paid as a bid item.
3. The signal assembly samples shall be submitted to the SFMTA Traffic Signal Shop at 2650 Bayshore Boulevard, Daly City, CA 94014 with one copy of the accepted product data or shop drawings for each. The samples shall be tagged to identify the project name and contractor. To coordinate delivery, the

Contractor shall contact one of the SFMTA Traffic Signal Shop supervisors at (415) 550-2736 at least two (2) working days before the proposed delivery date.

4. Accompanying all sample submittals, the Contractor shall submit a transmittal letter with invoice for a Signal Shop Supervisor to review and sign. The Signal Shop Supervisor(s) shall not be expected to create invoices for the submittals. The Contractor shall forward a copy of the signed invoice to the BCM Engineer at 1680 Mission Street, 4th Floor, San Francisco, CA, 94103 at fax number (415) 554-8218.
5. Deliveries will only be accepted between 8:00 A.M. and 2:00 P.M. on weekdays. The Contractor shall be responsible for unloading and placement of the samples as directed by the SFMTA Traffic Signal Shop supervisor.

D. Purchase Orders
Submit two (2) copies of Contractor's purchase orders for signal heads, mounting assemblies, poles, mast arms, and pedestrian push buttons to the BCM Engineer within the time allowance provided in Appendix B, Table 1. Purchase orders shall indicate Suppliers/Manufacturers confirmed delivery dates of each item listed above on respective supplier letterhead.

E. Special Notes
Equipment installed before the required submittals are accepted by the City is subject to rejection.

F. Sign Inventory Form
The Contractor shall submit a Sign Inventory Form to be used as the official sign inventory record. The form is to be submitted by the Contractor as part of the Traffic Control Plan prior to the start of any contract field work. The Sign Inventory Form is included in this Project Manual as Appendix A to this Section. Sign Inventory Forms are required for each intersection corner that included any pole or traffic signal work. Sign Inventory Forms shall accurately reflect all existing traffic control, street name, and other City signs at the required corners including approximately 25' along each sidewalk approaching the corner. See Article 3.5 of this section for additional details.

1.6 CONTRACTOR'S MINIMUM EXPERIENCE AND QUALIFICATIONS

A. The Contractor or its listed subcontractor or its key team members performing the traffic signal work for this contract shall have a current and active class A General Engineering Contractor or C-10 Electrical Specialty license, and have satisfactorily completed projects with Traffic Signal work that are similar in size and complexity to that of the Contract with the following minimum requirements:
   1. Three projects in the last 5 years with each project having Traffic Signal work worth $250,000 or more; or,
   2. Two projects in the last 5 years with each project having Traffic Signal work worth $500,000 or more.
   3. The Contractor and its subcontractors are advised that the City considers the proper classification for employees who perform all electrical work associated with the installation of underground fed traffic signals to be that of Electrician: Inside Wireman.

B. Refer to Section 00 45 13 Request for Qualifications for more information.

PART 2 – PRODUCTS

2.1 NOT USED

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 NOT USED

2.6 NOT USED

2.7 SIGNAL MOUNTING ASSEMBLIES

A. Signal mounting shall be constructed as per applicable details shown on SFMTA's STR-7025 and the 2010 CTSP ES- 4A, ES-4B, ES-4C, ES-4D and ES-4E dated May 20, 2011, as applicable; except as superseded by other contract plans or as needed to accommodate special mounting configurations. All signal frames shall consist of 1- 1/2-inch standard steel pipe and fittings, shall be hot-dip galvanized before assembly, with the exception of bronze terminal compartment, bronze slip fitter, bronze plumbizers, and bronze pole clamps (ears and hubs), and shall be watertight and free of sharp edges or protrusions which might damage conductor insulation. Before assembly, any cut pipe threads shall be coated with zinc primer paint as specified in Section 86-2.05C, "Installation," of the 2010 CTSS.

B. For poles that are between 11- ½-inch and 15- ½-inch in diameter, larger ears, hubs, and U-bolts must be used; called Long Hub with reinforced ears. The Long Hub with reinforced ears assembly shall vary depending upon the diameter of the pole but they all shall be powder coated, galvanized, and fabricated with ductile iron. The Long Hub shall be 196.85mm long, 44.45mm wide, have a 16.51mm open slot to fit the reinforced ears, and have a 1-1/2" NPT threaded hole in the middle in order to fit the signal mounting framework. The Long Hub shall be flat on one side and curved on the other in order to fit around large diameter poles. The radius of curvature shall be 305.75mm. For poles that are between 11- ½-inch and 12-1/2-inch in diameter, a short reinforced ear shall be used. For poles that are between 12- ½-inch and 15-1/2-inch in diameter, a long reinforced ear shall be used.

C. Each U-bolt type pole clamp shall consist of a cast bronze pole plate drilled and tapped for 1-1/2-inch pipe thread, a hot-dip galvanized 1/2-inch U-bolt to fit the perimeter of the pole and oversized galvanized nuts and SAE washers. Portions of the pole plate shall be hinged for adapting the plate to various pole contours and shall be equipped with bolt openings through which the ends of the U-bolt shall be installed. U-bolt threads shall extend beyond the face of the nut at least ¼ inch and no more than 1-1/2 inches.

D. A galvanized steel washer (2-11/16-inch O.D., 1- 15/16-inch I.D., 18 GA.) and a neoprene washer (2-11/16-inch O.D., 1-15/16-inch I.D., 1/8-inch thick) shall be furnished and installed at the top of each signal on the outside of the signal housing. The neoprene washer shall be next to the signal housing with the galvanized steel washer above. If the signal supplier provides signal heads with the washers installed on the inside, the Contractor shall move the washers to the outside as described above. Signal housings shall be attached to fittings by use of hex head lock nipples. When tops of signal housings are not attached to framework, the hole shall be closed with an ornamental cap, lock nut, metal washer and neoprene washer. After all adjustments have been made and all connections are fully tightened, duct sealing compound shall be applied externally to all joints at the top of the signal to make it watertight.

E. The Contractor shall drill a wiring entry hole on pole for the bottom clamp of each side-mounted signal bracket and for each pedestrian push button station for all internally wired poles without such suitable entry holes. Core drill "hole saw" shall be used for all holes drilling on concrete poles. Care shall be taken not to damage or cut the existing reinforcing steel inside the concrete standard. Part of reinforcing steel exposed during drilling shall be painted with

corrosion resistant paint as soon as possible and on the same day. The height for pedestrian signal is 7 feet and for traffic signal is 10 feet from the bottom of framework to sidewalk grade (i.e. 10 feet, 6 inches above street grade) unless otherwise noted. The vertical axis of each signal shall be truly vertical when installation is complete.

F. The Contractor shall mount all signals parallel to the centerline of the pole they are mounted on. For all tops mounted signals with terminal compartments, the terminal compartment door shall be oriented to face the curb to provide for street access. For all side-mounted signals, the terminal compartment shall be oriented to face away from the curb to provide for sidewalk access.

G. All set screws and back plate attachment screws shall be stainless steel. Plumbizer thru bolts, nuts, and washers shall be galvanized. Setscrews in slip fitters shall have square heads.

H. Terminal compartment door screws shall be stainless steel and be ¾ inch in length.

I. In cases where a top mounted signal assembly is required on existing marbelite traffic signal poles, the existing pole top adapter is to be reused. If setscrews are seized, blowtorch heat shall be applied to loosen.

J. The contractor shall apply an anti-seize compound to the threads of the following signal assembly items:
   1. All square headed set screws used to secure framework.
   2. The two screws used to secure the terminal block inside the terminal compartment.
   3. Chase nipples on top and bottom of all signal heads.
   4. The two terminal compartments cover screws.
   5. The hand hole cover screws on all poles.

2.8 NOT USED

2.9 TRAFFIC SIGNAL FOUNDATIONS

A. All concrete work related to traffic signal work shall be cast in place.

B. Concrete for foundations shall conform to Section 800.11 of SSDPWSF Class 6-3000- ¾, Section 90-2 of the Caltrans Standard Specifications (2010 CTSS) “Minor Concrete,” and these Special Provisions. Concrete shall contain not less than 564 pounds of cement per cubic yard, unless noted otherwise on contract drawings. See Section 26 05 00.

C. The Contractor is advised that existing pole foundations vary in size and shape. They may be as deep as 9 ft and as wide as 5 ft. There may be existing conduits embedded in the foundation. If the pole removed is a MUNI pole, the Contractor shall remove pole foundation to 5 ft or deeper as required to accommodate the new pole foundation and fill the cavity with slurry.

2.10 NOT USED

2.11 NOT USED

2.12 TRAFFIC SIGNAL CABINET - TYPE GSF

A. General
   1. All Cabinets shall be manufactured to the NEMA Standards Publication TS 2-2003 v02.06.
   2. A brief description of the cabinet follows. Further detail is given throughout this

section.

a. GSF: Three components:
   i. Upper Cabinet (40” H, 24.25” W, 17.5” D)
   ii. Pedestal Cabinet (30” H, 20” W, 16” D), and
   iii. Pedestal Cabinet Base (4” H, 17” W, 13” D); to mount on a 16” bolt circle foundation (see drawing titled “GSF PEDESTAL BASE” at the end of this section).
b. The Pedestal Cabinet is centered on the Pedestal Cabinet Base. The Upper Cabinet is flush at the rear with the Pedestal Cabinet and centered side to side over the Pedestal Cabinet.
c. Install a weatherproof and dust-proof closed cell neoprene gasket seal on the surface where the Upper Cabinet meets the Pedestal Cabinet. The gasket shall be a minimum of 0.250”. Gaskets shall be bonded permanently to the metal.

3. The traffic signal cabinet shall:
   a. Operate with a Type 2070 LXN2 controller, as described in March 12, 2009 Caltrans Transportation Electrical Equipment Specifications (TEES).
   b. Be NEMA TS 2 Type 1. The TS 2 Type 1 cabinets provided in this contract shall be 100% compatible with each other and with other compliant components. The NEMA TS 2 Type 1 cabinet assembly provided in this contract shall accept both 2070 and NEMA TS 2 Type 1 controllers built by other manufacturers that conform to the 2070 and NEMA specifications respectively. All necessary data shall be transferred between controller and cabinet. SFMTA will not accept hybrid non-standard solutions.

B. Cabinets
   1. General
      a. The cabinets shall be wired to meet NEMA TS 2 Type 1 specifications.
      b. Cabinet wiring diagram shall be provided as follows:
         i. Two printed sets, folded to finished size of 8 ½” X 11”.
         ii. On Compact Disk, or USB Flash Drive in CAD and PDF format.
      c. See Cabinet Layout and Wiring Diagram drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section.
      d. All cabinets shall be equipped with a sliding computer shelf with built in document storage compartment as per drawing titled “GSF LAPTOP SHELF AND DOCUMENT STORAGE DRAWER” at the end of this section.
      e. Equipment and auxiliary panels shall be installed as per drawing titled “GSF CABINET LAYOUT DIAGRAM” at the end of this section.
      f. Cabinet shall be wired and labeled as per drawing titled “GSF CABINET WIRING DIAGRAM” at the end of this section.
   2. Enclosure

Dimensions		**Type G**		
		Pedestal Base	Pedestal Cabinet	Upper Cabinet
External	Height	4”	30”	40”
	Width	17”	20”	24 ¼”
	Base Depth	13”	16”	17 ½”
Door Opening	Height	N/A	27 ¼”	34”
	Width	N/A	18”	22 ¼”

Sheet Metal Dimension Tolerance shall be ± ¼”

a. The cabinet shall be weatherproof and shall meet UL 3R enclosure specification.
b. Enclosure shall be 0.125" aluminum.
c. Channels shall be of the type to hold ¼" - 20 Channel Nut, Unistrut Part No. A4006-1420EG or approved equal and installed as follows:
    i. Upper Cabinet: two metal channels mounted vertically, horizontally adjustable, on all three sides of the cabinet interior;
    ii. Pedestal Cabinet*:* two metal channels mounted vertically, horizontally adjustable, on all three sides of the cabinet interior.
d. Shelves/controller mounting:
    i. The controller shall be bracket/rack mounted at the top of the upper cabinet.
    ii. In addition, the controller shall rest on two angle bracket shelves.
    iii. Provide 4 MONROE Item # 61221 wing knob screws or approved equal to secure the controller to the bracket/rack.
e. Doorframes:
    i. The enclosure doorframes shall be double flanged out on all four sides.
    ii. The doors shall close against a weatherproof and dust-proof closed cell neoprene gasket seal.
    iii. The gasket for the main doors shall be a minimum of 0.250" thick by 1.00" wide.
    iv. The police door gasket shall be a minimum of 0.250" thick by 0.500" wide.
    v. All gaskets shall be bonded permanently to the metal.
f. Roof
    i. The roof of the enclosure shall incorporate an exhaust plenum with a vent screen. Perforations in the vent screen shall not exceed 0.125 inches in diameter.
    ii. It shall also include a thermostatically controlled Cabinet Ventilation system as per 7.9 of the TS 2-2003 v02.06 NEMA Standards. It shall be acceptable to use Omega KT011011419 thermostat or equal as per 6.2.4.4 of the March 12, 2009 TEES.
g. All seams shall be continuously welded and ground smooth. Interior seams shall be sealed.
h. Cabinet Light
    i. The cabinet shall include a light with a cabinet door activated on/off switch.
    ii. The light shall be 16 Watt, "Micro fluorescent" Adjustable T4 Grounded Light Fixtures120VAC. It shall be mounted on the interior left wall of the upper cabinet. See drawing titled "GSF CABINET LAYOUT DIAGRAM" at the end of this section.
i. The cabinet shall be equipped with a unique serial number.
j. Pedestal Base: See "GSF PEDESTAL BASE" drawing at the end of this section for dimensions and specifications. The Pedestal Cabinet shall be centered over the Pedestal Base and the center pipe access hole and the mounting bolt holes in the bottom of the Pedestal Cabinet shall match the mounting bolt holes on the top of the Pedestal Base and its center pipe access hole.

3. Door
    a. Dimensions:
        a. Upper Cabinet: Height: 36", Width 24 ¼"
        b. Pedestal Cabinet: Height: 29¼", Width 20". Dimensions are approximate. See 2.12.B.2 for fit to enclosure details.
    b. Door shall be 0.125" aluminum.

c. The cabinet door shall be on the front, full width, full height, and include an auxiliary door or police panel. The police door shall have a gasket to prevent entry of moisture or dust and the lock shall be provided with one brass key (SM-0200). The Police door shall contain the following:
   i. Properly labeled AUTO/MANUAL toggle switch. A permanently wired six foot (6') manual control cord with push button switch shall be provided and stored in police panel.
   ii. Properly labeled AUTO/FLASH toggle switch.
d. The upper cabinet door shall be equipped with a three point latching mechanism without nylon rollers at the top and bottom.
e. The lower cabinet door shall be equipped with a slam lock.
f. The doors except for the Police Door shall have a lock, which is a Corbin #1548-1, or equal (single locking mechanism with Corbin #2 key).
g. The upper cabinet and pedestal cabinet doors shall have a heavy duty gauge continuous hinge with a 3/16" diameter stainless steel hinge pin minimum. The hinge shall be secured with ¼-20 stainless steel carriage bolts and stainless steel lock nuts.
h. Both doors shall be sealed with a closed-cell neoprene gasket.
i. Door stops at 90 and 180 degrees shall be provided for both upper and lower cabinet doors.
j. All door hardware to be stainless steel.
k. The upper cabinet door shall have a louvered air vent, filter retainer bracket, and air filter.

4. Finish: Upper Cabinet and Pedestal Cabinet
   a. The exterior shall be powder coated forest green Cardinal Industrial Products #T007-GN16 at a minimum thickness of 2 mils over prime coating. A final top coat of Coval Anti-Graffiti Coat for metal surfaces by Coval Molecular Coatings Inc. shall be applied.
   b. The interior shall be powder coated white Cardinal Industrial Products #T009-WH11 at a minimum thickness of 2 mils.
   c. All surfaces, burrs, and welds shall be cleaned and smoothed before painting.
5. Cabinet Power Distribution and Wiring
   a. The cabinet's Signal Bus shall be wired with a solid state relay; mercury relays will not be accepted. Signal Bus Solid State Relay shall be CRYDOM CWA4850H.
   b. The cabinet's Line Filter shall be 120 VAC, 60Amps, HESCO LF 60 or 120VAC, 60Amps EMERSON INXT120NL000-1.
   c. The cabinet's Surge Protector shall be 120VAC, 10AMP, 50/60 HZ, EDCO ACP-340.
   d. All terminal block screws shall be tightened to the manufacturers recommended screw tightening torque.
   e. The cabinet shall be powered by a 30A, 120/240V, main circuit breaker (Square D cat. # QOU130 Series 3). This breaker shall be located in the pedestal cabinet 18" from the bottom on the right side, and labeled as main disconnect. This main circuit breaker shall feed three (3) circuit breakers as described on the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of this section. These three breakers shall supply the following:
      i. One (1) 20 amp breaker to feed the fan/thermostat, cabinet light, and the 20 amp GFI receptacle. This breaker shall be labeled CB2 GFI FAN LIGHT.
      ii. One (1) 20 amp breaker to feed all other cabinet functions (except CB2 and CB4). This breaker shall be labeled CB3 EQUIP.
      iii. CB4 - One (1) 10 amp circuit breaker to feed 20-amp duplex

surge protected NEMA rated non GFI receptacle. This breaker shall be labeled CB4 ACO.

f. One Marathon #1423570 three-position power distribution block and one Marathon #1422570 two position power distribution block shall be installed side by side as follows:
   i. A jumper for 120VAC and AC neutral shall be wired between the two terminal blocks as illustrated on the drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section.
   ii. A bonding jumper between AC neutral and ground shall be installed.
   iii. The jumpers shall be on the rear side of the terminal block.
   iv. The field terminal side shall face forward.
   v. This assembly shall be mounted on a common back plate with, and forward of the filtered outlets and circuit breaker on the right side near the top of the Pedestal Cabinet.
   vi. A suitable dead front cover shall be placed over this assembly.
   vii. This facilitates the incorporation of a battery back-up system.
   viii. Keep the space below this assembly for other possible peripheral mounting.

g. One eight-position minimum terminal block shall be installed for power supply terminations to auxiliary devices. The minimum termination functions shall be:
   i. AC Line
   ii. AC Neutral
   iii. Earth Ground
   iv. Logic Ground
   v. +12 VDC
   vi. +24 VDC
   vii. 12 VAC, and
   viii. Line Frequency Reference
   ix. AC Neutral and/or Earth Ground maybe terminated on a bus bar in close proximity to this terminal block.
   x. The terminal block shall be appropriate for terminating copper wire; spade-type lugs will be allowed.
   xi. Each terminal shall be isolated from the next. This terminal block is in addition to 5.3.1.3 Power and Control Terminals section of the NEMA TS2 Version 02.06.

h. The cabinet shall be wired with a solid state relay; electromechanical relays will not be accepted. The purpose of this solid state relay is to disconnect +24 VDC from the common side of the load switches when the intersection is in flash using flash transfer relays. The relay shall be Crydom Part Number ED06B5. This relay fits on Crydom standard DIN rail & PCB mountable sockets. The relay socket shall be Crydom Part Number DRSED.

i. Both the upper cabinet and pedestal cabinet shall be considered separate cabinets, in regards to earth ground connection to cabinet shell as per NEMA Standards Publication TS 2-2003 v02.06.

j. FLASH TRANSFER RELAY
   Terminals shall be provided for the flash circuits to the red and yellow indications of each load switch. The cabinet drawing shall include instructions for flash color change or no flash. The wiring of the cabinet shall be as follows:
   i. Channels 1 – 8 shall have flash transfer relays.
   ii. Load Switches 1,3,5,7 shall be controlled by circuit one of the flasher, and

iii. Load Switches 2,4,6,8 shall be controlled by circuit two of the flasher.
iv. Configure load switches 1, 2, 3, and 4 for red flash in fault condition.
v. Configure load switches 5, 6, 7, and 8 for no flash operation (dark) in fault condition.

k. Spade terminal lugs shall not be used on field conductors. Detector loop terminals are accepted.

l. Load Switch Wiring:
i. The cabinet shall be wired to accommodate 8 load switches.
ii. All eight load switches shall terminate on a single tier.

m. The terminals shall be oriented such that no cabinet or field wiring shall obstruct the terminals.

n. The cabinet shall be furnished with the following two receptacles:
i. One 20-amp TS2 standard GFI convenience outlet fed through a 20-amp circuit breaker in item 2.12.B.5.e.i. This receptacle shall be mounted and wired as illustrated on the cabinet layout and wiring diagram drawings at the end of this section.
ii. One 15-amp surge protected NEMA rated non-GFI duplex outlet fed through the 10-amp circuit breaker in item 2.12.B.5.e.iii. This receptacle shall be mounted and wired as illustrated on the drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section.

o. Cabinet shall be wired with a type RH (MIL-R-18546D Type RE) chassis mount, wire-wound 25 Watt, 2K resistors, on the pedestrian yellow outputs for load switches 5, 6, 7 and 8. These resistors shall be situated as illustrated on the drawing titled “GSF CABINET LAYOUT DIAGRAM” at the end of this section. This is to allow the MMU to monitor pedestrian protection outputs.

p. The harness wires for field channel inputs one through eight to the MMU shall be terminated readily accessible and easily movable on the front side of the upper cabinet back panel. Soldered wires are not acceptable.

q. MMU-MA Harness PIN HH shall be wired to Logic Ground Bus for Type 16 Mode with SDLC.

r. Detector Rack:
i. One TS2 standard detector rack shall be provided for all cabinets.
ii. The detector rack shall be rack-mounted and communicate with the controller via SDLC as stipulated in the NEMA TS2-Type 1 specifications.
iii. One BIU shall be provided in the detector rack.
iv. The detector rack shall have six slots:
- The first four accommodating two-channel loop amplifier cards or four-channel loop amplifier cards and
- The last two wired for Opticom.
- Slot 5 shall be wired for an Opticom two channel optical phase selector to drive PE IN-3 and PE IN-4.
- Slot 6 shall be wired for an Opticom phase selector (either optical or GPS) to drive PE IN-1 and PE IN-2 for a two channel phase selector, or PE IN-1, PE IN-2, PE IN-3, and PE IN-4 for a four channel phase selector. See Opticom Detector Rack Slots Table below.
- The Opticom green sensing block shall not be provided.

OPTICOM DETECTOR RACK SLOTS TABLE

PIN	SLOT 5 FUNCTIONS for OPTICAL TWO CHANNEL PHASE SELECTOR Driving PE 3 & PE 4	SLOT 6 FUNCTIONS for OPTICAL TWO or FOUR CHANNEL PHASE SELECTOR or GPS PHASE SEL. Driving PE 1, PE 2, PE 3, & PE 4
A	-----	-24 VDC
B	-----	24 VDC
C	-----	-----
D	CHANNEL C PRIMARY DET. INPUT	CHANNEL A PRIMARY DET. INPUT
E	DETECTOR 24 VDC OUTPUT	DETECTOR 24 VDC OUTPUT
F	CHANNEL C PRIORITY OUTPUT, COLLECTOR (+)	CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, COLLECTOR (+)
H	CHANNEL C PRIORITY OUTPUT, EMITTER (-)	CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, EMITTER (-)
J	CHANNEL D PRIMARY DET. INPUT	CHANNEL B PRIMARY DET. INPUT
K	DETECTOR GROUND	DETECTOR GROUND
L	EARTH GROUND	EARTH GROUND
M	AC- IN (AC RETURN)	AC- IN (AC RETURN)
N	AC+ IN (115 VAC)	AC+ IN (115 VAC)
P	-----	CHANNEL C PRIMARY DET. INPUT
R	DETECTOR 24 VDC PWR. OUTPUT	DETECTOR 24 VDC PWR. OUTPUT
S	-----	CHANNEL C PRIORITY OUTPUT / REAR OUTPUT 3, COLLECTOR (+)
T	-----	CHANNEL C PRIORITY OUTPUT / REAR OUTPUT 3, EMITTER (-)
U	-----	CHANNEL D PRIMARY DET. INPUT
V	DETECTOR GROUND	DETECTOR GROUND
W	CHANNEL D PRIORITY OUTPUT, COLLECTOR (+)	CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, COLLECTOR (+)
X	CHANNEL D PRIORITY OUTPUT, EMITTER(-)	CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, EMITTER (-)
Y	-----	CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, COLLECTOR(+)
Z	-----	CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, EMITTER(-)
19	-----	TRANSMIT DATA
21	-----	RECEIVE DATA

s. Detector Rack Terminal Block:
300 series Marathon/Kulka or equivalent terminal blocks for loop wires shall be provided for 8 channels and located as illustrated on the drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section.

t. The following switches shall be included inside the upper cabinet as illustrated on the drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section:
   i. AUTO/FLASH SWITCH
   ii. SIGNALS ON/OFF SWITCH**.** When in the SIGNALS OFF position, power shall be removed from all signal heads in the intersection. The MMU shall not fault or require reset.
   iii. STOP TIME SWITCH**.** The switch shall have two positions: stop time and normal.
   iv. CONTROLLER EQUIPMENT ON/OFF SWITCH. When in the ON position, the controller, MMU, all load bays, all BIU’s, and the

cabinet power supply shall run. When in the OFF position, they shall power down, signals shall flash, and the MMU shall not fault.

v. DOOR SWITCH**.** The switch shall call Alarm 1 when the upper cabinet door is open. It shall be a normally closed switch.

u. The SDLC Bus shall be constructed as follows:

i. Place six 15 pin D-sub female sockets with screw-locks in one row on a flat back mount panel.

ii. The D-sub sockets shall have gold plated soldered terminals and shall meet the TS-2 Specification.

iii. The panel shall measure approximately 1 ¾" wide x 8" long x 1" deep.

iv. The panel shall include 1" ears at each end, offset toward the back of this assembly so as to provide clearance for wiring the D-sub sockets.

v. All D-sub female terminals #1 are wired in parallel as are pins 3, 5, 7, 9, 11, 13, and 15. The even numbered, unused female terminals shall be populated.

vi. Mount this panel as illustrated on the drawing titled "GSF CABINET LAYOUT DIAGRAM" at the end of this section.

v. Provide SDLC cables with screw-locks on one end to connect to the SDLC bus and on the other end connect with standard TS-2 spring-locks. Provide enough SDLC cables with male sockets for all SDLC equipment installed in the cabinet plus 1 spare. The D-sub sockets shall have gold plated soldered or crimped terminals and back-shells and shall meet the NEMA TS-2 Specification. The even numbered, unused male terminals shall be populated on both ends of the SDLC cable.

w. Pedestrian push button field terminals shall be located in the pedestal cabinet. Two pair of neutral and pedestrian push button field input terminals should be provided per button input as illustrated on the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of the section.

x. Install a ground bus in the Pedestal Cabinet with eight unused terminals minimum. This ground bus shall be mounted above the neutral bus, connected to the Upper Cabinet ground bus using green #8 AWG stranded copper wire. See the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of this section.

y. The Pedestal Cabinet AC isolated neutral bus shall be copper, accept #10 AWG stranded or solid copper wire, have twelve unused terminals, and be located approximately three inches from the bottom and near the right edge of the field terminal back plate. See the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of this section.

z. Lower Cabinet Terminal Strip:

Provide Lower Cabinet Terminal Strip as illustrated on the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" as follows:

i. Provide two terminals per signal output. Field wire terminals shall be Square D, class 9080 type GR6. Use color coded blocks as follows:

- GRR6 for red load switch output.
- GRY6 for yellow load switch output.
- GRG6 for green load switch output.
- Mount Blocks on din 3 9080 MH** or Phoenix Contact NS 35/7, 5 Perforated - 0801733 or Allen Bradley 199-

DR1/DR2.
- Use screw on end clamps MHA10.
- Use end barrier GM6B.
- Use vinyl marking strip (9080 GH220) with marking strip end plug (9080 GH60).

ii. Mount ninety-six Square D model 9080 type GR6 terminal block sections in two vertical rows of 48 blocks each for field wire terminals in the Pedestal Cabinet. The top 48 terminal blocks shall be color coded as per section 2.12.B.5.z.i. All other blocks shall be black (GRB6).

iii. Mount them no more than 3 ½" inches apart center to center on a 12" x 24" aluminum back plate on the rear wall of the Pedestal Cabinet.

iv. Use 2 pole jumpers 9080 GH72 for continuity of terminal pairs as illustrated on the drawing titled "GSF CABINET LAYOUT DIAGRAM" at the end of this section.

v. Feed wires to the Upper Cabinet from the center of the two vertical rows.

vi. Leave the outboard terminals of the vertical terminal rows empty for field wires.

vii. These terminals are for the following:
- Field wire outputs - two per phase color
- Pedestrian push button inputs - two pair per pedestrian push button input
- Twelve Master Cable field wires - two per function including spares.

viii. The 48 rows shall be wired and labeled as illustrated on the drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of this section. Row function are as follows:
- Rows 1 thru 24 are for field wire outputs.
- Row 25 is a spare.
- Rows 26 thru 33 are for pedestrian buttons.
- Rows 34, 35, and 36 are spares.
- Rows 37 thru 48 are for 12-Conductor Cable feed thru wiring.

ix. Load Switch driver wiring to the terminal block shall be 14AWG stranded copper wire. Use PANDUIT MALE BLADE – VINYL INSULATED DV14-145M-C prior to termination.

x. Input wiring for Pedestrian Push Button shall be 18AWG stranded copper. Use PANDUIT MALE BLADE – VINYL INSULATED DV18-145M-CY prior to termination.

xi. Pedestrian Push Button neutral shall be 14AWG stranded copper wire. Use PANDUIT MALE BLADE – VINYL INSULATED DV14-145M-C prior to termination.

xii. See Termination Panel on the drawing titled "GSF CABINET LAYOUT DIAGRAM" at the end of this section for layout and wire color code.

6. Traffic Signal Controller Cabinet Components/Equipment

Payment for all Traffic Signal Controller Cabinet Components/Equipment shall be included with the controller cabinet assembly bid item unless noted otherwise. Where possible, all items shall ship in their original manufacturers packaging.

a. All Bus Interface Unit (BIU's) shall be for a TS-2 environment. The only

approved model at this time is the Eberle Design Inc. (EDI) BIU-700.

b. Each cabinet shall include one (1) TS-2 Bus Interface Unit (BIU) mounted on the back panel and one (1) TS-2 BIU in the detector rack as a minimum.

c. Each cabinet shall include two (2) 16-channel NEMA Malfunction Management Unit (MMU) with LCD display which shall monitor all field outputs. The MMU shall be EDI MMU-16LEIP with ECCOM software in all features and functionality.

d. Each cabinet shall include one (1) TS-2 cabinet power supply which shall be EDI PS-200. The width of this power supply shall not exceed 5 ¾" (inches).

e. Load Switch:
   i. Each cabinet shall be equipped with eight (8) load switches. Each shall have an input/output display indication.
   ii. Load switch output indicator light shall not draw current to prevent MMU from identifying a no-load condition in the field.
   iii. Load switches shall be PDC SSS-86 I/O or RENO A & E Model LS-200.
   iv. Load switch socket jumpers are not required and shall not be shipped with cabinets.

f. Flasher Unit:
   i. Each cabinet shall be equipped with one (1) Flasher Unit.
   ii. The flasher unit shall be PDC model SSF-87 or EDI model 810 or approved equal.

g. Flash Transfer Relay:
   i. Each cabinet shall be equipped with four (4) NEMA approved flash transfer relays.
   ii. Flash transfer relays shall be Struthers-Dunn 21XBXPL33-120VAC.

h. Garmin GPS:
   i. Each cabinet shall include two (2) Garmin GPS units, Model GPS 19x HVS, Garmin Part # 010-01010-00 or approved equal.
   ii. One unit shall be installed by the cabinet manufacturer as described in Section 2.12.B.9 and as per drawings titled "GSF CABINET LAYOUT DIAGRAM" and "GSF CABINET WIRING DIAGRAM" at the end of this section.
   iii. The second unit shall be a spare unit, shipped to SFMTA Traffic Signal Shop at 2650 Bayshore Boulevard, Daly City, CA 94014, configured, painted and wired ready for installation.

The length of each cable in inches for the spare unit shall be minimum:	
DB9 Cable to 7A-Module	84"
DB9 Cable to GARMIN Antenna	96"
±24VDC	60"

i. Network Switch: Each cabinet shall include:
   i. Two (2) Cisco Industrial Ethernet Switches model IE-3000-8TC.
   ii. Two (2) Cisco Power Modules model PWR-IE3000-AC.
   iii. Four (4) Cisco model GLC-LH-SMD or GLC-LH-RGD.
   iv. These units are not to be installed by cabinet vendor.

j. Each cabinet shall include two (2) SC-LC duplex single mode fiber optic patch cords, 2 meters in length.

k. Each cabinet shall include four (4) Belkin A3L791-08-GRN CAT5e Patch Cable RJ45M / RJ45M; 8' Green.

l. Each cabinet shall include two (2) Belkin A3L791-03-S CAT5e 700 Series Patch Cable RJ45M / RJ45M; 3' Grey.
m. Each cabinet shall include two (2) Cat 5e RJ45 Inline Coupler- Straight, with Gold Plated contacts, with non-conducting housing.
n. For each ten (10) cabinets purchased or fraction thereof, provide the following spare components
    i. One AC power line filter.
    ii. One surge protector filter.
    iii. One of all types of MOV's used in the cabinet.
    iv. One of all types of RC networks used in the cabinet.
    v. One of all types of diodes used in the cabinet.
    vi. One +24VDC solid state relay used in Section 2.12 B.5.h.
    vii. One signal bus relay (Main contactor) used in Section 2.12.B.5.a.

7. 12-Conductor Cable Cabinet Wiring
The terminal strip (Section 2.12.B.5.z) shall have feed through color coded wiring as per the table below. The terminal strip is used as a feed through only, the controller shall not receive information from the 12-conductor cable.

12-CONDUCTOR CABLE (#14 AWG)

Color & Terminal Strip Order	**FUNCTION**	**LABEL**
Green	Offset 1	O1
Blue w/ black stripe	Offset 2	O2
Green w/ black stripe	Offset 3	O3
Black	Dial 2	C2
Blue	Dial 3	C3
Orange w/ black stripe	Flash	FL
Red	Split 2	ST2
Orange	Split 3	ST3
White w/ black stripe	Spare	SP1
Red w/ black stripe	Spare	SP2
Black w/ white stripe	Spare	SP3
White	Interconnect Common	COM

8. BIU TF1 Inputs and Outputs
a. The 4 Opticom Pre-empt inputs and all other inputs and outputs shall be wired to BIU TF1 (on the back panel) according to the following table:

BIU 1 IN "G" CABINET

JI	BIU 1		J1	BIU 1	
PIN	**FUNCTION**	**Fed By**	**PIN**	**FUNCTION**	**Fed By**
1A	+24VDC	+24VDC	1B	+24VDC	----
2A	LS1 RED	LS1-6	2B	LS1 YELLOW	LS1-8
3A	LS1 GREEN	LS1-10	3B	LS2 RED	LS2-6
4A	LS2 YELLOW	LS2-8	4B	LS2 GREEN	LS2-10
5A	LS3 RED	LS3-6	5B	LS3 YELLOW	LS3-8
6A	LS3 GREEN	LS3-10	6B	LS4 RED	LS4-6
7A	LS4 YELLOW	LS4-8	7B	LS4 GREEN	LS4-10
8A	LS5 RED	LS5-6	8B	LS5 YELLOW	LS5-8
9A	LS5 GREEN	LS5-10	9B	LS6 RED (OUT)	LS6-6
10A	LS6 YELLOW (OUT)	LS6-8	10B	LS6 GREEN (OUT)	LS6-10
11A	LS7 RED (OUT)	LS7-6	11B	LS7 YELLOW (OUT)	LS7-8
12A	LS7 GREEN (OUT)	LS7-10	12B	LS8 RED (OUT)	LS8-6
13A	LS8 YELLOW (OUT)	LS8-8	13B	LS8 GREEN (OUT)	LS8-10
14A	TBC AUX 1 (OUT)	AUX 1	14B	TBC AUX 2 (OUT)	AUX 2
15A	PE ACT 1 (OUT)	PE 1 Out	15B	PE ACT 2 (OUT)	PE 2 Out
16A	PE CALL 1 (IN)	PE 1 In	*16B*	PE CALL 2 (IN)	PE 2 In
17A	*PE CALL 3 (IN)* *	*PE 3 In*	*17B*	*PE CALL 4 (IN)* *	*PE 4 In*
18A	AUTO FLASH (IN)	Auto FL	*18B*	DIMMING ENABLE (IN)	*DIM EN*
19A	MAN CONT ENABLE (IN)	MCE In	*19B*	INTERVAL ADVANCE (IN)	*Int. Adv.*
20A	*ALARM 1 (IN)* *	*Alm. 1*	*20B*	EXT START (IN)	*Ext. St.*
21A	*LOCAL FLASH (IN)* *	Loc FL	*21B*	STOP TIME (RING 1)	Stop time
22A	STOP TIME (RING 2)	Stop time	*22B*	MAX II SELECT (RING 1)	MAX SEL
23A	MAX II SELECT (RING 2)	MAX SEL	*23B*	FORCE OFF (RING 1)	Force off
24A	FORCE OFF (RING 2)	Force off	*24B*	CALL TO NA 1	Call to na
25A	WALK REST MODIFY	Walk Rest	*25B*	PED ISO 1	PC1
26A	PED ISO 2	PC2	*26B*	PED ISO 3	PC3
27A	PED ISO 4	PC4	*27B*	PED ISO COMMON	Ped Com
28A	ADDRESS SEL. O	----	28B	ADDRESS SEL 1	----
29A	ADDRESS SEL 2	----	29B	ADDRESS SEL 3	----
30A	DATA XMIT RESERVED	----	30B	DATA REC. RESERVED	----
31A	EARTH GROUND	Erth. Gd.	31B	LINE FREQ. REF.	Lf Ref
32A	LOGIC GROUND	Log. Gd.	32B	LOGIC GROUND	Log. Grd.

* = DEVIATION FROM STANDARD BIU 1

9. GARMIN GPS Communication Panel (GCP) and GPS Antenna Unit
Garmin GPS Communication Panel shall have the following key components:
   a. Printed Circuit Board equipped with two 9 pin D-sub female sockets with screw locks and a 1 Amp Circuit Breaker as illustrated on the drawings titled “GSF CABINET LAYOUT DIAGRAM” and “GSF CABINET WIRING DIAGRAM” at the end of this section.
   b. The Printed Circuit Board and Circuit Breaker shall be panel mounted. The panel shall be made of 0.090, 5052 H32 aluminum material. Mount this panel on the left side at an accessible location in the Pedestal Cabinet as shown on the drawing titled “GSF CABINET LAYOUT DIAGRAM” at the end of this section.
   c. The 1 Amp Circuit Breaker rated for 24VDC power shall be IDEC NRC 110 din rail mount. GARMIN supplied fuse shall not be used. ±24VDC power shall be brought to the GARMIN Communication Panel from cabinet ±24VDC source. Use 16 AWG Red and Black stranded wire. Label this Circuit Breaker as CB5.
   d. CB5 shall feed +24VDC to the Printed Circuit Board. Printed Circuit Board shall contain power terminal blocks for ±24VDC Power Input as follows:
      i. One terminal for +24VDC power. +24VDC terminal shall have circuit traces connected to Pin 2 of both 9 Pin D-sub female sockets.
      ii. One terminal for -24VDC (Logic Ground). -24VDC terminal shall have circuit traces connected to Pin 2, 4, and 7 of both 9 Pin D-sub female sockets.
   e. The 9 Pin D-sub sockets shall have gold plated soldered terminals and meet the TS-2 Specification. All D-sub female terminals on the Printed Circuit Board Pin #1 circuit trace are wired in parallel as are Pins 2, 3, 4, 5, 6, 7, 8, and 9.
   f. Provide the following NEMA approved DB9 Male Connector serial cables with screw locks with the following requirements:
      i. 2070-7A Module: Use GARMIN supplied cables. One end of the serial cable shall connect to 2070-7A Module and the other end shall connect to GARMIN GPS Communication Panel.
      ii. GARMIN GPS Antenna: Use GARMIN supplied cables. One end of the GPS 19x NEMA 0183 HVS Power/Data connector cable shall connect to GARMIN GPS Antenna. The other end of the cable with DB9 Male connector shall connect to GARMIN GPS Communication Panel.
      iii. The D-sub sockets shall have gold plated soldered or crimped terminals and back-shells and shall meet the NEMA TS2 Specification.
      iv. Shall be wired as per drawing titled “GSF CABINET WIRING DIAGRAM” at the end of this section.
   g. Install GARMIN Antenna:
      i. As per GARMIN installation instructions for surface mounting GPS 19x HVS antenna.
      ii. In addition to the mounting instruction, apply a bead of sealant to the “surface mount bracket” before and after installation of GARMIN antenna. Apply sealant around the base of the antenna where it meets the cabinet surface.
      iii. Use DAP® DYNAFLEX 230® Premium Indoor/Outdoor Sealant – Clear”.

iv. Paint GARMIN GPS Antenna to match cabinet exterior color as per section 2.12.B.4. Do not prime or use anti-graffiti coat.

h. Mount GARMIN GPS antenna externally, centered on the top of the cabinet.

10. SHIPPING / PALLETIZING

a. EACH CABINET SHIPPED SHALL BE BOLTED TO A PALLET WITH THE FOLLOWING MINIMUM SPECIFICATIONS / INSTRUCTIONS.

i.	Pallet Size:	40” wide x 29” deep
ii.	Top Construction:	1 each 7 ply (minimum) ¾” D-D Structural Plywood (type used in concrete forming). Attached using 7 each 6D pallet nails per riser (21 each).
iii.	Riser Construction:	3 each 2” x 4” x 29” S4S (surfaced 4 sides) board on edge (1 at left and right edge and 1 centered).
iv.	Base Construction:	3 each 1” x 4” x 40” S4S slat flat (1 at front and rear edge and 1 centered). Attached using 2 each 6D pallet nails per slat and per riser (18 each).
v.	Cabinet Assembly Position:	Center Cabinet Assembly on pallet including door handle.
vi.	Cabinet Assembly Mount:	4 each 2” x ½-13 plain or plated steel bolts, 8 each ½” US plain or plated steel flat washers, and 4 each ½-13 plain or plated steel full hex nuts (one set near each cabinet corner through cabinet base and plywood top.

11. WARRANTY AND SUPPORT

a. TRAFFIC SIGNAL CABINET SUPPORT AND WARRANTY

i. The cabinet vendor shall provide phone technical support with a response time of 2 hours or less during vendor’s normal business hours. This technical support shall be at no additional cost during the life of the contract or warranty period. The technical support shall be provided by qualified personnel with extensive knowledge of the hardware characteristics of the cabinets provided in this contract.

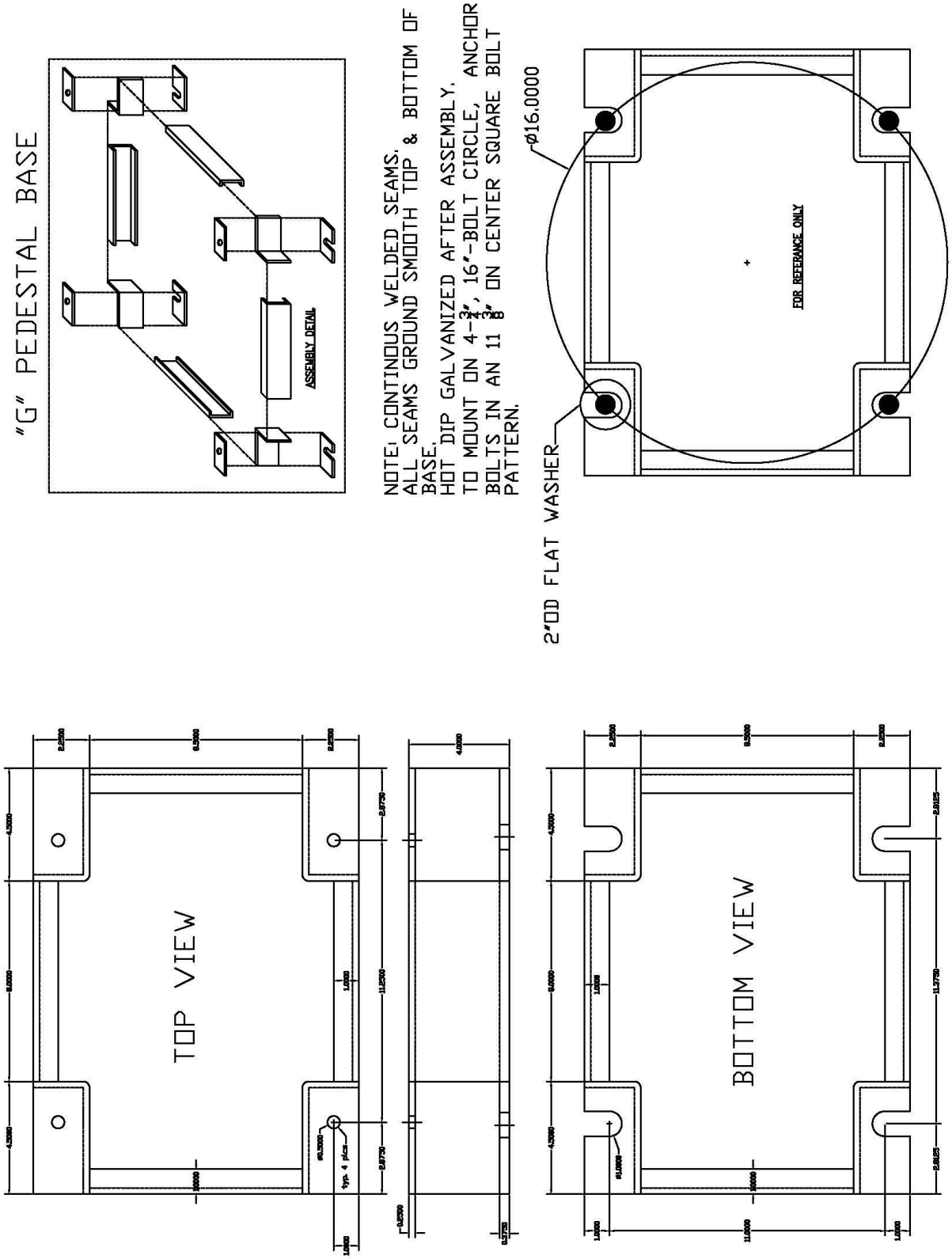
ii. The cabinet, including cabinet wiring and related hardware, shall be guaranteed against defective materials or workmanship for a 24-month period (from date of delivery). The vendor shall be responsible for reimbursing City forces for any time and material utilized to make necessary field trouble calls due to defective cabinets and/or related hardware peripherals during the warranty period. Units that are identified as being defective before the warranty has expired shall be replaced within 14 calendar days. The vendor shall be responsible for all costs, including shipping, incurred by SFMTA for all units that are installed at an intersection and fail as a result of warranty covered failure within the warranty period.

iii. Prior to delivery, the cabinet assembly shall be tested by the cabinet manufacturer or authorized local distributor to ensure proper component integration and operation. All inputs and

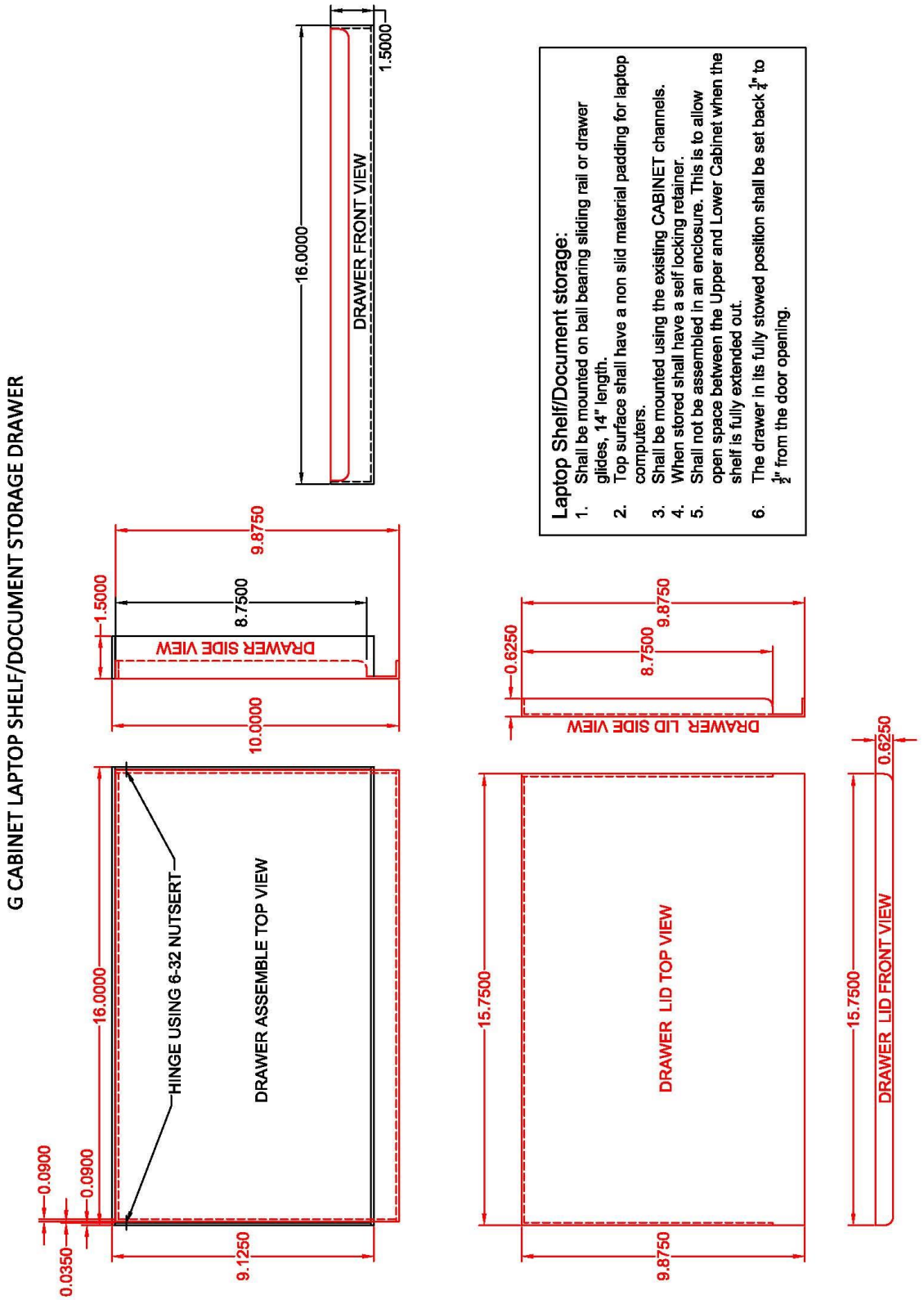
outputs shall be tested. The cabinet manufacturer shall provide certification that the cabinet assembly has met all NEMA quality assurance tests.

iv. The cabinet manufacturer shall in writing authorize SFMTA Signal Shop copyrights to reproduce wiring diagram on paper and electronic media for shop and field use.

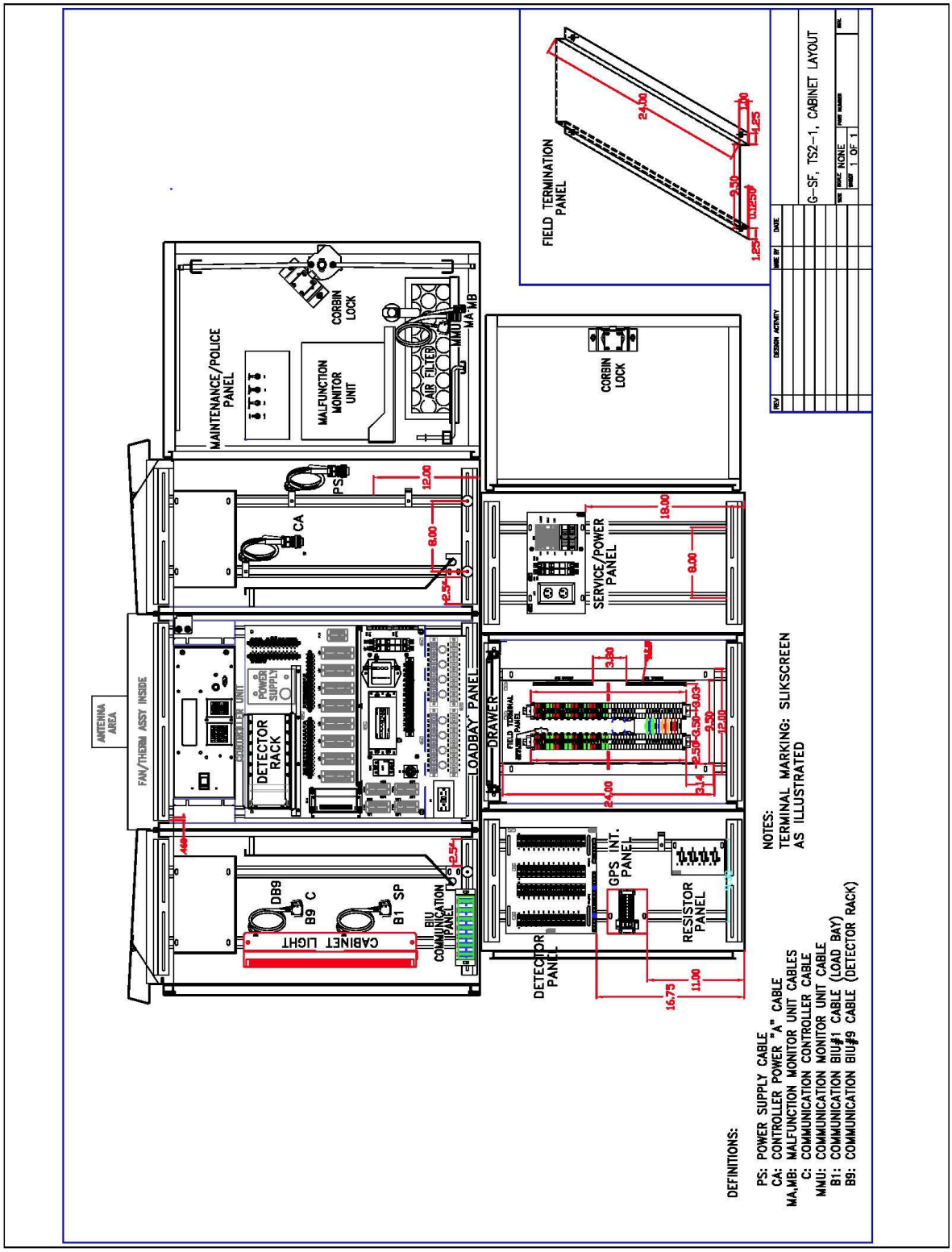
GSF PEDESTAL BASE



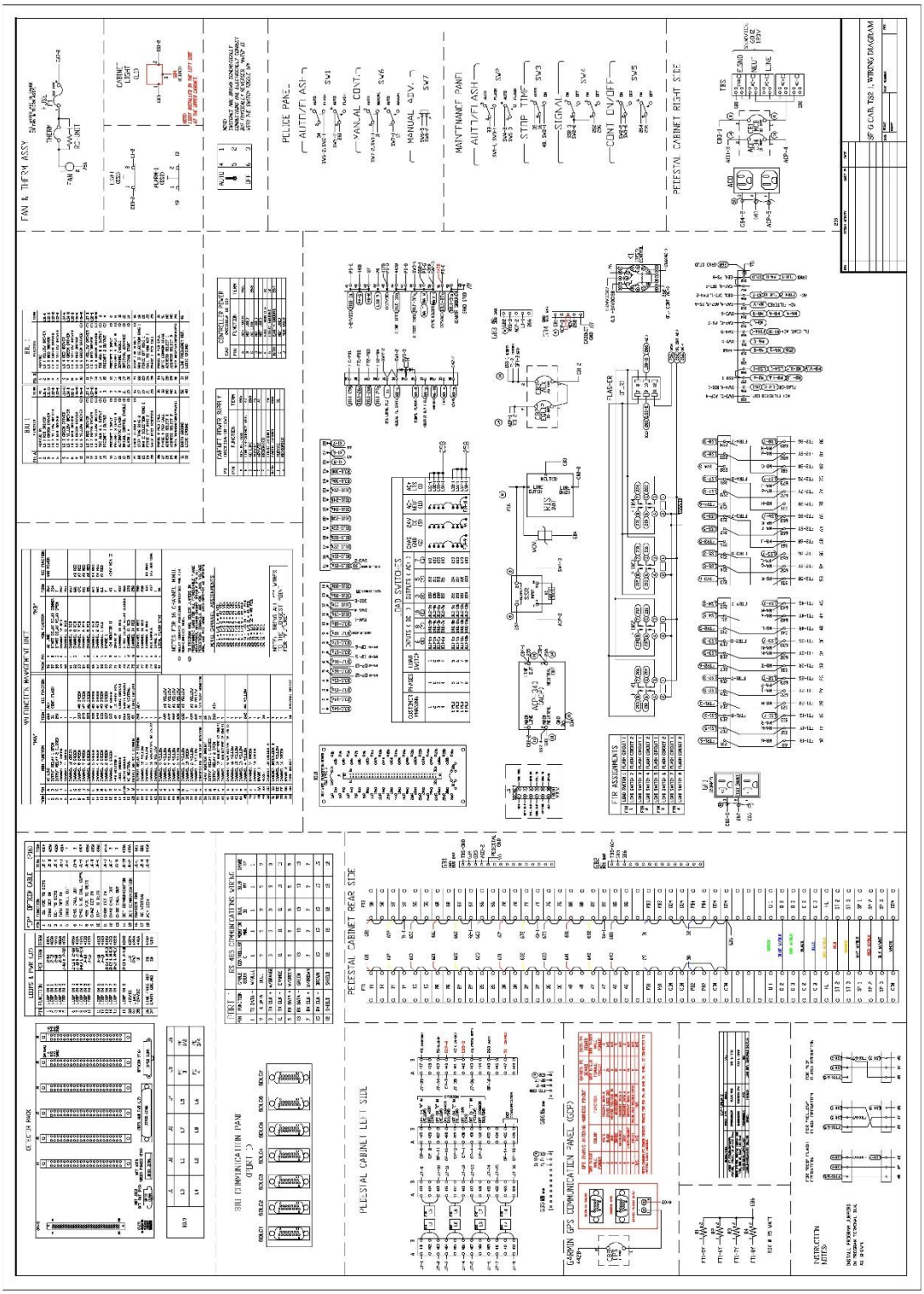
GSF LAPTOP SHELF AND DOCUMENT STORAGE DRAWER



GSF CABINET LAYOUT DIAGRAM



GSF CABINET WIRING DIAGRAM



2.13 TRAFFIC SIGNAL CABINET - TYPE M-SF STANDARD (MSF60)

A. General

1. All Cabinets shall be manufactured to the NEMA Standards Publication TS 2-2003 v02.06.
2. The traffic signal controller cabinet shall be NEMA TS2 Type 1. The TS2-Type 1 cabinets provided in this contract shall be 100% compatible with type 2070 LXN2 controllers as described in the March 12, 2009 Caltrans Transportation Electrical Equipment Specifications (TEES). The TS2 Type 1 cabinet assembly provided in this contract shall accept both 2070 and NEMA TS2 Type 1 controllers built by other manufacturers that conform to the 2070 and NEMA specifications respectively. All necessary data shall be transferred between controller and cabinet. SFMTA will not accept hybrid non-standard solutions.

B. Cabinet

1. General
   a. Cabinet wiring and cabinet layout diagrams shall be provided as follows:
      i. Two printed sets, folded to finished size of 8 ½" X 11".
      ii. On Compact Disk or USB Flash Drive in CAD and PDF format.
   b. Cabinets shall be equipped with a sliding computer shelf with built in document storage compartment. See diagram "MSF60 CABINET BOTTOM SHELF LAPTOP SHELF-DRAWER" at the end of this section.
   c. See diagram titled "MSF60 CABINET LAYOUT" at the end of this section for Cabinet Layout details.
   d. The cabinet shall be designed to mount on an M-SF concrete controller foundation as illustrated on the diagram titled "MSF60 BASE" at the end of this section.
2. Wiring and Equipment Layout
   a. Equipment and auxiliary panels shall be installed as per Cabinet Layout drawing titled "MSF60 CABINET LAYOUT" at the end of this section.
   b. Cabinet shall be wired and labeled as per wiring diagram titled "MSF60 WIRING DIAGRAM" at the end of this section. Wiring and terminals shall be labeled as illustrated on wiring diagram.

   The M-SF cabinet assembly shall meet the following additional requirements:
3. Enclosure (See drawings titled "MSF60 CABINET DOOR" SHEETS 1, 2, 3, AND 4)
   a. The cabinet shall be weatherproof and shall meet UL 3R enclosure specification.
   b. Enclosure shall be 0.125" aluminum.
   c. Dimensions shall be as follows:

MSF60		
External	Height – "Front / Back"	61" / 60"
	Width	36"
	Depth(with doors)	18 ½"
Door Opening	Height (Minimum)	51"
	Width (Minimum)	33 5/8"
Base Flange (See diagram titled "MSF60 BASE")	Front and Back	3"
	Sides	3 1/2 "

   d. Four anchor bolt holes slotted in the base flange: diameter 1-3/8", pattern 2 @ 13.5" center-to-center (front & back) and 2 @ 32.5" center-to-center

(sides) to match M-SF foundation anchor bolt pattern. See the "MSF60 BASE" diagram at the end of this section for details. Concrete foundation bolts are not required or desired with cabinets.

e. Channels
Channels shall be of the type to hold ¼" - 20 Channel Nut, Unistrut Part No. A4006-1420EG or approved equal. Height of the channel shall be 5/8". Two or more metal channels shall be installed vertically on each of the three interior sides of the cabinet. The channels shall be welded permanently at points along the full interior length of the sides and back of the cabinet.

f. Cabinet Shelves:
   i. The cabinet shall have two shelves 11 ½" minimum depth.
   ii. The Top Shelf shall have a height of ¾" and shall be reserved for peripherals such as Variable Message Sign controllers, or Ethernet switch. The Top Shelf shall have the Detector Rack. Detector Rack shall be mounted as far left as possible. The front edge of the shelves shall have ¼" holes punched every 6 inches to accommodate tie wrapping of cables / harnesses.
   iii. The Lower Shelf shall hold the controller, the MMU and the cabinet power supply.
   iv. The Lower Shelf shall house a sliding computer shelf with built in document storage compartment. See diagram titled "MSF60 CABINET BOTTOM SHELF LAPTOP SHELF-DRAWER" for details. The front edge of the shelves shall have ¼" holes punched as illustrated on the drawing.

g. The enclosure doorframe shall be double flanged out on all four sides. The door shall close against a weatherproof and dust-proof closed cell neoprene gasket seal. The gasket for the main door shall be a minimum of 0.250" thick by 1.00" wide. The police door gasket shall be a minimum of 0.250" thick by 0.500" wide. All gaskets shall be bonded permanently to the metal.

h. The roof of the enclosure shall incorporate:
   i. An exhaust plenum with a vent screen. Perforations in the vent screen shall not exceed 0.125 inches in diameter.
   ii. It shall also include a thermostatically controlled Cabinet Ventilation system, as per 7.9 of the TS 2-2003 v02.06 NEMA Standards. It shall be acceptable to use Omega KT01101141900 thermostat or equal as per 6.2.4.4 of March 12, 2009 TEES.

i. All exterior seams shall be continuously welded and ground smooth. Interior seams shall be spot welded and sealed.

j. Cabinet shall include a 16 Watt T4 Micro Fluorescent with ground equipped with day light lamp with a door activated On/Off Switch. It must meet California State Law AB 1109 and required to have 5mg of mercury or less. Record mercury content of the product proposed _____%

k. The cabinet shall be equipped with a unique serial number.

4. Door (See drawings titled "MSF60 CABINET DOOR" SHEETS 1, 2, 3, AND 4 at the end of this section.)
   a. Door dimensions shall conform to the door opening height.
      i. Height 52.5", Width 18"
   b. Door shall be 0.125" aluminum.
   c. The cabinet door shall have a twin door and shall be on the front, full width, full height. The right side door shall include an auxiliary door or police panel. The police door shall include a gasket to prevent entry of moisture or dust and the lock shall be provided with one brass key (SM-0200). The Police door shall contain the following:

i. AUTO/MANUAL SWITCH. Cabinet wiring shall include a properly labeled AUTO/MANUAL toggle switch. The switch shall be in the top position in the AUTO mode. A permanently wired six foot (6') manual control cord with push button switch shall also be provided and stored in the police panel.
ii. AUTO/FLASH SWITCH**.**

d. The door shall be equipped with a three point latching mechanism with nylon rollers at the top and bottom.
e. The door handle shall be stainless steel and shall have provisions for padlocking. The handle shall be on the right side door.
f. The main door lock shall be a Corbin #1548-1 or equal (single locking mechanism with Corbin #2 key).
g. Both doors shall have a heavy duty gauge continuous hinge with a 3/16" diameter stainless steel hinge pin. The hinge pin shall be secured with ¼-20 stainless steel carriage bolts and stainless steel lock nuts.
h. Both door opening shall stop at 90 and 180 degrees.
i. All door hardware to be stainless steel.
j. The door on the right shall have a:
i. Louvered air vent, filter retainer bracket, and air filter (see "DOOR AIR FILTER RETAINER BRACKET" diagram for details at the end of this section).
ii. 1 only Flanders PrecisionAire Model ST55R-1216, Ring Panel Air Filter or approved equal.

5. Finish
a. The exterior shall be powder coated forest green (Cardinal Industrial Products #T007-GN16) or accepted equivalent at a minimum thickness of 2 mils over prime coating. A final top coat of Coval Anti-Graffiti Coat for metal surfaces by Coval Molecular Coatings Inc., or accepted equivalent shall be applied.
b. The interior shall be powder coated white (Cardinal Industrial Products #T009-WH11) or accepted equivalent at a minimum thickness of 2 mils.
c. All surfaces, burrs, and welds to be cleaned and smoothed before painting.

6. Cabinet Power Distribution and Wiring (See "MSF60 WIRING DIAGRAM" and "MSF60 CABINET LAYOUT" drawings.)
a. The cabinet's Signal Bus shall be wired with a solid state relay; mercury relays will **not** be accepted. Signal Bus Solid State Relay shall be CRYDOM CWA4850H or approved equal.
b. The cabinet's Line Filter shall be 120 VAC, 60Amps, HESCO LF 60 or approved equal.
c. The cabinet's Surge Protector shall be 120VAC, 10AMP, 50/60 HZ, EDCO ACP-340 or approved equal.
d. All terminal block screws shall be tightened to the manufacturer's recommended screw tightening torque.
e. The cabinet shall be powered by a 40A, 120/240V, main circuit breaker (Square D cat. # QOU130 Series 3 or accepted equal). This main breaker shall be labeled as CB1 main disconnect. This main circuit breaker shall feed three (3) circuit breakers adjacent to it; these three breakers shall feed the following:
i. One (1) 20 amp breaker to feed the fan/thermostat, cabinet light, and the 20 amp GFI receptacle. This breaker shall be labeled CB2 GFI FAN LIGHT.
ii. One (1) 30 amp breaker to feed all other cabinet functions (except for CB2 and CB4). This breaker shall be labeled CB3 EQUIP.

iii. CB4 - One (1) 10 amp surge protected circuit breaker to feed 20-amp quad surge protected NEMA rated non GFI double duplex outlet in 2.13.B.6.p. This breaker shall be labeled CB4 ACO.

f. One Marathon #1423570 three-position power distribution block and one Marathon #1422570 two position power distribution block (or approved equal) shall be installed side by side. A jumper shall be wired in series between the two. A bonding jumper between AC neutral and ground shall be installed. The jumpers shall be on the rear side of the terminal block/blocks. The field terminal side shall face forward. This assembly shall be mounted on a common back plate. A suitable dead front cover shall be placed over this assembly. The plate shall be mounted on the lower right side of the cabinet. This facilitates the incorporation of a battery back-up system. See Power Panel assembly diagrams in "MSF60 WIRING DIAGRAM" and "MSF60 CABINET LAYOUT" at the end of this section.

g. One eight-position minimum terminal block shall be installed for power supply terminations to auxiliary devices. The minimum termination functions shall be:
   i. AC Line.
   ii. AC Neutral.
   iii. Earth Ground.
   iv. Logic Ground.
   v. +12 VDC.
   vi. +24 VDC.
   vii. 12 VAC.
   viii. Line Frequency Reference.
   ix. AC Neutral and/or Earth Ground may be terminated on a bus bar in close proximity to this terminal block. The terminal block shall be appropriate for terminating copper wire; spade-type lugs will be allowed.
   x. Each terminal shall be isolated from the next. This terminal block is in addition to 5.3.1.3 Power and Control Terminals section of the NEMA TS2 Version 02.06.

h. The cabinet shall be wired with an octal relay to disconnect +24 VDC from the common side of the load switches when the intersection is in flash using flash transfer relays. This relay shall have an LED status lamp and a Non Lockable momentary push button to apply power to the load switches +24 VDC inputs for troubleshooting purposes. Acceptable relays shall be Magnecraft 750XCXM4L-120A or 750XBXM4L-120A with locking door removed by cabinet manufacturer or approved equal.

i. FLASH TRANSFER RELAY
   Terminals shall be provided for the flash circuits to the Red and Yellow indications of each load switch. The cabinet drawing shall include instructions for flash color change or no flash. The wiring of the cabinet shall be as follows:
   i. Channels 1–16, shall have flash transfer relays.
   ii. Load Switches 1, 2, 5, 6, 9, 11, 13, and 14 shall be controlled by circuit one of the Flasher Unit.
   iii. Load Switches 3, 4, 7, 8, 10, 12, 15 and 16 shall be controlled by circuit two of the Flasher Unit.
   iv. Configure load switch channels 1, 2, 3, 4, 5, 6, 7, 8, 13, 14, 15 and 16 to Flash Red in fault condition.
   v. Configure load switch channels 9, 10, 11 and 12 for no flash (dark) in fault condition.

j. Spade terminal lugs shall not be used on field conductors.

k. The cabinet shall be wired to accommodate 16 load switches.

l. Field Output Terminal Block:
   i. All field output terminals shall be mounted at the front bottom of the cabinet panel in two tiers. The tiers shall be spaced 5" center to center minimum. The tiers shall face up at a 30 to 50 degree angle from the back plane. The first eight load switches (LS1 - LS8) shall terminate on the upper tier, the second eight load switches (LS9 – LS16) shall terminate on the lower tier. The terminals shall be oriented such that no cabinet or field wiring shall obstruct the terminals.
   ii. Field output terminal block field wire terminals shall be Square D, class 9080 type GR6 or approved equal. Use color coded blocks as follows:
      - GRR6 for Red signal outputs.
      - GRY6 for Yellow signal outputs.
      - GRG6 for Green signal outputs.
      - The panel shall have 2 rows of 48 blocks. Blocks shall be color coded from left to right, 2 red (GRR6), 2 yellow (GRY6), 2 green (GRG6) this would be LS-1. Repeat this pattern thru to LS–16.
      - Use 2 pole jumpers 9080 GH72 for continuity of terminal pairs.
      - Mount blocks on din 3 9080 MH3** or Phoenix Contact NS 35/7, 5 Perforated-0801733 or Allen Bradley 199-DR1/DR2.
      - Use screw on end clamps MHA10.
      - Use end barrier GM6B.
      - Use vinyl marking strip (9080 GH220) with marking strip end plug (9080 GH60). Label as illustrated on the diagram titled "FIELD OUTPUT FILE LABEL" at the end of this section.
      - Install cabinet wiring and 2 pole jumpers (9080 GH72), on the top side of the terminal blocks.
      - Install the jumper portion of the 9080 GH72 facing the din rail.
   iii. Load Switch driver wiring to the field output terminal block shall be 14AWG stranded copper wire. Use TE Connectivity 790347 Male Blade Nylon Insulated or approved equal prior to termination.
   iv. Use TE Connectivity 150730 Male Blade Nylon Insulated or approved equal for MMU wiring to the field output terminal block.

m. The cabinet shall have AC Neutral bus, 15 positions minimum for field neutrals.

n. The cabinet shall have ground bus, 15 positions minimum for field grounding system.

o. The back panel (load switch bay and field wire terminal blocks) shall be "fold-out" for easier access to the rear wires and soldered terminals. A distance of not less than 6" shall be maintained from the interior bottom of the cabinet to the lower edge of the field terminal blocks. This space shall have no obstructions within its boundaries.

p. In addition to the TS-2 standard GFI convenience outlet, the cabinet shall be furnished with one quad 20A double duplex surge protected NEMA rated non-GFI outlet located as shown on cabinet layout diagram titled "MSF60 CABINET LAYOUT" at the end of this section.

q. Cabinet shall be wired with a type RH (MIL-R-18546D Type RE) chassis mount, wire-wound 25 Watt, 2KΩ resistors, on the pedestrian yellow outputs as shown on cabinet layout diagram ("MSF60 CABINET LAYOUT") at the end of this section.

r. These resistors shall be situated so as to be easily accessible for maintenance and replacement. (This is to allow the MMU to monitor pedestrian protection outputs.)

s. One TS-2 standard detector rack shall be provided for each cabinet. One BIU shall be provided for each detector rack. The detector rack shall have 10 slots, the first eight accommodating two-channel loop amplifier cards or four channel loop amplifier cards and the last two wired for Opticom. Slot 9 shall be wired for an Opticom two channel optical phase selector to drive PE IN-3 and PE IN-4. Slot 10 shall be wired for an Opticom phase selector (either optical or GPS) to drive PE IN-1 and PE IN-2 for a two channel phase selector, or PE IN-1, PE IN-2, PE IN-3, and PE IN-4 for a 4 channel phase selector. See Opticom Detector Rack Slots Table for details.

t. The Opticom green sensing block shall not be provided.

u. 300 series Marathon/Kulka or equivalent terminal blocks for loop wires shall be provided for 16 channels.

v. 300 series Marathon/Kulka or Square D, class 9080 type GR6 (black GRB6) or equivalent terminal blocks for 8 pedestrian detector inputs and at least 4 pedestrian detector common inputs.

w. 300 series Marathon/Kulka or equivalent terminal blocks for Opticom wires shall be provided for 4 channels.

x. The following switches shall be included inside the cabinet:
   i. AUTO/FLASH SWITCH.
   ii. SIGNALS ON/OFF SWITCH. When in the SIGNALS OFF position, power shall be removed from all signal heads in the intersection. The MMU shall not conflict or require reset.
   iii. STOP TIME SWITCH. The switch shall have two positions: stop time and normal.
   iv. CONTROLLER EQUIPMENT ON/OFF SWITCH. When in the ON position, the controller, MMU, all load bays, all BIU's and the cabinet power supply shall run. When in the OFF position, they shall power down, signals shall flash, and the MMU shall not fault.
   v. DOOR SWITCH. The switch shall call Alarm 1 when the cabinet door is open. It shall be a normally closed switch.

y. The SDLC Bus shall be constructed as follows:
   i. Place eight 15 pin D-sub female sockets with screw-locks in one row on a flat back mount panel.
   ii. The D-sub sockets shall have gold plated soldered terminals and shall meet the TS-2 Specification.
   iii. The panel shall measure approximately 1 ¾" wide x 9 ½" long x 1" deep.
   iv. The panel shall include 1" mounting ears either at each end or side, offset toward the back of this assembly so as to provide clearance for wiring the D-sub sockets.
   v. All D-sub female terminals shall be wired as per the TS-2 specifications.
   vi. Any unused female terminals shall be populated.
   vii. Mount this panel in the cabinet at an accessible location, horizontally on the left side at the upper most position below the top shelf.

z. Provide SDLC cables with:
   i. Screw-locks on one end to connect to the SDLC bus in item y above and on the other end connect with standard TS-2 spring-locks.

ii. Male sockets for all SDLC equipment installed in the cabinet plus 1 spare.
iii. The D-sub sockets shall have gold plated soldered or crimped terminals and back-shells that meet and are wired as per TS-2 Specification.
iv. Any unused male terminals shall be fully populated.

C. Traffic Signal Controller Cabinet Components/Equipment

Payment for all Traffic Signal Controller Components/Equipment shall be included with the controller cabinet assembly bid item unless noted otherwise. Where possible all items shall ship in their original manufacturers packaging.

1. All Bus Interface Unit (BIUs) shall be for a TS-2 environment. The only approved model at this time is the Eberle Design Inc. (EDI) BIU-700. Samples of other BIUs may be submitted for testing and may be approved for future contracts.
2. Each cabinet shall include two (2) TS-2 Bus Interface Units (BIUs) mounted on the back panel and one (1) TS-2 BIU in the detector rack as a minimum.
3. Each cabinet shall be equipped with two (2) 16-channel NEMA Malfunction Management Unit (MMU) with LCD display which shall monitor all field outputs. The MMU shall be EDI MMU-16LEIP with ECCOM software or approved equal in all features and functionality.
4. Each cabinet shall be equipped with one (1) TS-2 cabinet power supply. The cabinet power supply shall be EDI Model PS-200 or approved equal.
5. Each cabinet shall be equipped with eight (8) load switches each with an input/output display indication. Load switch output indicator light shall not draw current to prevent MMU from identifying a no-load condition in the field. Load switches shall be PDC SSS-86I/O or RENO A & E Model LS-200 or approved equal.
6. Each cabinet shall be equipped with two (2) Flasher Units. The flasher unit shall be PDC model SSF-87 or EDI model 810 or approved equal.
7. Each cabinet shall include eight (8) NEMA flash transfer relays. Flash transfer relays shall be Struthers-Dunn 21XBXPL33-120VAC or approved equal.
8. Garmin GPS:
   a. Each cabinet shall include two (2) Garmin GPS units, Model GPS 19X HVS, Garmin Part # 010-01010-00 or approved equal.
   b. One unit shall be installed by cabinet manufacture as described in Section 2.13.E and as per diagram titled “GARMIN GPS PANEL” at the end of this section.
   c. The second unit shall be a spare unit, shipped to SFMTA Traffic Signal Shop, configured, painted and wired ready for installation.
9. Network Switch. Each Cabinet shall include:
   a. Two (2) Cisco Industrial Ethernet Switches model (IE-3000-8TC).
   b. Two (2) Cisco Power Modules model (PWR-IE3000-AC).
   c. Four (4) SFP-GBIC, Cisco model (GLC-LH-SMD), or approved equal.
   d. These units are not to be installed by cabinet vendor.
10. Each cabinet shall include two (2) SC-LC, duplex single mode fiber optic patch cords, two (2) meters in length.
11. Each cabinet shall include two (2) Belkin A3L791-08-GRN CAT5e Patch Cable RJ45M / RJ45M; 8’ Green or approved equal.
12. Each cabinet shall include one (1) Belkin A3L791-03-S CAT5e 700 Series Patch Cable RJ45M / RJ45M; 3’ Grey or approved equal.
13. Each cabinet shall include one (1) Cat 5e RJ45 Inline Coupler- Straight, with Gold Plated contacts, with non-conducting housing.
14. For each ten (10) Cabinets purchased or fraction thereof provide the following spare components:

a. 1 AC power line filter.
b. 1 surge protector filter.
c. 1 of all types of MOV's used in the cabinet.
d. 1 of all types of RC networks used in the cabinet.
e. 1 of all types of diodes used in the cabinet
f. 1 relay used in section 2.13.B.6.h, and
g. 1 solid state Main contactor.

D. 120 Volt 12-Conductor Interconnect Cable Components

1. Install a 12 position terminal Block Marathon 1112S or approved equal. This terminal strip is used as a feed through only. The controller shall not receive information from the 12 conductor cable.
2. 12 conductor terminal strip layout and order (see table below). Wire color code is informational only.

Color & Terminal Strip Order	FUNCTION	LABEL
Green	Offset 1	O1
Blue w / black stripe	Offset 2	O2
Green w / black stripe	Offset 3	O3
Black	Cycle 2	C2
Blue	Cycle 3	C3
Orange w / black stripe	Flash	FL
Red	Split 2	ST2
Orange	Split 3	ST3
White w / black stripe	Spare	SP1
Red w / black stripe	Spare	SP2
Black w /white stripe	Spare	SP3
White	Interconnect Common	COM

E. GARMIN GPS Unit and Termination Panel

Wire as per diagram titled "GARMIN GPS PANEL" at the end of this section.

1. Supply Garmin Termination panel using NEMA Type Terminal Blocks, class 9080 type GM6 Natural White. The panel shall have:
   a. 1 row of 8 blocks plus one IDEC NRC110 1A Circuit Breaker (din rail mount) or approved equal.
   b. 24VDC power shall be brought to the GARMIN panel from cabinet 24VDC source. (Use 16 AWG Red and Black stranded).
   c. The panel wiring shall be protected via 1A circuit breaker installed on the panel.
   d. GARMIN supplied fuse shall not be used.
   e. Install NEMA approved DB9 Male Connector and wire as per wiring diagram. This is to allow GARMIN GPS serial connection to the 2070-7A module.
   f. For wiring DB9 and GARMIN GPS Antenna use GARMIN supplied cable. Each cable shall be maximum 5' in length.
2. Mount Blocks on din 3 9080 MH** or Phoenix Contact NS 35/7, 5 Perforated - 0801733 or Allen Bradley 199-DR1/DR2.
3. Use end barrier (GM6B).
4. Use screw on end clamp (MHA10).
5. Use vinyl marking strip (9080 GH220) and leave blank. Use marking strip end plug (9080 GH80).
6. The panels shall be made of 0.090, 5052 H32 aluminum material.
7. Install GARMIN Antenna:

a. As per GARMIN installation manual instructions for surface mounting GPS 19x antenna.
b. In addition to the mounting instruction, apply a bead of sealant to the "surface mount bracket" before and after installation of GARMIN antenna. Apply sealant around the base of the antenna where it meets the cabinet surface.
c. Use "DAP® DYNAFLEX 230® Premium Indoor/Outdoor Sealant – Clear" or approved equal.
d. Paint GARMIN GPS Antenna to match cabinet exterior color as per section 2.13.B.5.a. Do not prime or use anti-graffiti coat.

8. Mount this panel at an accessible location, horizontally on the left side at the upper most position below the bottom shelf.
9. Mount GARMIN GPS antenna externally, centered on the top of the cabinet.

F. SHIPPING / PALLETIZING

EACH CABINET SHIPPED SHALL BE BOLTED TO A PALLET WITH THE FOLLOWING MINIMUM SPECIFICATIONS / INSTRUCTIONS.

1.	Pallet Size:	40" wide x 29" deep
2.	Top Construction:	1 each 7 ply (minimum) ¾" D-D Structural Plywood (type used in concrete forming). Attached using 7 each 6D pallet nails per riser (21 each).
3.	Riser Construction:	3 each 2" x 4" x 29" S4S (surfaced 4 sides) board on edge (1 at left and right edge and 1 centered).
4.	Base Construction:	3 each 1" x 4" x 40" S4S slat flat (1 at front and rear edge and 1 centered). Attached using 2 each 6D pallet nails per slat and per riser (18 each).
5.	Cabinet Assembly Position:	Center Cabinet Assembly on pallet including door handle.
6.	Cabinet Assembly Mount:	4 each 2" x ½-13 plain or plated steel bolts, 8 each ½" US plain or plated steel flat washers, and 4 each ½-13 plain or plated steel full hex nuts (one set near each cabinet corner through cabinet base and plywood top.

G. WARRANTY AND SUPPORT

1. TRAFFIC SIGNAL CABINET WARRANTY and SUPPORT
   a. The cabinet vendor shall provide phone technical support with a response time of 2 hours or less during vendor's normal business hours. This technical support shall be at no additional cost during the life of the contract or warranty period. The technical support shall be provided by qualified personnel with extensive knowledge of the hardware characteristics of the cabinets provided in this contract.
   b. The cabinet, including cabinet wiring and related hardware, shall be guaranteed against defective materials or workmanship for a 24-month period (from date of delivery). The vendor shall be responsible for reimbursing City forces for any time and material utilized to make necessary field trouble calls due to defective cabinets and/or related hardware peripherals during the warranty period. Units that are identified as being defective before the warranty has expired shall be replaced within 14 calendar days. The vendor shall be responsible for all costs, including shipping, incurred by SFMTA for all units that are installed at an

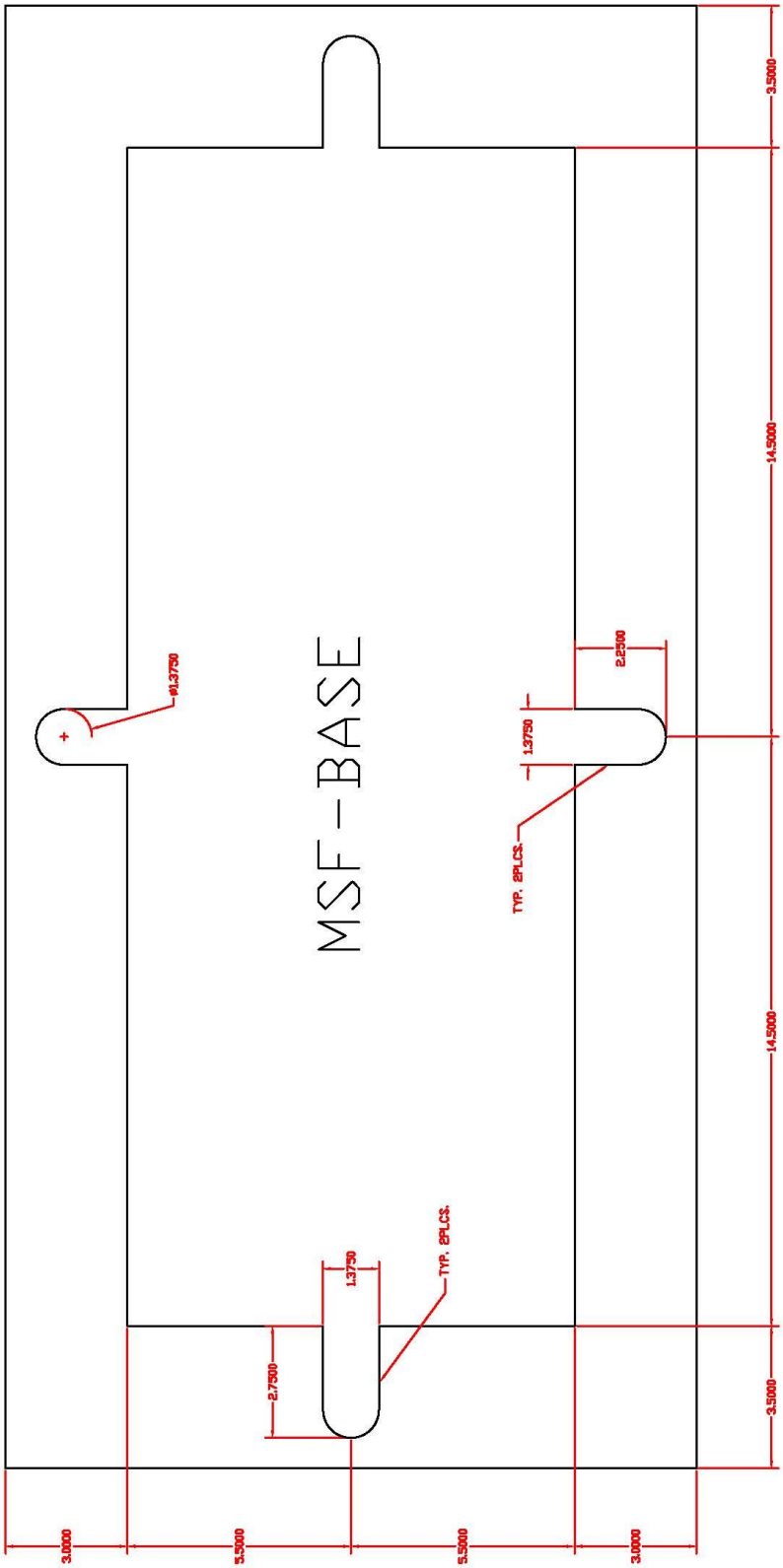
intersection and fail as a result of warranty covered failure within the warranty period.

c. Prior to delivery, the cabinet assembly shall be tested by the cabinet manufacturer or authorized local distributor to ensure proper component integration and operation. All inputs and outputs shall be tested. The cabinet manufacturer shall provide certification that the cabinet assembly has met all NEMA quality assurance tests.

d. The cabinet manufacturer shall in writing authorize SFMTA Signal Shop copyrights to reproduce wiring diagram on paper and electronic media for shop and field use.

OPTICOM DETECTOR RACK SLOTS TABLE		
PIN	SLOT 9 FUNCTIONS for OPTICAL TWO CHANNEL PHASE SELECTOR Driving PE 3 & PE 4	SLOT 10 FUNCTIONS for OPTICAL TWO or FOUR CHANNEL PHASE SELECTOR or GPS PHASE SEL. Driving PE 1, PE 2, PE 3, & PE 4
A	-----	-24 VDC
B	-----	+24 VDC
C	-----	-----
D	CHANNEL C PRIMARY DET. INPUT	CHANNEL A PRIMARY DET. INPUT
E	DETECTOR 24 VDC OUTPUT	DETECTOR 24 VDC OUTPUT
F	CHANNEL C PRIOTITY OUTPUT, COLLECTOR (+)	CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, COLLECTOR (+)
H	CHANNEL C PRIORITY OUTPUT, EMITTER (-)	CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, EMITTER (-)
J	CHANNEL D PRIMARY DET. INPUT	CHANNEL B PRIMARY DET. INPUT
K	DETECTOR GROUND	DETECTOR GROUND
L	EARTH GROUND	EARTH GROUND
M	AC- IN (AC RETURN)	AC- IN (AC RETURN)
N	AC+ IN (115 VAC)	AC+ IN (115 VAC)
P	-----	CHANNEL C PRIMARY DET. INPUT
R	DETECTOR 24 VDC PWR. OUTPUT	DETECTOR 24 VDC PWR. OUTPUT
S	-----	CHANNEL C PRIOITY OUTPUT / REAR OUTPUT 3, COLLECTOR (+)
T	-----	CHANNEL C PRIORITY OUTPUT / REAR OUTPUT 3, EMITTER (-)
U	-----	CHANNEL D PRIMARY DET. INPUT
V	DETECTOR GROUND	DETECTOR GROUND
W	CHANNEL D PRIORITY OUTPUT, COLLECTOR (+)	CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, COLLECTOR (+)
X	CHANNEL D PRIOITY OUTPUT, EMITTER(-)	CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, EMITTER (-)
Y	-----	CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, COLLECTOR(+)
Z	-----	CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, EMITTER(-)
19	-----	TRANSMIT DATA
21	-----	RECEIVE DATA

MSF60 BASE


MSF-BASE
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1.3750
TYP. 8PLCS.
1.3750
TYP. 8PLCS.
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14.5000
3.5000
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5.5000
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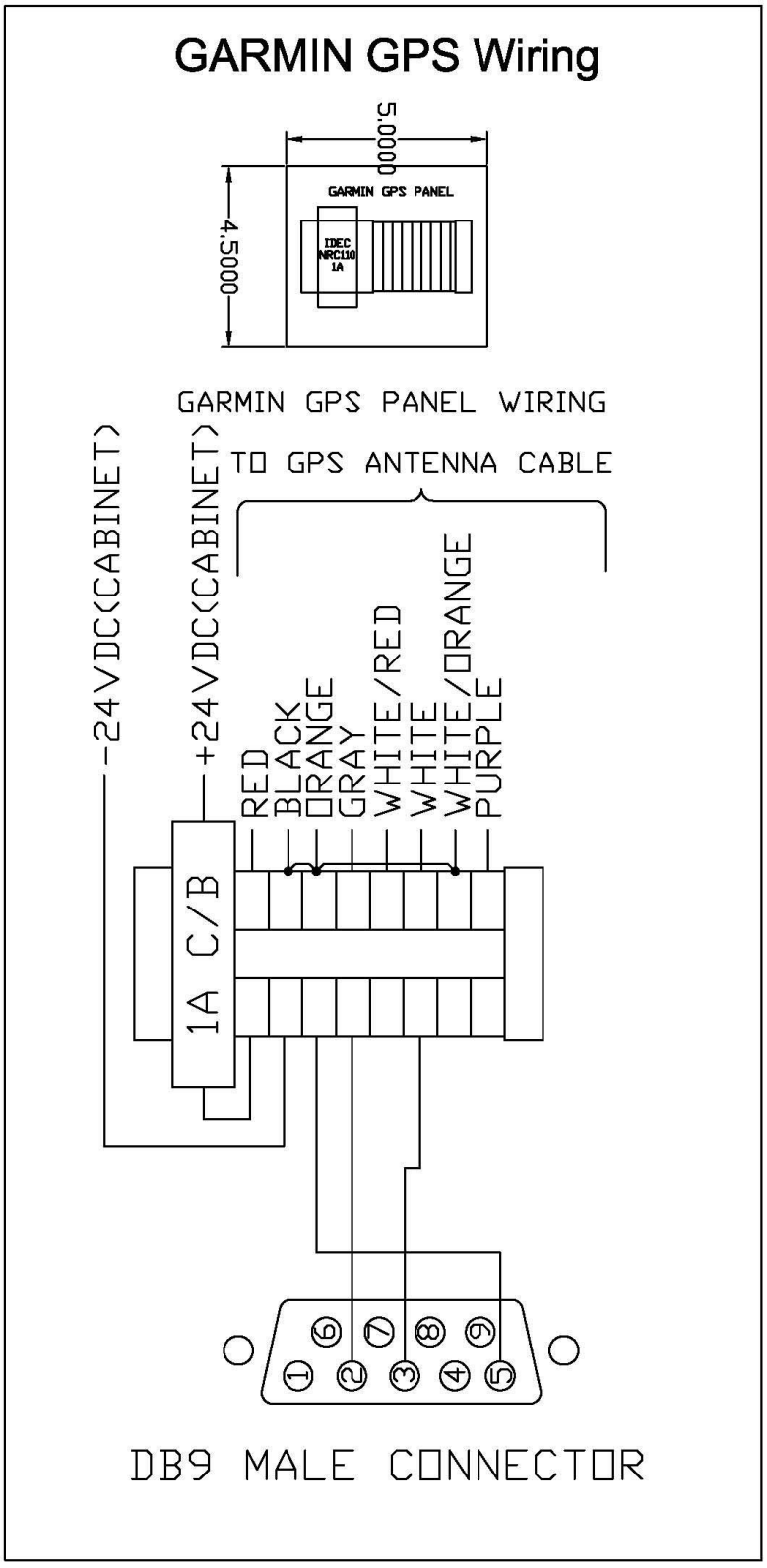
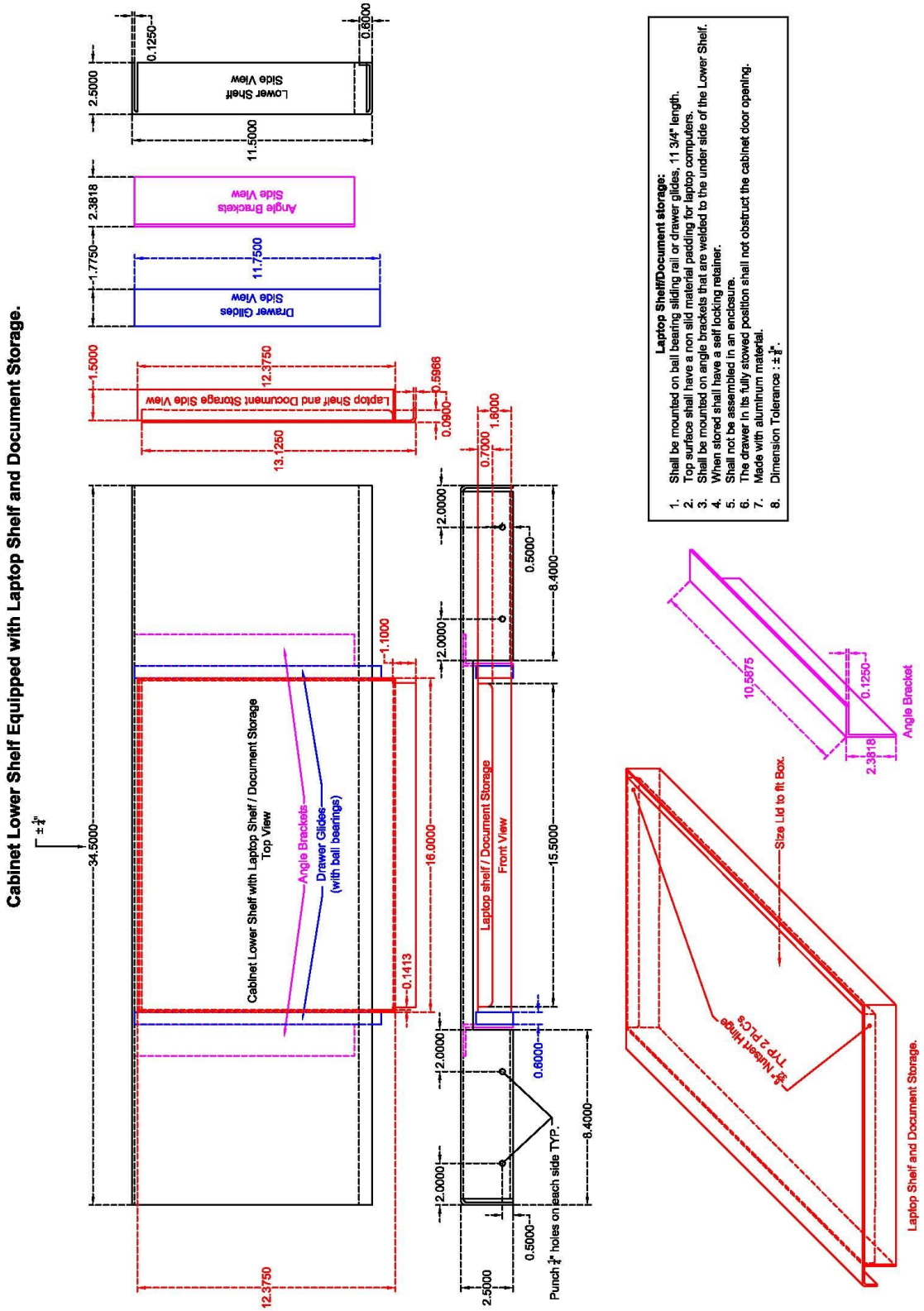
3.0000

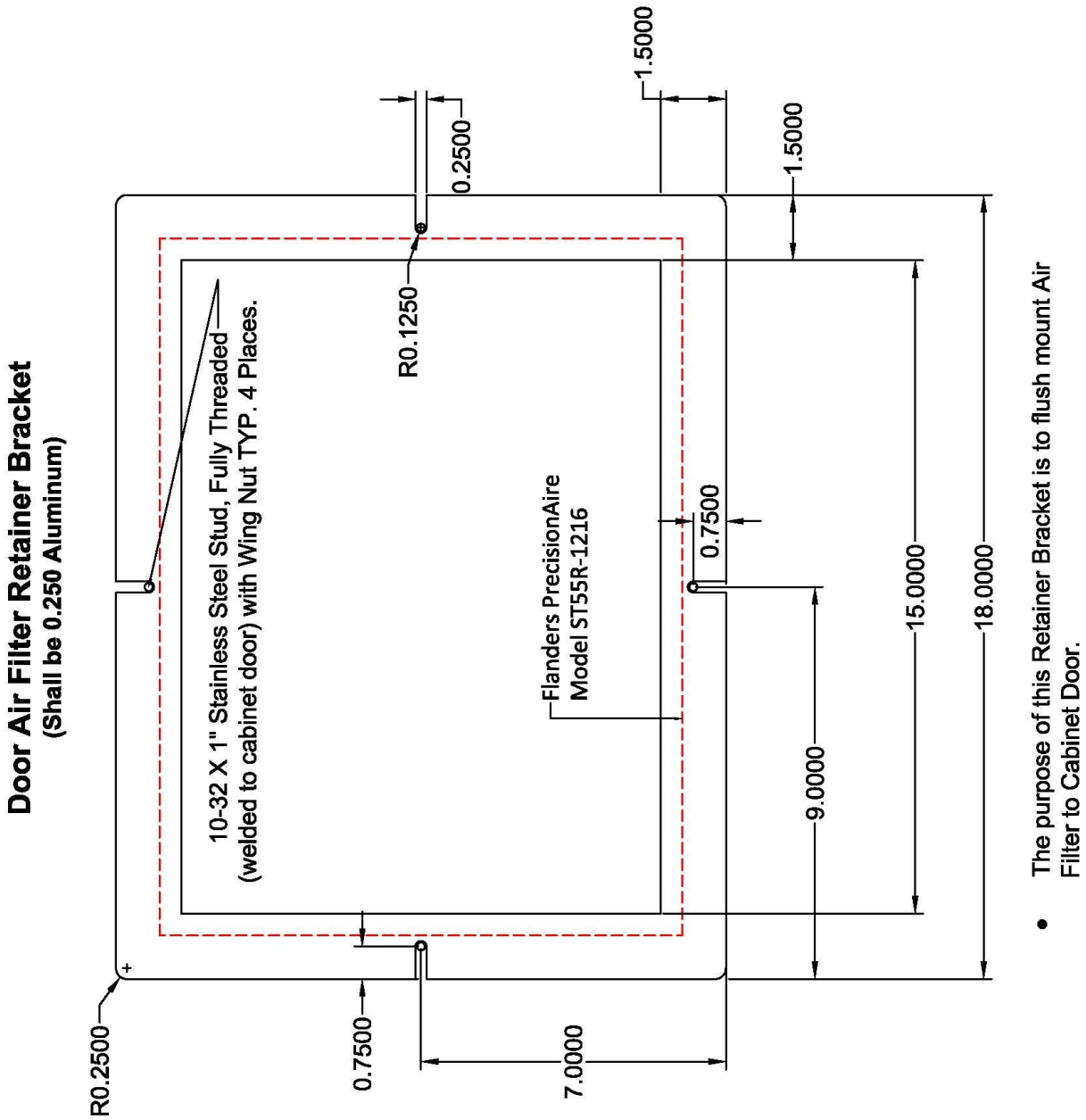
GARMIN GPS PANEL



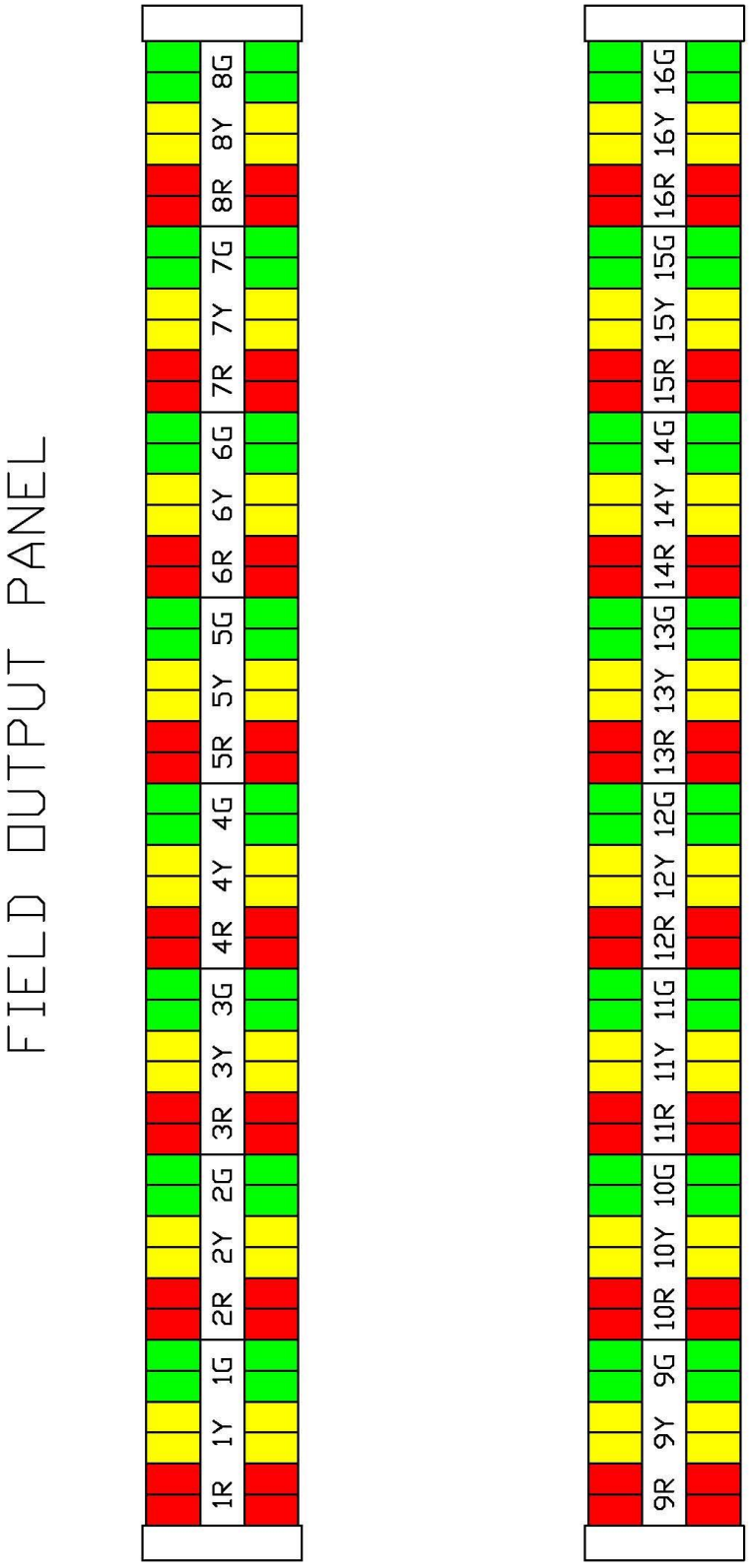
MSF60 CABINET BOTTOM SHELF LAPTOP SHELF-DRAWER



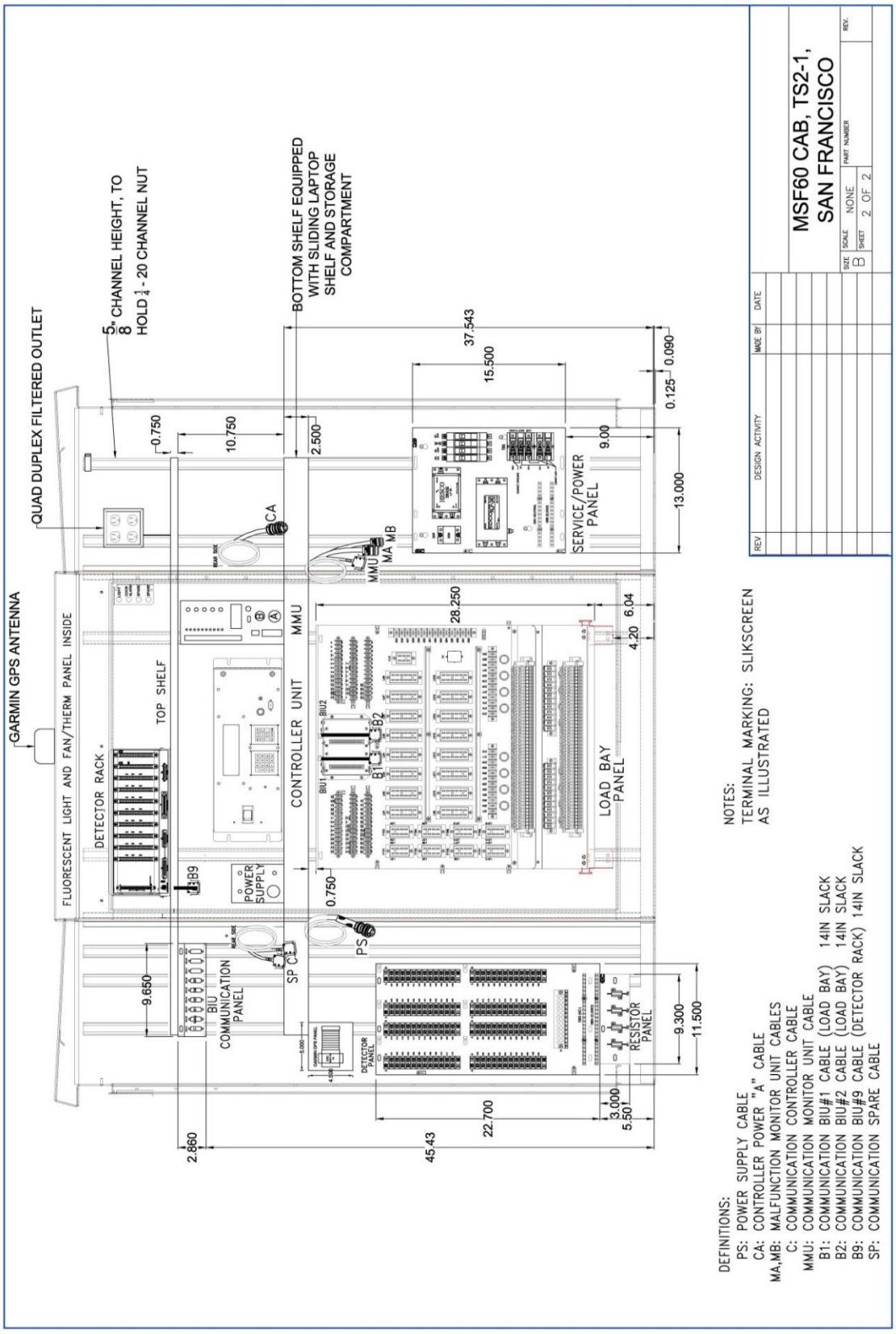
DOOR AIR FILTER RETAINER BRACKET



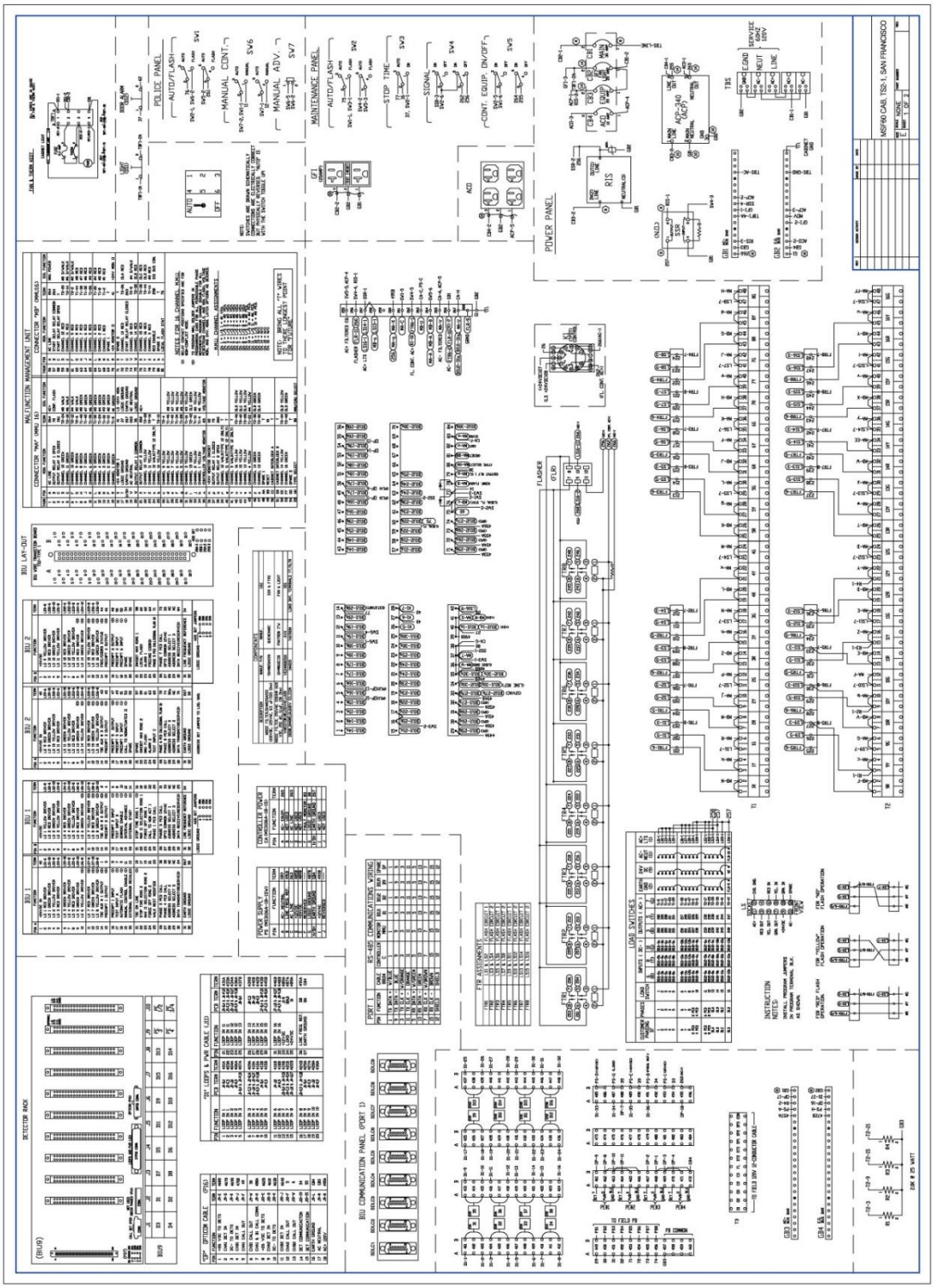
FIELD OUTPUT FILE LABEL



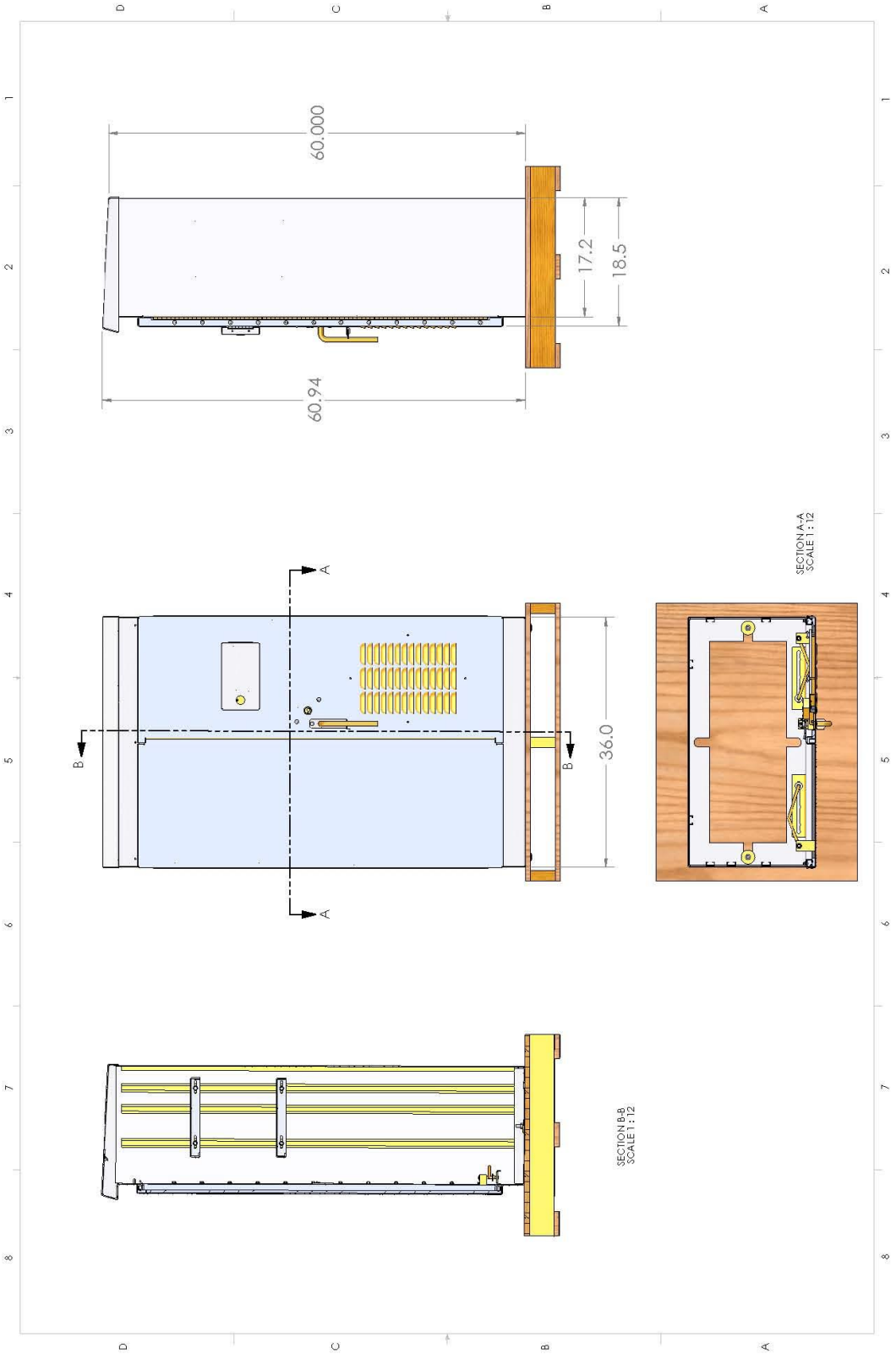
MSF60 CABINET LAYOUT



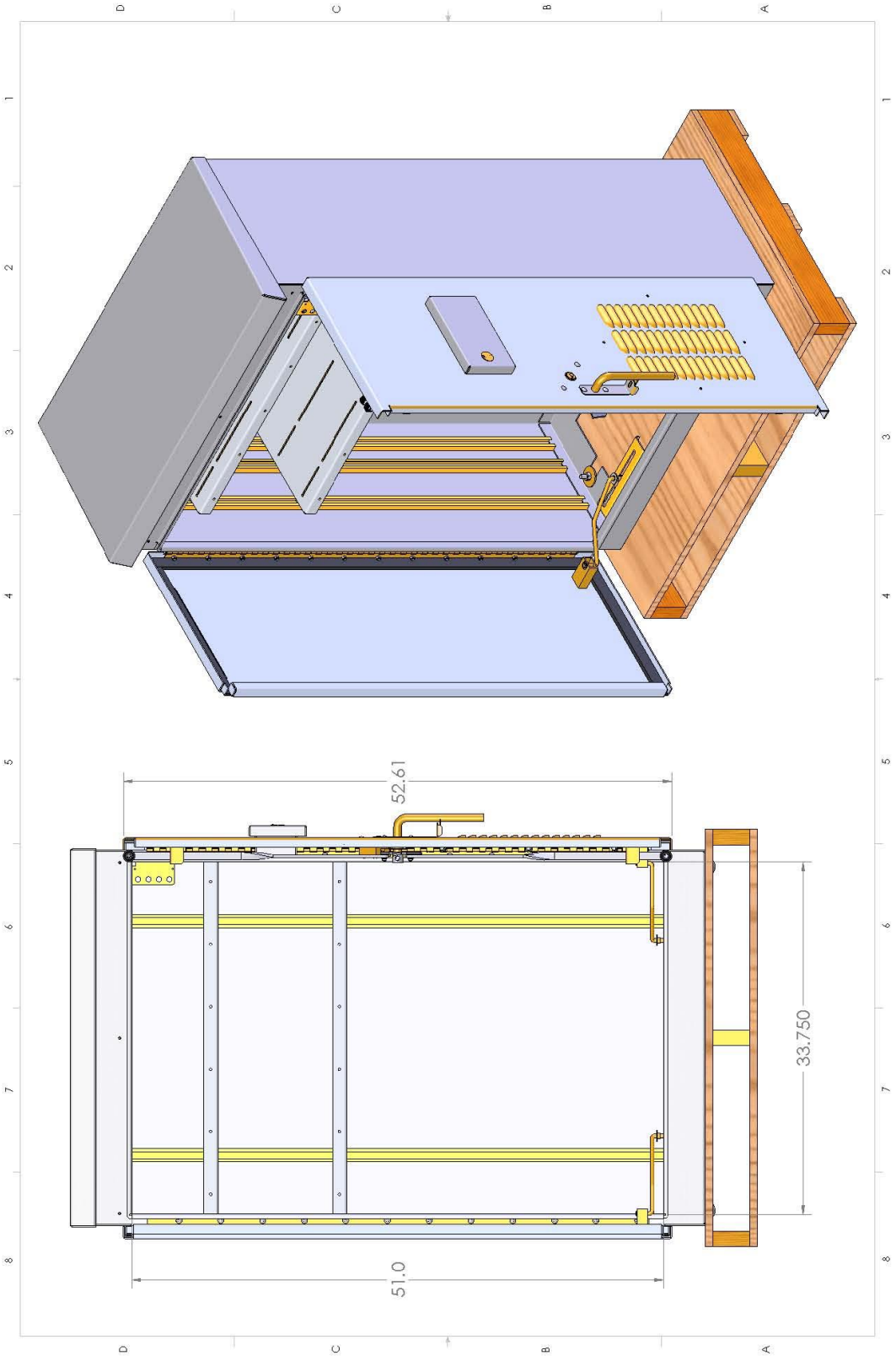
MSF60 WIRING DIAGRAM



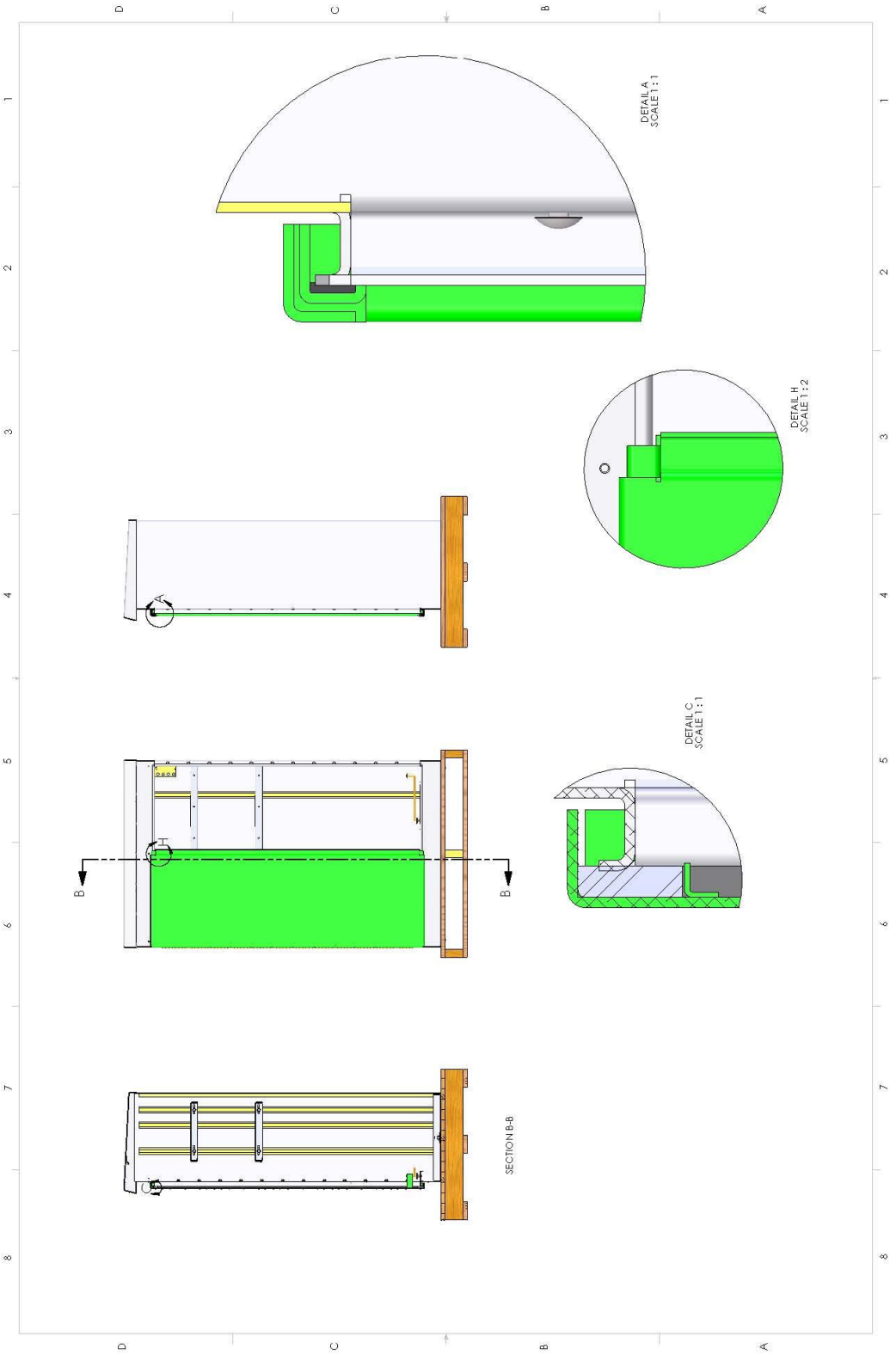
MSF60 CABINET DOOR SHEET 1



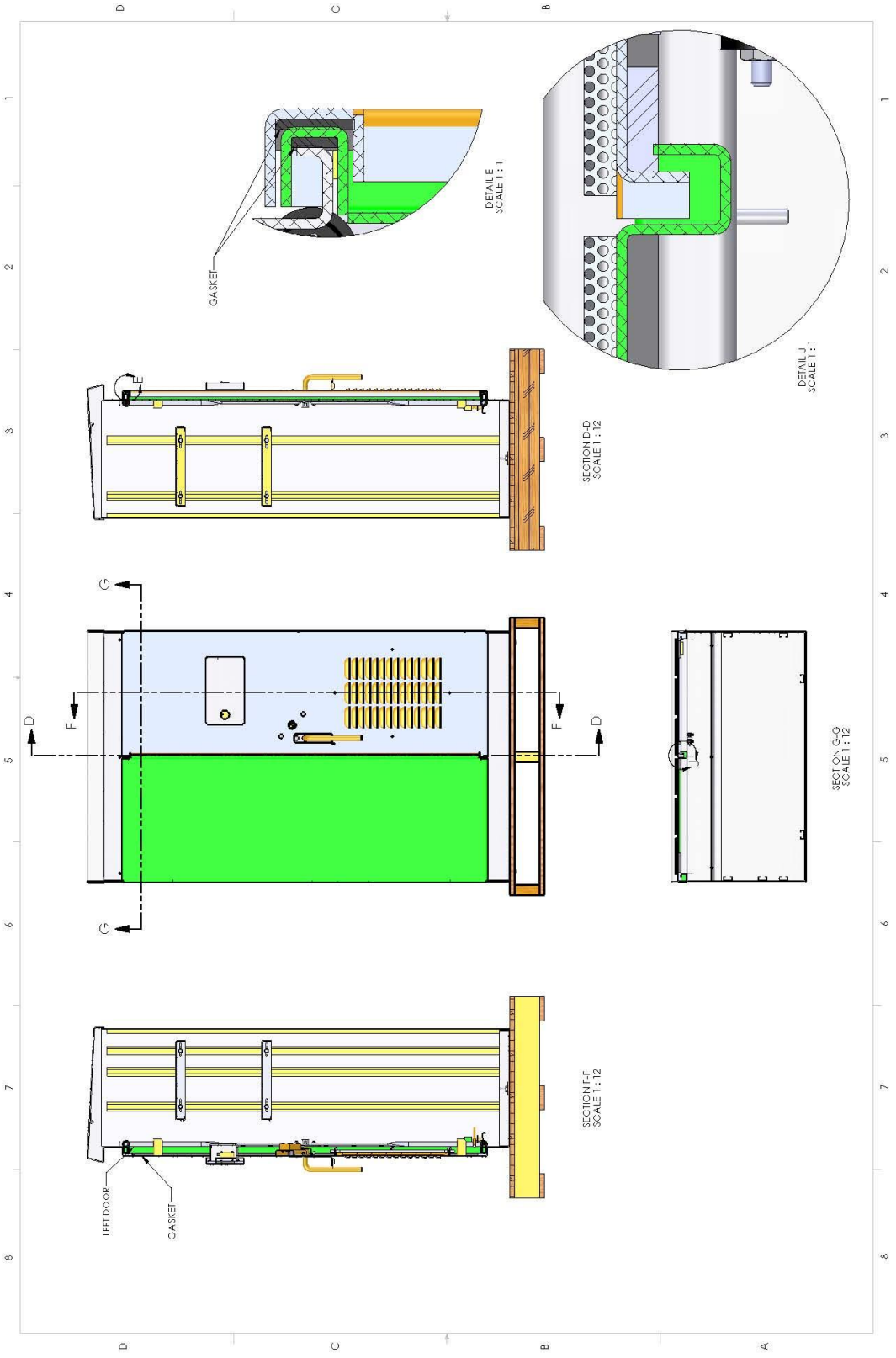
MSF60 CABINET DOOR SHEET



MSF60 CABINET DOOR SHEET 3



MSF60 CABINET DOOR SHEET 4



2.14 NOT USED

2.15 NOT USED

2.16 NOT USED

2.17 NOT USED

2.18 NOT USED

2.19 NOT USED

2.20 NOT USED

2.21 NOT USED

2.22 VEHICLE DETECTION SYSTEMS

A. INDUCTIVE LOOP DETECTORS

1. Performance characteristic, materials and inductive loop detectors shall conform to Section 86-5 "Detectors" of 2010 CTSS and this Project Manual.
2. Detector cables shall be labeled per plans and as required by Conductors of this Section.
3. For installation details, see Inductive Loop Installation in this Section.
4. Loop detectors shall be paid on per loop basis including all materials and labor to furnish and install. The loop detector bid item shall include payment for hand hole and cable back to the controller cabinet. The loop detector bid item shall not include equipment in the controller cabinet such as detector amplifiers or BIUs.

B. WIRELESS MAGNETOMETER VEHICLE DETECTION SYSTEM

1. General
   a. The wireless radar and/or magnetometer vehicle detection system shall be a Sensys Networks system or equal. This specification sets forth the minimum requirements for a system to detect vehicles on a roadway by using battery-powered radar and/or magnetometer-type sensors that communicate their detection data by radio to a roadside communications hub before the data is relayed to a local traffic controller, a central software system, and/or a data server as required by the application.
   b. The detection system shall provide accurate roadway information as needed to support traffic signal control. The Wireless Battery-Powered Vehicle Detection System shall consist of one or more of the following:
      i. Battery-powered magnetometer sensors installed in-pavement in each traffic lane for vehicle detection
      ii. Battery-powered radar sensors installed in-pavement in each traffic lane for vehicle detection and bicycle detection
      iii. Access Points (APs) mounted on the side of the roadway, serving as the communications hub for the installation
      iv. Serial Port Protocol (SPP) Digital Radios mounted on the side of the roadway
      v. Optional wireless Repeaters (RPs) mounted on the side of the roadway, serving to extend the radio range of an AP or SPP
      vi. Contact Closure Interface (CC) cards to support the interface between an AP and a standard traffic controller using contact closure signals

vii. Access Point Contact Closure Interface (APCC) cards to provide sensor information processing and support the interface between an SPP and a standard traffic controller using contact closure signals
viii. Optional Extension (EX) cards to provide additional detector outputs to a traffic controller
ix. Optional Isolation (ISO) Module to provide surge suppression and isolation, as well as providing signal conditioning to enhance the communication distance from the SPP and the APCC
x. Optional Input/Output (I/O) Module to provide additional communication options, memory option and a battery backed real time clock
xi. Software to control and configure the sensors, APs, APCCs, SPPs and RPs
xii. Software to store and retrieve detection data

c. Communications between a sensor and the AP or SPP can be direct, via a single RP, or via two RPs operating in tandem.
d. Communications between the sensors and the AP, SPP or RP and between the RP and AP, SPP or another RP shall be via radio.
e. Detection data shall be capable of being relayed from each AP to a local traffic controller for real-time vehicle detection using contact closure signals.
f. As an option, data shall be capable of being relayed from each AP to a central software system or central server over standard IP (Internet Protocol) networks.

2. Functional Capabilities
a. Each magnetometer sensor shall detect a vehicle by measuring changes in the earth's magnetic field near the sensor as caused by a stopped or passing vehicle (i.e., magnetometer-type detection).
i. The sensor shall sample the earth's magnetic field at a rate of 128 Hz.
ii. The sensor shall communicate time-stamped ON and OFF vehicle detection events.
iii. Each sensor shall automatically recalibrate in the event of a detector lock.
b. Each radar sensor shall detect a vehicle by measuring the time delta and the intensity of the reflected energy return from the self-initiated radar pulse field near the sensor as caused by a stopped vehicle.
c. The sensor shall sample the radar pulse and reflected energy at a user selectable rate of 1 to 2 Hz.
d. The sensor shall communicate time-stamped ON and OFF vehicle detection events.
e. Each sensor shall automatically recalibrate in the event of a detector lock.
f. Each sensor shall communicate by radio to a nearby AP, RP or SPP
i. Each sensor shall transmit its detection data within 150 ms of a detected event.
ii. Each sensor shall automatically re-transmit a detected event if no acknowledgement is received from the AP.
iii. Each sensor may stop retransmission after 8 attempts.
iv. Each sensor shall transmit a unique identifying code.
v. Each sensor shall respond within 100 seconds when the AP is powered on and transmitting.
vi. When no AP, RP or SPP is present or powered on and transmitting, the sensors are not required to detect vehicles.

g. The radio links between each sensor and AP, RP or SPP and between each RP and AP or SPP or each RP and RP shall conform to the following:
   i. The physical layer of the radio links (i.e., the over-the-air data rate(s), modulation type(s), forward error correction, bit interleaving, channel coding, and other aspects of the transmitted signal) shall conform to published standards (e.g., IEEE, ITU-T, etc.).
   ii. The center frequencies, bandwidths, and transmit power levels of the radio links shall allow operation in an unlicensed frequency band.
   iii. Frequency channels shall be employed by the sensors, APs, and RPs to avoid interference with other devices operating in the unlicensed band.
   iv. Frequency channels shall be user-configurable.
   v. At least 16 frequency channels shall be supported.
   vi. The link budget (i.e., transmit power plus transmit antenna gain plus receive antenna gain minus receive sensitivity, where receive sensitivity shall assume a 1% packet error rate) for all radio links shall be 93 dB or greater.
   vii. The maximum distance between a sensor installed in the roadway and an AP, an SPP or an RP with a clear line-of-sight between devices shall be: at least 175 feet for an AP, SPP or RP installed 30 feet above the roadway; at least 150 feet for an AP, SPP or RP installed 20 feet above the roadway, and at least 125 feet for an AP, SPP or RP installed 16 feet above the roadway
   viii. The maximum distance between an AP and an RP or between an RP and another RP shall be at least 750 feet when both units are installed 18 feet above the roadway and with a clear line-of-sight between devices.
   ix. Maximum wireless distances shall be based on the front of the AP, SPP or RP housing directly aimed at the device (AP, SPP, RP or sensor) it is communicating with. Deviations from the centerline of the front of the AP, SPP or RP shall reduce the effective distance of communication

h. Each magnetometer sensor in an installation shall be capable of being individually configured with its own sensitivity level
   i. A single sensor shall be capable of being configured with a sensitivity level that approximates the detection zone of a standard 6’ x 6’ inductive loop
   ii. Each magnetometer sensor shall be capable of being configured with relatively higher or lower sensitivity levels as may be required to detect bicycles, motorcycles, or light rail
   iii. As an option as directed by the plans, up to two sensors properly configured shall be capable of detecting motorcycles in a standard traffic lane or bicycles in a designated bicycle lane.

i. Each radar sensor in an installation shall be capable of being individually configured with its own range level

j. A single radar sensor shall be capable of being configured with a maximum range level for vehicles that approximates 10 feet deep by 12 feet wide with the bicycle detection zone being smaller. The radar sensor shall be located at the edge of the zone, centered on the 12 feet width side.

k. At least 2 User selectable ranges within the above defined detection area shall be available

l. 4 foot radius

m. 6 foot radius
n. An AP or APCC shall support the relay of sensor detection data through several interfaces as required by the application.
   i. Detection data shall be communicated to a standard roadside traffic controller via Contact Closure Interface cards capable of being installed in standard contact closure input shelves, where the following controller types shall be supported: Type 170, Type 2070 ATC, NEMA TS1, and NEMA TS2.
   ii. As an option, detection data shall be communicated over TCP/IP via an integrated 10Base-T Ethernet interface.
   iii. The AP or APCC shall be capable of simultaneously communicating detection data via the contact closure interface, optional Ethernet interface, and optional cellular data modem interface.
o. Each sensor, AP, APCC, SPP and RP shall be capable of accepting software and firmware upgrades.
p. The Wireless Battery-Powered Vehicle Detection System shall provide software operating on conventional notebook/portable PCs to support configuration of a sensor, to support configuration of an AP, to support configuration of an RP, and to store and retrieve detection data.

3. System Hardware
   a. Sensor Hardware
      i. All sensor components shall be contained within a single housing.
      ii. The sensor housing shall conform to NEMA Type 6P and IEC IP68 standards.
      iii. The sensor components shall be fully encapsulated within the housing to prevent moisture from degrading the components.
      iv. The sensor housing shall be capable of being installed in a 4-inch diameter hole approximately 2 ¼ inches deep for magnetometer sensors and approximately 2 ½ inches deep for radar sensors.
      v. A sensor shall operate at temperatures from -37 ˚F /-38.3˚C to +176 ˚F / +80 ˚C.
      vi. A sensor shall be battery-powered with an average lifetime of ten (10) years when the sensor is configured for and operating under normal traffic conditions.
      vii. Two configurations of sensors shall be available from the manufacturer. The first magnetometer sensor type shall provide all sensor functions, including data collection functions. The second magnetometer type shall support presence detection only. The third radar based type shall support presence detection only of stopped vehicles. The drawings and/or plans shall dictate the sensor type required.
   b. Access Point (AP) Hardware
      i. An AP shall support at least 48 sensors
      ii. An AP shall be factory-configurable to support at least two (2) different power options: via an isolated nominal 48 VDC (36-58 VDC) input consuming a maximum of 4W and providing 1500 V isolation and 5 kV surge protection OR via non-isolated nominal 12 VDC (10-15 VDC) input, consuming a maximum of 4W
      iii. An AP shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C
      iv. All AP components shall be contained within a single housing
      v. The AP housing shall conform to NEMA Type 4X and IEC IP67 standards

vi. An AP shall be no larger than 12” H x 8” W x 4” D
vii. An AP shall weigh no more than 4 pounds

c. Repeater (RP) Hardware
i. An RP communicating directly to an AP shall support at least 10 sensors
ii. An RP communicating to an AP via an intermediate RP (i.e., tandem operation) shall support at least 6 sensors
iii. An RP shall be battery-powered, solar-powered or a combination of the two
iv. The RP battery shall be field replaceable
v. An RP shall operate at temperatures from -37 ˚F /-38.3 ˚C to +176 ˚F / +80 ˚C
vi. All RP components shall be contained within a single housing
vii. The RP housing shall conform to NEMA Type 4X and IEC IP67 standards
viii. An RP shall be no larger than 5” H x 4” W x 4” D
ix. An RP shall weigh no more than 3 pounds
x. As an option, the RP-LL (Long-Life Repeater) shall be configured to have all operational characteristics similar to the RP except: 1) 7 year average battery life based on typical use and standard (125 ms) latency; 2) the batteries shall not be user-replaceable; 3) an RP-LL shall be no larger than 7” H x 7” W x 4” D; and 4) an RP-LL shall weigh no more than 9 pounds

d. Serial Port Protocol (SPP) Hardware
i. An SPP shall support at least 48 sensors with a 0.125 second latency
ii. An SPP shall operate at temperatures from -37 ˚F /-38.3 ˚C to +176 ˚F / +80 ˚C
iii. All SPP components shall be contained within a single housing
iv. The SPP housing shall conform to NEMA Type 4X and IEC IP67 standards
v. An SPP shall be no larger than 12” H x 8” W x 4” D
vi. An SPP shall weigh no more than 4 pounds
vii. The SPP shall communicate to the APCC utilizing a standard CAT5e or higher Ethernet cable
viii. The SPP shall have a weatherproof Ethernet connector on the bottom. The Ethernet connector shall be shipped with a cover firmly attached to provide protection from the elements prior to cable connection. The weatherproof connector shall not require any specialized tools for installation

e. Contact Closure Interface (CC) Card Hardware
i. Each CC card shall provide detector data as contact closure signals to the traffic controller
ii. A CC card shall directly plug in to standard 170/2070 input files or NEMA detector racks
iii. One or more CC cards shall provide up to 256 channels of detection data from a single AP’s supported sensors, where each channel comprises an optically isolated contact closure relay and, if configured for TS2 operation, an additional contact closure relay to indicate the channel status
iv. Each CC card shall be configurable
v. A CC card shall provide contact closure signals in either presence or pulse mode
vi. A CC card shall provide up to 31 seconds of delay timing
vii. A CC card shall provide up to 7.5 seconds of extension (carryover) timing

viii. The CC card front panel shall provide status LEDs to monitor: Detection channel status, Line Quality, and Fault Monitor
ix. The CC card front panel shall provide switches to select and configure: Presence or pulse mode, Delay timing, and Extension timing
x. A CC card shall be powered by the traffic controller backplane via an 11-26 VDC input
xi. A CC card shall be surge protected to GR-1089 standards
xii. A CC card shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 ˚C
xiii. A CC card shall operate in humidity up to 95% (non-condensing)

f. Access Point Contact Closure (APCC) Card Hardware
i. Each APCC card shall be capable of communicating with at least 2 SPP modules
ii. Optional Extension (EX) cards shall provide additional contact closures (user configurable from 1 to 4 outputs each)
iii. The APCC shall provide all the higher level processing and interface functions of the system
iv. Each APCC card shall provide detector data as contact closure signals to the traffic controller
1. An APCC card shall directly plug in to standard 170/2070 input files or NEMA detector racks
2. One or more EX cards shall provide up to 256 channels of detection data from a single APCC's supported sensors, where each channel comprises an optically isolated contact closure relay and, if configured for TS2 operation, an additional contact closure relay to indicate the channel status
v. Each APCC and EX card shall be configurable
1. A CC card shall provide contact closure signals in either presence or pulse mode
2. A CC card shall provide up to 31 seconds of delay timing
3. A CC card shall provide up to 7.5 seconds of extension (carryover) timing
vi. The CC and EX card front panel shall provide status LEDs to monitor:
1. Detection channel status
2. Line Quality
3. Fault Monitor
vii. The CC and EX card front panel shall be either software or via front panel switches configurable to provide:
1. Presence or pulse mode
2. Delay timing
3. Extension timing
viii. An APCC or EX card shall be powered by the traffic controller backplane via an 11-26 VDC input
ix. Power Consumption for an APCC (without optional cellular interfaces) operating in a low power mode shall be under 750 milliwatts. In other modes (but not including a cellular modem), the power shall be under 1 watt.
x. An EX card shall be surge protected to GR-1089 standards
xi. An APCC and EX card shall operate at temperatures from -37 ˚F / -38.3 ˚C to +176 ˚F / +80 C
xii. An APCC and EX card shall operate in humidity up to 95% (non-condensing)

g. Outdoor-rated CAT-5e Cable

i. Vehicle detection wiring between the traffic signal intersection controller (IC) and the access point device shall be a continuous run. Cable shall be 4 pair, 8 strand tinned copper conductor, 24 AWG, with PE insulation, and PVC inner and outer jackets, and shall be rated at 75 degree C. Cable shall be high flex, moderate noise, industrial Ethernet cable, and shall be sun resistant, oil resistant for class II materials, and rated for CMR (ETL) and C (ETL) applications. Cable shall NOT be gel filled. Cable shall be CommScope Catalog No. ICAT5E 20002 or equal.

h. Isolator (ISO) Module
   i. An ISO shall be used between each SPP and APCC, except in cases where the APCC is battery or solar powered
   ii. The ISO shall extend the communication range between the APCC and SPP from 30 feet to 2000 feet.
   iii. The ISO shall provide electrical isolation of 1500V
   iv. The ISO shall provide surge protection of up to 1500V
   v. The ISO shall provide AC power cross protection
   vi. The ISO shall be no larger than 5” H x 4” W x 4” D

i. Input/Output (I/O) Module
   i. An I/O module shall expand the capabilities of an APCC by adding
      1. SD Memory Card Slot
      2. Battery backed up real time clock
      3. As an option, RS232 port for serial communications
      4. As an option, detection data shall be communicated as IP data over GSM-based cellular data services via a GPRS cellular modem
      5. As an option, detection data shall be communicated as IP data over CDMA-based cellular data services via a 1xRTT cellular modem
   ii. The I/O module shall be physically mounted to the APCC and shall be the same width. The combined APCC with I/O module shall be the width of a standard 2 slot wide detector amplifier

j. Epoxy
   i. The epoxy shall be a two part poly-urea based joint sealant
   ii. It shall have self-leveling characteristics
   iii. The surface the epoxy will be bonding to shall be free of debris, moisture and anything else which might interfere with the bonding process
   iv. The epoxy shall be approved by the manufacturer of the detection system

C. TRANSIT SIGNAL PRIORITY (TSP) EQUIPMENT

1. General
   a. Furnish materials and equipment bearing evidence of UL listing where UL standard exist and such product listing is available.
   b. Materials and equipment specified shall conform to referenced standards and codes require proof of such conformance. Labels or listings indicating such compliance are acceptable evidence.
      i. For materials and equipment whose compliance with organizational standards or specifications is not regulated by listing or label, provide manufacturer’s certificate of compliance.
      ii. Certificates of compliance shall identify manufacturer, product, referenced standards and manufacturer’s certification that the product conforms to all requirements of the Specifications and listed referenced standard.

iii. Receivers and Optical Signal Processors (OSP) equipment for traffic signal priority shall have a ten (10) years no-cost replacement warranty.

c. The traffic signal priority system shall utilize infrared technology that consists of transmitter installed in the articulated trolley coaches and articulated diesel coaches, receivers installed on the poles, and optical signal processors connected to the traffic intersection controller.

i. The OSP shall have expandable capability to interface with SFgo's Intelligent Traffic Management System (ITMS) equipment for schedule adherence.

ii. The Contractor shall provide all necessary programming equipment, power supplies, relay, software, programs, cables, module, junction boxes and other miscellaneous items for a complete system.

iii. The Contractor shall provide all necessary mounting accessories and other miscellaneous items for mounting traffic signal equipment.

2. Equipment Functional Requirements

The traffic signal priority system equipment shall function as follows:

Transmitter →	Receiver →	OSP →	***Traffic Controller***
		Optical Signal Processor	
Pre-installed on buses.	Install on poles at the intersections.	Connect to traffic controller and install in cabinet.	Processes the signal priority request to extend the "GREEN" phase by 8, 12 or 20 seconds.

a. Receivers

i. Receiver shall convert optical pulses into electrical pulses.

ii. Receiver shall operate reliable under all ambient lighting conditions.

b. Optical Signal Processor (OSP)

i. The Optical Signal Processors (OSP) shall be capable of communicating with existing 2070-type, 170-type, NEMA type and other existing traffic signal controllers. Installation of the OSP shall not require replacing the existing intersection controller.

ii. Upgrading the priority system shall not require replacing the existing equipment.

iii. The OSP shall be capable of distinguishing between transit buses, fire trucks and ambulances.

iv. Each type of priority level shall have the capability to group the vehicle in 8 or more different sub-groups.

v. The OSP shall time stamp all requests and store the bus ID, which can be retrieved at a later date for records and data analysis. The OSP shall store a minimum of 10,000-signal priority request data. The OSP shall have the programmable capability to ignore priority request from certain buses (bus IDs) as determined and programmed by SFMTA's Traffic Signal Shop.

vi. The OSP shall be user friendly and have the capability to communication with a laptop computer. The vehicle detection drop off time or reacquisition time shall be adjustable. The reacquisition time shall be programmed as recommend by the

equipment manufacturer and as approved by the Engineer.

vii. SFMTA's Sustainable Streets Division shall have the authority to retrieve and/or delete the time-stamp data log and program the OSP. Any modification to OSP shall require maintenance and supervisory access level, so only the authorized personnel has the access to modify the programming.

viii. SFMTA's Transit Division shall have limited access, which consists only of retrieving the time-stamp data log. The bus ID & time-stamp data log shall be sorted and arranged in a tabular format as required by the end-user. Repeated and undesired data log shall be filtered and deleted when arranging the data in the specified tabular format.

ix. The application software program shall be provided to manipulate the data as described below, but not limited to:

1. Determine the total travel time for a particular bus along a specific bus route within a time period as specified by the end-user. When end-user enters the particular bus ID, bus route and time period (i.e. time & date), the program shall provide total travel time for inbound & outbound directions, which shall include arrival and departure times at each intersection within the specified time period.
2. Determine the total number of buses at a particular intersection in the time period as specified by the end-user. When the end-user enters the particular intersections and time period (i.e. time & date), the program shall provide the total number of buses for inbound & outbound directions, which shall include arrival and departure times of each bus within the specified time period.
3. Determine the headway for particular bus route within the specified time period as specified by the end-user. When the end-user enters the bus route and time period (i.e. time & date), the program shall provide headway for inbound & outbound directions, which shall include arrival and departure times of each bus at each intersection within the specified time period.
4. Arrange data log in tabular format as recommended by the equipment manufacturer.
5. All software and programs shall be in Microsoft Windows operation environment.

3. Traffic Signal Priority And Test Equipment

a. The supplier for the traffic signal priority and test equipment shall be from the same manufacturer. The supplier of the equipment shall be either 3M Safety and Security System Division or equal.

b. Traffic signal priority equipment shall be provided as follows:

Qty./Intersection	Equipment Description
1	4-Channel OSP – Optical Signal Processor
1	OSP Card Cage
2	Optical Signal Receiver with appropriate lens type

2	Single Receiver mounting assembly
1	Green Phase Monitor
Average 350 feet	Receiver cable

c. The acceptable equipment supplier and manufacturer shall be:
   i. The supplier of 3M Opticom Priority Control System shall be as distributed by Advanced Traffic Product (contact Alan Hollen at (877) 344-7973 or Tom O'Neil at - 3M (800) 927-5471), or
   ii. Equal.

4. Wires And Cables
   a. Receiver cable shall be three conductors (3/C) cable with PVC jacket, #20 AWG stranded tinned copper, rated 600 volts, polyethylene insulation, with color yellow, blue and orange. The polyester tape shall be aluminum/polyester tape shield, #20 AWG stranded tinned copper drain wire. Receiver cable shall be as manufactured by A&J Electric Cable Corp. Catalog No. 32-3C20P-CT or equal.

   b. Provide waterproof identification (ID) labels to all new wires and receiver cables in pull boxes and cabinets. In addition, provide brass ID tags to all receiver cables with "MUNI PRIORITY" label in pull boxes.

2.23 NOT USED

2.24 AUTOMATED PHOTO ENFORCEMENT SYSTEM

A. Service wiring shall be jacketed with three (3) 600-volt insulated, No. 10 AWG, or No. 14 AWG stranded, copper conductors with black, white, and green insulation as required by the plans. Traffic signal phase cable shall be jacketed with seven (7) 600-volt insulated, No. 14 AWG, stranded, copper conductors. Communication cables between camera poles shall be type PE-22, 6 pair, 24 AWG, or approved equal. Communication cables between cameras and their respective control box shall be CAT 5e cable. Trigger sync cables shall be ATS Part number 9000-0137 or approved equal. Camera power cables shall be ATS Part number 9000-0138 or approved equal. Camera video cable shall be RG59/U 75 Ohm co-axial video camera, 20 AWG or approved equal.

B. The jacketing for new automated photo enforcement system wires shall be color-coded and labeled in accordance with the following schedule:

Grounded and Common

CONDUCTORS	COLOR
Service	Black with a Pink stripe
Phase cable	Black with an Orange stripe
Camera communication cables (between camera poles)	Black with a Yellow stripe

SFMTA also requires that all conductors be labeled in accordance with the following schedule and guidelines:

CONDUCTORS	LABELS
Service	Camera Service
Phase cable	Camera Phasing
Camera communication cables (between camera poles)	Camera COMS

Conductor labeling material shall be Panduit Write-on, Self Laminating Labels (Catalog No. PLD-2) or equal. Labeling and grouping requirements apply to all new conductors at a given intersection.

In all pull boxes, all conductors running between the same two conduits shall be further grouped and wrapped in at least one location with electrical tape near the center of the slack.

In the controller cabinet, all conductors shall be further grouped and labeled in an orderly manner.

C. Phase 2 designations have been established by SFMTA as follows:

1. At signalized intersections north of Portola Drive/Market Street the phase 2 designation is from south to north on the following streets: Franklin Street, Gough Street, Van Ness Avenue, Columbus Avenue, Park Presidio Boulevard, Great Highway, Sunset Boulevard, 19th Avenue/Crossover Drive, 7th Avenue, 8th Avenue, 9th Avenue, Stanyan Street (south of John F. Kennedy Drive), Clayton Street at Twin Peaks Boulevard, Clayton Street @17th Street, and Dewey Boulevard/Laguna Honda.
2. At signalized intersections north of Portola Drive/Market Street the phase 2 designation is from west to east on the following streets: Lincoln Way, Sloat Boulevard, Fulton Street, Geary Boulevard, Clement Street, California Street, Oak Street, Fell Street, Lombard Street, Bay Street, Alemany Boulevard at Brotherhood Way (only), and Brotherhood Way at Arch Street.
3. At signalized intersections on Portola Drive/Market Street phase 2 is designated from west to east.
4. At signalized intersections in the Mission District (north of Cesar Chavez Street, south of 13th Street/Duboce Avenue) phase 2 is designated from south to north.
5. At signalized intersections in the SOMA District phase 2 is designated from 13th Street to The Embarcadero.
6. At the signalized intersections on the following streets phase 2 is designated from south to north: Lake Merced Boulevard, 19th Avenue, Junipero Serra Boulevard, Alemany Boulevard, San Jose Avenue, Mission Street (south of Cesar Chavez Street), Bayshore Boulevard, 3rd Street (south of China Basin) and Potrero Avenue.
7. At the signalized intersections on the following streets phase 2 is designated from west to east Ocean Avenue (Aptos to Howth), Monterey Boulevard, Bosworth Street, Silver Avenue, Geneva Boulevard east of Mission Street, Cesar Chavez Street, and Duboce Avenue/13th Street. All other phase numbers are relative to phase 2 and follow the NEMA phasing convention.

2.25 NOT USED

2.26 PAINTING OF WORK FURNISHED AND INSTALLED OR WORKED ON UNDER THIS CONTRACT

A. All electrical equipment (with the exception of video detection, CCTV dome-style cameras, and other items noted below) furnished and installed by the Contractor shall not be painted unless otherwise noted on the plans or in these specifications. If electrical equipment is specified to be painted in the plans or in these specifications, the equipment shall be factory painted. Existing equipment worked on by the contractor shall be touched up painted. All painting completed by the contractor shall be in accordance to Section 809 of the SFDPWSS. Poor workmanship resulting in spotting, peeling, cloudiness, discolorations, etc., shall be rejected and re-done by the Contractor at no cost to the City.

B. Prime Painting
1. First Coat: One application of a zinc dust-zinc oxide paint conforming to the requirements of Federal Specification TT-P641, Type II, applied immediately following the completion of all prepainted preparations.
2. Second Coat: One application of a pre-treatment vinyl wash primer conforming to the requirements of the 2010 Caltrans Standard Specifications Section 86-2.16. The vinyl wash primer shall be applied by spraying or brushing to produce a uniform wet surface.

C. Finish Painting
1. Two separate and complete applications of finish paint shall be applied, unless otherwise noted on the plans or in these specifications. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the final application.
2. The finish paint color for all signal heads, visors (with or without louvers) and controllers shall be Dark Olive Green color (Caltrans Color Chip No. 68) in accordance with the 2010 Caltrans Standard Specifications Section 86-2.16.
3. The inside of visors and louver vanes shall be painted a luster black in accordance with Caltrans Standard Specification.
4. Steel street lighting, VMS and signal standards, and signal arms shall not be painted, unless otherwise noted on the plans or in these specifications.

D. External conduit shall not be painted unless noted on the plans. If noted on the plans for paint, the paint shall be considered as incidental work.

PART 3 - EXECUTION

3.1 NOT USED

3.2 NOT USED

3.3 VEHICLE DETECTION SYSTEMS INSTALLATION

A. INDUCTIVE LOOP INSTALLATION
1. The Contractors shall lay out the loop installation, with paint, and notify the Traffic Engineer thru the Engineer at least 2 working days in advance, before the scheduled date of slot cutting. The slots for the loops shall be cut only after the approval of the Traffic Engineer.

2. Residue material resulting from slot cutting operations shall not be allowed to flow across sidewalk or traffic lanes and shall be removed from the pavement surface.
3. The depth of the cut shall be 4.0 to 4.5 inches except when noted otherwise on the contract plans and drawings. The width of the saw cut shall be minimum 1/2-inch. Each corner shall be core drilled. The Contractor shall core drill the point where the curb line and road surface meet.
   The Contractor is advised that City streets are generally 2 inch to 4-inch asphalt concrete wearing surface on an 8 inch to 12-inch concrete use.
4. The Contractor shall submit a schedule of installation, for all phases of, saw cutting for approval. The Engineer shall verify the following:
   a. Layout of loops and home runs prior to saw cut.
   b. Depth and width of the saw cut for the loop.
5. Contractor shall notify the Engineer not less than 24 hours prior to cleaning of pavement cuts, installation of loop wires and installation of loop sealant. Failure to notify the Engineer will result in this work being rejected.

B. WIRELESS MAGNETOMETER VEHICLE DETECTION SYSTEM INSTALLATION, WARRANTY, AND SYSTEM SUPPORT

1. Installation
   a. Install as per manufacturer's instructions, and in the presence of and at the direction of City staff and manufacturer's staff.
   b. Each installation of the Wireless Battery-Powered Vehicle Detection System shall consist of one or more sensors installed in each traffic lane where presence detection is required. Magnetometer sensors should avoid sources of magnetic noise such as underground power cables, overhead high tension power cables, light rail or subway tracks, and power generation stations and sub-stations.
   c. The Contractor shall install magnetometer sensors as follows:
      i. The roadway shall be core drilled to provide a 4” diameter hole, 2.25” deep for each sensor.
      ii. The sensor shall be placed inside a small, clear plastic shell formed to provide a tight fit around the sensor.
      iii. A small layer of sand or epoxy approximately 1.25” shall be applied to the bottom of the cored hole.
      iv. The sensor shall then be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor.
      v. The sensor shall be fully encapsulated with the epoxy to the lip of the cored hole.
      vi. The sensors shall be located as specified by the intersection plans.
      vii. Each sensor’s supporting AP or RP shall be installed no farther than the maximum range indicated in Part 2, Section 2.22.
   d. The contractor shall install radar sensors as follows:
      i. The roadway shall be core drilled to provide a 4” diameter hole, a minimum 2.55” deep.
      ii. The sensor shall be placed inside a small, clear plastic shell formed to provide a tight fit around the sensor.
      iii. A small layer of epoxy approximately 1.25” shall be applied to the bottom of the cored hole.
      iv. The sensor shall then be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor. The clamshell shall maintain the proper installation depth relative to the top of the roadway.
      v. The sensor shall be fully encapsulated with the epoxy to the lip of the cored hole.

vi. The sensors shall be located as specified by the intersection plans.
vii. Each sensor's supporting AP, RP or SPP shall be installed no farther than the maximum range indicated in Part 2, Section 2.22.

2. Warranty
   a. The supplier shall provide a limited two-year warranty for the Wireless Battery-Powered Vehicle Detection System, with the exception of the batteries for the standard life repeater.
   b. During the warranty period, technical support shall be available from the supplier via telephone within 2 business days of the time a call is made by a user, where this support shall be provided by factory-authorized personnel or factory-authorized installers.
   c. During the warranty period, standard updates to the software shall be available from the supplier without charge.
3. System Support
   a. The supplier shall maintain a sufficient inventory of parts to provide support and maintenance of the system, where these parts shall be available for delivery within 30 days of receipt of a purchase order by the supplier at the supplier's then-current pricing and terms of sale.
   b. The supplier shall maintain an ongoing program for customer support for the system via telephone, email, or trained personnel sent to the installation upon receipt of a purchase order at the supplier's then-current pricing and terms of sale for technical support services.
   c. Installation and/or training support shall be provided by a factory-authorized representative.
   d. The Contractor shall notify the Engineer and the Manufacturer's certified installation personnel 10 working days prior to the installation of the Vehicle Detection System.
   e. Prior to installation, the contractor shall provide personnel that have been certified by the manufacturer to test and pre-configure the components; and record all detection component ID numbers on a project drawing.
   f. Installation procedures, wire pulls and the ultimate location of APs and RPs will be at the discretion of the Manufacturer's certified personnel. The Contractor shall install each sensor in the roadway per Manufacturer's recommendations.
   g. The contractor will install Presence sensors for stop bar detection only; and Full function sensors will be deployed for all other detection applications.
   h. All documentation shall be provided in the English language.

C. TRANSIT SIGNAL PRIORITY (TSP) EQUIPMENT INSTALLATION
1. General
   a. The Contractor shall install the receivers and optical signal processors per approved Shop Drawings.
   b. The receivers shall be mounted on the existing or new traffic signal poles. Installation method or location(s) shall not cause any interference with the operation of the receivers.
   c. The Optical Signal Processors shall be mounted in the traffic signal cabinet and connected directly to the traffic signal controllers without requiring major modification and/or removing any existing equipment or wiring.
   d. Adjusting the sensitivity or fine-tuning the receivers must be done at the Optical Signal Processor (OSP) located in the traffic signal controller.
2. Programming Of Systems

a. The Contractor shall set up, adjust, program and demonstrate to the City the proper and complete operation of all installed systems.
b. In the presence of the Engineer, the Contractor, at each intersection, shall perform the following:
   i. Properly align all receivers.
   ii. <u>Program all SET POINT in the optical signal processor using a transmitter equipped Muni diesel bus.</u>
   iii. SET POINT accuracy test shall be performed a minimum of five (5) consecutive times for consistency. The actual SET POINTs observed from testing must be consistent.
   iv. Demonstrate to the Engineer that each unit properly performs its required function.
   v. Make adjustments accordingly until the system is satisfactory and functional to the Engineer's approval.
c. Testing: After verifying the equipment installation, and making necessary adjustments, the Contractor shall provide all communication radios and request from Muni a transmitter equipped diesel coach and operator for testing the installation. The Engineer shall cooperate with and assist the Contractor in said testing. The Contractor shall record the dates of the start of the operation of the system and equipment.

3. Acceptance Test
   a. Prior to final acceptance by the Engineer, the complete systems shall be required to operate trouble-free for a minimum of thirty (30) calendar days.
   b. The Contractor shall be responsible for obtaining the Engineer's approval on the starting date of the thirty- (30) day acceptance test, in writing. The Contractor must obtain signatures from the Engineer and the respective Muni Supervisors from the Potrero and Flynn Facilities prior to final acceptance of the installation of all equipment provided. Obtain signatures on the Table, at the end of this section, for installation of transmitter in the buses.
   c. Any system failure within the thirty- (30) day acceptance test period shall automatically result in test termination. The Contractor shall make all corrections and changes necessary for the proper operation of the systems at no cost to the City. After taking corrective action the Contractor shall reinitiate the acceptance test, through the Engineer, as described above.

3.4 NOT USED

3.6 NOT USED

3.7 UTOMATED PHOTO ENFORCEMENT SYSTEM INSTALLATION

A. Install as per manufacturer's instructions, per contract specifications as specified in PART 2 of this Section, and per contract plans.

3.8 CONTROLLER UNIT TERMINATION (TURN-ON OR SWITCHOVER)

A. The traffic signal cabinet will be furnished and installed by the Contractor (unless otherwise specified). The Contractor shall perform the final signal wiring termination by connecting the field wiring to the appropriate terminal location in the controller cabinets. City forces will program the City-furnished controllers and conduct the turn-ons and switchovers.

B. At least 40 calendar days before the first scheduled turn-on/switchover, the Contractor shall pickup from the SFMTA Signal Shop all traffic signal controller cabinets that are to be installed as part of this contract. The Contractor shall install all the traffic signal cabinets and related hardware per the contract plans and specifications.

C. The SFMTA Traffic Signal Shop schedules intersection activations (switchovers for existing signals and turn-ons for new signals) in blocks of months. The Contractor shall submit to the Traffic Engineer, through the Engineer, a proposed schedule of intersection activations (switchovers for existing signals and turn-ons for new signals), no later than 15th day of the month, 2 months before the month that contains the first proposed activation date. For example, activations proposed to start in the month of November shall be submitted no later than the 15th of September. The schedule of activations to occur in a given month shall be considered final after the last day of the month, 2 months before the month that contains the activation dates. For example, the schedule of activations for the month of November shall be considered final after the 30th of September. If the Contractor needs to change the activation schedule after this deadline, the City will reschedule to the next available date. If the rescheduled date is after the contract duration has expired, liquidated damages shall be assessed. The cancellation of scheduled activations by the Contractor or due to the Contractor's failure to perform shall not be grounds for any claim or extension of contract time.

D. Intersection controller turn-ons (new) and switchovers (existing) shall be conducted only on a Tuesday, Wednesday or Thursday provided that none of these days precede or follow an official City holiday. At newly signalized intersections, after the controller has been activated, the signal shall be placed in flashing operation mode for 48 hours in advance of the scheduled first day of normal cycling mode operation. The Contractor's qualified electrician must be present at all times during the turn-on or switchover.

In general, a maximum of two turn-ons or switchovers may be performed within the same working day (maximum of 5 per week). If the Contractor wishes to conduct more than two turn-ons or switchovers on a single day, a written request shall be submitted to the Engineer for review by the Traffic Engineer. If allowed, all the requirements of this section still apply. The request shall explain why the Contractor expects to be able to conduct the proposed activations within the required 2-hour period. More than one activation on a single day will only be allowed with the approval of the Engineer and the Traffic Engineer.

E. If the Contractor cancels activation with less than 7 calendar days notice, the Contractor shall be billed liquidated damages for 8 hours at the appropriate City Electrician hourly rate. Payment shall be made within 15 calendar days in the form of a check made out to SFMTA and be sent to the SFMTA Traffic Signal Shop at 2650 Bayshore Boulevard. Failure to remit payment in a timely manner will result in cancellation of further activations and may lead to prohibitions of bidding on future signal contracts. Activations will not be rescheduled until the check has been received.

F. At new traffic signal locations, the turn-ons shall be scheduled to begin at 9:00 AM. At locations with existing signals requiring a new controller, the switchovers shall be scheduled to begin at a time between 9:00 AM and 10:30 AM. The Contractor shall make all necessary arrangements to complete activations no later than 3:00 PM.

G. The Contractor shall complete all preparatory work and testing by 12:00 noon the day before the scheduled traffic signal controller activation. Testing by the contractor shall include temporarily energizing each individual wire for a short period of time. On the afternoon before a scheduled traffic signal controller activation, the work shall be thoroughly inspected by the Engineer. If the Engineer determines all preparatory work is not satisfactorily complete, the scheduled activation shall be cancelled and re-scheduled

for the next available date (minimum 5 working days notice). A list of outstanding defects will be provided by the Engineer to the Contractor and shall be completed prior to activation.

H. At locations requiring final termination of new field wiring or new controller installations, the Contractor shall have all preparatory work completed to the extent that the time required for the City's Electrician(s) to be present is minimal. It is estimated that the turn-on/switchover should not exceed 2 hours (except as noted elsewhere in plans and specifications). The Contractor shall be billed for expenses incurred by the City (the appropriate hourly rates for City staff) for any time exceeding this limit (for example, as a result of having to reschedule) for this service. Payment shall be made within 15 calendar days in the form of a check made out to SFMTA and be sent to the SFMTA Traffic Signal Shop at 2650 Bayshore Boulevard. Failure to remit payment in a timely manner will result in cancellation of further turn-ons/switchovers and may lead to prohibitions of bidding on future signal contracts.

I. Errors found in mislabeled wiring shall be deemed an "unsafe" condition and the scheduled activation will be immediately cancelled and rescheduled. If the signal cannot be made to work within the allotted 2 hours, the activation shall be cancelled and rescheduled. If a problem occurs during the activation that requires more than 30 minutes time for the Contractor to correct, the activation shall be cancelled and rescheduled.

J. If a required service connection is not completed at least 72 hours in advance of the scheduled activation, the activation will be cancelled.

3.9 INSTALLATION OF POLES

A. The Contractor shall complete installation of new pole prior to removal of existing poles. Relocation of guywires from poles to be removed to new poles will be done by SFMTA Overhead Lines Department. Prior to removal of existing poles, the Contractor shall coordinate with SFMTA Overhead Lines Department (415-279-5406) at least 15 working days prior to pole work and decide upon SFMTA's start of work date that is agreeable to both parties. The Contractor shall include 3 working days for SFMTA to complete guywire work into the schedule.

B. The locations of new trolley poles as shown in the Contract Drawings may be changed to avoid unforeseen obstructions. The exact locations will be determined in the field by the Engineer, where necessary.

C. The Contractor shall mark the proposed location of new poles in the field and request inspection and concurrence from the Engineer and Owners of adjacent utilities prior to starting work.

3.10 MAINTAINING EXISTING TRAFFIC SIGNAL AND STREET LIGHTS IN OPERATION

A. Before commencing the work, the Contractor shall submit in writing to the Engineer a description and detailed schedule of the intended operations relative to keeping the traffic signals, traffic signal interconnect, and street lights in operation.

B. Every day that any field work is to be performed, the Contractor shall provide a list of such locations and a brief description of work to be performed to the Engineer, Traffic Engineer (Fax# 415-701-4737), and the Traffic Signal Shop. Notifications to the Traffic Signal Shop shall be emailed to the following individuals: lauren.green@sfmta.com; ferdinand.lumbad@sfmta.com; laura.munter@sfmta.com;

nilesh.ram@sfmta.com; weisheng.zhang@sfmta.com, ben.murphy@sfmta.com and alan.blank@sfmta.com. Notification shall be made no earlier than 8:00 AM the day before work is to be performed and no later than 8:00 AM the morning work is to be performed. If for any reason the Contractor wishes or needs to work at a new location not included on the list already submitted, a revised list shall be submitted to the parties mentioned above before work starts at the new location. Notification shall also include a 24/7 contact name and number to be used in case of emergency. If the Contractor fails to provide notice as detailed above, liquidated damages shall be assessed at $200 per incident.

C. The Contractor shall similarly notify the Bureau of Light, Heat and Power, (Fax# 415 554-1854), in advance of any work on existing street light equipment.

D. Disconnection of any existing or temporary streetlights shall not be permitted until the new equipment has been tested and properly adjusted.

E. Traffic signal system (intersection controller and signals) shutdowns shall be limited to periods between the hours of 9AM and 3PM. Furthermore, individual signal head shutdowns shall be limited to periods between the hours of 9AM and 4 PM. If necessary, the Contractor shall install or reinstall temporary wiring, at his or her own expense, to put such equipment in service by the times mentioned above. Failure to ensure the signal system is operational by 3PM and each traffic signal head is operational by 4 PM will result in liquidated damages being assessed in the amount of $200 per hour per location. Street lighting system shall be in continuous service from 4 PM of each day to 9 AM of the following day.

Note that Section 15 55 26 Traffic Control may further restrict the hours that signal shutdowns may be conducted.

F. The Contractor shall furnish and install whatever temporary or permanent conduit, overhead and other wiring and equipment as necessary, shall make all connections and do other work necessary to maintain normal signal and street lighting operation and at the conclusion of the need therefore, shall remove all temporary facilities from the site.

G. The Contractor shall temporarily relocate existing City-owned equipment if the present location of equipment conflicts with an installation of this contract.

H. Many traffic signals are interconnected via 12-conductor cable to provide signal coordination. Coordination of the traffic signals shall be maintained every day between the hours of 7-9 AM and 3-6 PM. During all other times, the contractor shall make every effort to maintain the existing coordination. Failure to ensure traffic signal interconnect is operational between the peak periods of 7-9 AM or 3-6 PM will result in liquidated damages being assessed in the amount of $200 per intersection per peak period.

I. The Contractor shall be completely responsible for the maintenance and continuity of operation of any temporary electrical facility installed by the Contractor.

J. Lamps (LEDS) in traffic signal heads installed or relocated by the Contractor that burn out during the life of the contract shall be replaced by the Contractor with new approved traffic signal rated lamps.

K. Lamps in street light luminaires installed, relocated or worked on by the Contractor that burn out during the life of the contract shall be replaced by the Contractor with new, equal lamps.

L. The cost of electrical energy for any temporary facility will be borne by the City but the Contractor shall bear all costs of any temporary service connections.

M. Newly installed vehicular signals, pedestrian signals and pedestrian push buttons shall be covered by black plastic bags and securely taped until the time they are activated for operation. Existing signals and pedestrian push buttons that are no longer in service shall similarly be covered until they are removed. Duct tape shall not be applied directly to any traffic signal equipment.

N. All work and expenses for maintenance of existing traffic signal and streetlights in operation shall be done as incidental work to traffic signal work of this contract.

3.11 MAINTENANCE, RELOCATION, AND REMOVAL OF EXISTING TRAFFIC CONTROL, STREET NAME, AND OTHER CITY SIGNS

A. Before commencing any work, the contractor shall submit completed Sign Inventory Forms as part of the Traffic Control Plan submittal.

B. The Contractor shall maintain all signs listed on the Sign Inventory Form at a given intersection until the switchover or turn-on has been completed AND thirty (30) calendar days have passed since the Contractor has notified the Engineer in writing that all pole installation and relocation work has been completed and all signs have been temporarily relocated. Such notification will not be accepted until the signal switchover or turn-on has been completed.

Absent such written notification, the Contractor shall maintain all signs listed on the Sign Inventory Form at a given intersection until thirty (30) calendar days after the City has determined the entire contract to be substantially complete.

C. Signs, as required by the persecution of work, to be removed by the Contractor as City property shall be returned to the Sign Shop within 3 calendar days of removal or the Contractor shall be assessed liquidated damages in the amount of $100 per day per sign for each calendar day said sign(s) are not returned. In addition, the Contractor shall be assessed liquidated damages in the amount of $100 per hour per sign for signs deemed missing that were required to be maintained by the Contractor.

D. The Contractor shall temporarily relocate all traffic control, street name, and other City signs, as required for the prosecution of the work and to prevent interference with traffic signal installations, and shall satisfactorily maintain such signs in place at all times with ¾” type 201 stainless steel 0.03 inch thick straps and buckles both with an average 2,250 lbs breaking strength. The contractor shall similarly relocate, or remove and salvage as City property, the standards for such signs. The contractor shall salvage standards in their entirety, and remove any concrete therefrom.

E. The temporary relocation of each arterial STOP or other traffic regulatory sign shall be done immediately upon its removal, and to a locations as close as possible to the original position of such sign, or where directed by the Engineer. The contractor shall remove, and salvage as City property, existing arterial “STOP” or other signs superceded by traffic signals installed by the contractor, immediately upon being notified by the Engineer that such signals will remain in operation.

F. When specifically shown on the plans, the contractor shall either permanently relocate traffic control and other signs and standards to the locations shown, or shall remove, salvage, load, haul, and deliver them as City property to the SFMTA Traffic Sign Shop at 1508 Bancroft Avenue, San Francisco, CA 94124, telephone 415-558-7936, and place them as directed. Each sign returned to the Sign Shop shall be tagged and labeled

providing such information as location and the direction sign was facing prior to its removal.

G. The work of this article shall be considered incidental and no separate payment will be made therefore.

3.12 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT

A. Removing, reinstalling or salvaging electrical equipment shall be in accordance with Section 86-7 of the 2010 CTSS, " Removing, Reinstalling or Salvaging Electrical Equipment," and this Project Manual.

B. In addition to Section 01 71 33, Part I, 1.4A (Safeguarding of Existing Facilities) and Section 00 72 00, Article 3, 3.19 (Indemnification), the following shall apply:
1. If existing equipment, required to be salvaged, is damaged by the Contractor or by others when such equipment is within the Contractor's control, repairs shall be made at the Contractor's expense to the satisfaction of the Engineer.
2. If pole(s) and equipment are to be removed and salvaged, the equipment shall be removed from poles before delivering to City yard(s).
3. If such equipment is lost prior to or during delivery to the City, deductions shall be made from final payment in accordance with the following table:

EQUIPMENT	**DEDUCTION**
Vehicle Signal Head	$200 per section
Programmed Visibility Signal Head	$500 per section
Pedestrian Signal Face	$150 each
Traffic Signal Mounting Assembly	$100 each
Red, Yellow, or Green Vehicular LED module	$100 each
Pedestrian LED module	$100 each
Traffic Signal Standard	$350 each
Traffic Signal Controller and Cabinet	$3,000 each
Lighting Standard	$400 each
Metal Lids from Cast-In-Place Pull Boxes	$200 each

C. If repairs required to be made by this Section of the Specifications are not to the satisfaction of the Engineer, the respective equipment shall be considered as lost. Deduction from final contract pavement shall be made in accordance with the above table.

D. The listing of the above equipment and payment adjustments does not preclude the City from making claims or adjustments for other existing equipment, which may be lost or damaged by the Contractor.

3.13 DELIVERY OF SALVAGED EQUIPMENT AT CITY YARDS

A. The Contractor shall deliver all existing traffic signal equipment specified to be salvaged as City property to the Traffic Signal Shop Yard at 2650 Bayshore Boulevard, Daly City.

B. The Contractor shall deliver all existing street lighting equipment specified to be salvaged as City property to the Bureau of Light, Heat and Power, 635 Bryant Street, San Francisco.

C. The Contractor shall furnish the Engineer with a receipt dated and signed by City Yard personnel stating the number, description and condition of materials delivered.

D. Deliveries shall be between 9:00 A.M. and 3:00 P.M. Appointments for the delivery of salvaged equipment shall be made at least twenty-four (24) hours in advance as follows:
1. Traffic Signal Equipment – The Traffic Signal Division
   Telephone No.: (415) 550-2736
2. Traffic Signs – Traffic Sign Division
   Telephone No.: (415) 558-7936
3. Street Lighting Equipment – BLHP Maintenance Yard
   Telephone No.: (415) 495-5576 or
   Telephone No.: (415) 554-0729

E. Traffic signals shall be removed from poles and disassembled. Each traffic signal shall be tagged and labeled providing the minimum following information; Intersection, specific corners and traffic direction facing.

F. Signals and mountings shall be separated and delivered on pallets. The Contractor shall provide two laborers and any lifting equipment (crane) required to unload the traffic signal salvaged equipment from the Contractor's truck. No forklift is required from the Contractor. City will provide direction.

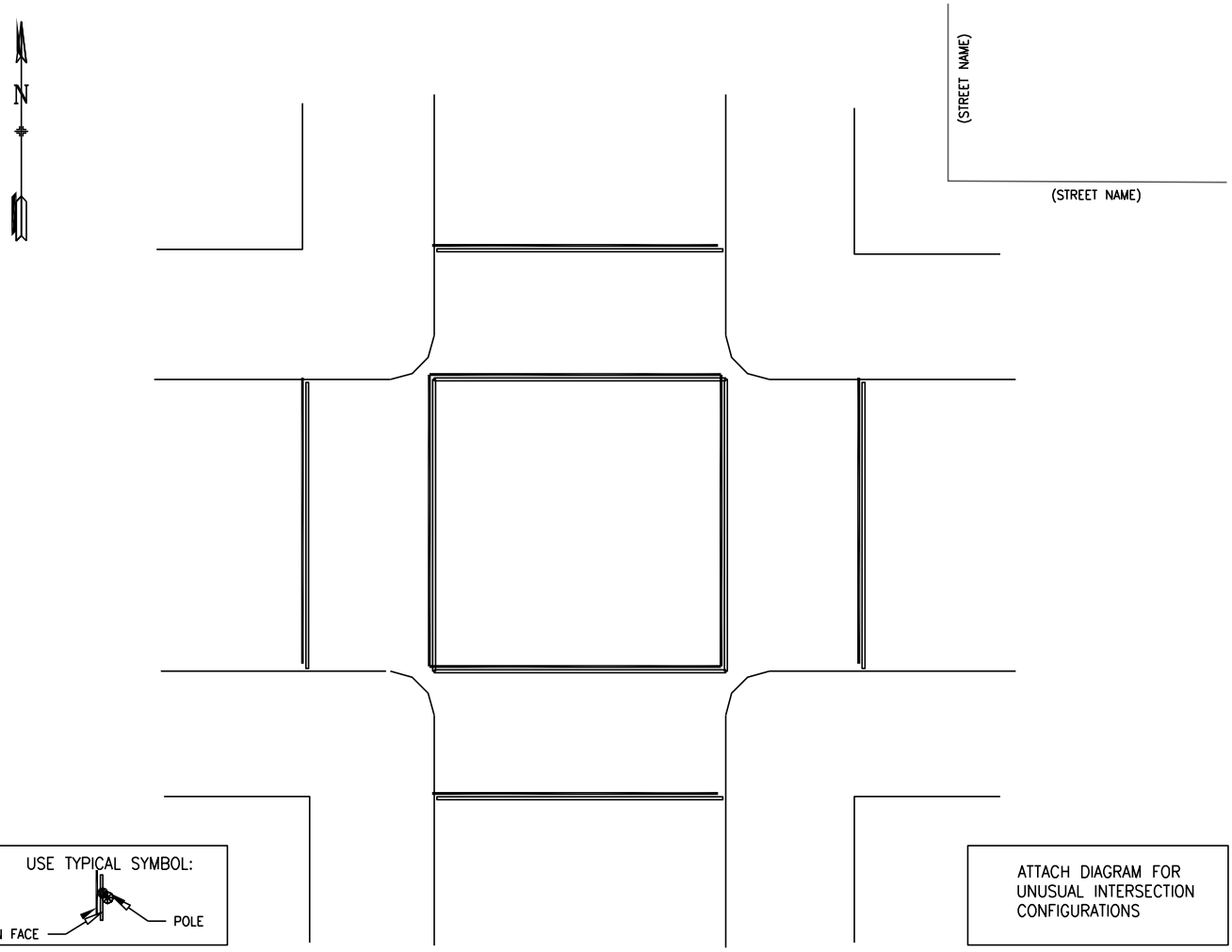
G. The contractor shall collect the existing metal covers and metal frames from the existing pull boxes which house the 12/C cable when they are no longer needed. Upon collecting all the metal covers, the Contractor shall stack and bind them neatly on a palette for delivery to the Traffic Signal Shop at 2650 Bayshore Boulevard. The Contractor shall call the Traffic Signal Shop at 415 550-2736 to schedule a date and time to deliver the palettes.

H. The contractor shall remove and sort all pedestrian signal and vehicle signal LED units into separate colors and/or types before delivering them to the Traffic Signal Shop. For example, all the green vehicle signal LED units should be in one box labeled "green vehicle LED units" and all pedestrian signal countdown units in one box labeled "countdown units".

3.14 NOT USED

END OF SECTION

APPENDIX “A” TO SECTION 34 41 13
SIGN INVENTORY FORM



CODE	TYPE OF SIGN
1	STREET NAME (TYPICAL, BLACK ON WHITE)
2	STREET NAME (LARGE, WHITE ON GREEN)
3	STOP
4	DO NOT ENTER
5	NO U TURN
6L	ONE-WAY LEFT
6R	ONE-WAY RIGHT
7	NO TURNS
8	NO TURN ON RED

CODE	TYPE OF SIGN
9L	NO LEFT TURN
9R	NO RIGHT TURN
10	
11	
12	
13	
14	
15	
16	

SIGN INVENTORY DIAGRAM

DPT FORM 3/16/2001 Rev.

COMPLETED BY:	DATE:	DPT REVIEWED:	DATE:
RE REVIEWED:	DATE:		

APPENDIX “B” TO SECTION 34 41 13
SUBMITTAL, REVIEW, AND DELIVERY TIME ALLOWANCES

Section 34 41 13 Appendix B
Table 1 – Submittal, Review, and Delivery Time Allowances

	Calendar Days	Time Requirement Restrictions on Submittal Task
Product Data and Shop Drawings	7	Maximum number of days after notice to proceed that product data and shop drawings can by submitted by Contractor
	21	Maximum number of days City has to review product data and shop drawings
	14	Maximum number of days Contractor has to resubmit product data and shop drawings, if necessary
	14	Maximum number of days City has to review resubmittals, if necessary
Samples	30	Maximum number of days City has to inspect and test samples after paper submittals have been approved by the City
	14	Maximum number of days Contractor has to resubmit samples, if necessary
	14	Maximum number of days City has to inspect and test new resubmitted samples, if necessary
Additional Requirements for Traffic Signal Controllers and Cabinets	7	Maximum number of days after approval of controller and cabinet samples that Contractor shall submit copies of purchase orders to the Signal Shop
	60	Minimum number of days before the scheduled turn-on that that Contractor must deliver the controllers to the Signal Shop

Notes:
1. The above time allowances shall not be changed due to unrelated contract time extensions.

Appendix G

FORM OF BUSINESS RULES QUESTIONNAIRE

[A PDF of the Business Rules Questionnaire is available upon request.]