SECTION 02 22 10
PIER DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Demolition and removal of piers and associated structures.
   2. Disconnecting, capping or sealing, and removing site utilities.
B. Related Sections:
   1. Section 311000 "Site Clearing“ for site clearing and removal of above- and below-grade site improvements not part of pier demolition.

1.3 DEFINITIONS
A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.
B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.
C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.4 MATERIALS OWNERSHIP
A. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
   1. Coordinate with Owner’s project manager, who will establish special procedures for removal and salvage.
1.5 SUBMITTALS

A. Qualification Data: For demolition firm and professional engineer.

B. Demolition Work Plan: Address all environmental requirements, construction equipment operations, schedule of activities, tenant relations, disposal, recycling, etc. Schedule of Pier Demolition Activities shall include the following:
   1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Coordination for shutoff and capping and continuation of utility services.
   4. Locations of temporary protection and means of egress, including for other tenants affected by pier demolition operations.
   5. Coordination of Owner’s continuing occupancy of adjacent piers and partial use of premises.

C. Dust Control and Pollution Prevention Plans

D. Health and Safety Plan

E. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

F. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements (including finished surfaces) that might be misconstrued as damage caused by pier demolition operations. Submit before the Work begins.

G. Landfill Records: Indicate receipt and acceptance of hazardous wastes, including creosoted treated wood waste, by a landfill facility licensed to accept wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: A firm with a minimum of 3 years experience in demolition of marine structures.

B. Regulatory Requirements: Comply with governing BAAQMD notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with the regulatory requirements of the City’s dust control and recycling ordinance.


D. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to pier demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be demolished.
   2. Review structural load limitations of existing structures.
   3. Review and finalize pier demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

A. Pier areas to be demolished will be vacated prior to the start of Work. The majority of the pier areas are inaccessible to the public due to poor condition.

B. Demolition will be occurring in a navigable waterway. Contractor shall keep waterways open to allow access to and continued use of existing facilities.

C. Buildings immediately adjacent to demolition area will be occupied. Conduct pier demolition so operations of occupied buildings will not be disrupted.
   1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
   2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
      a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

D. Owner assumes no responsibility for pier structures to be demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

E. Creosote Treated Wood Waste (CTWW): It is expected that wood treated with creosote will be encountered in the Work. All timber piles are assumed to be creosote treated, other timbers and wood may be creosote treated.
   1. Contractor's work includes identifying, handling, storing, transporting, and disposing of CTWW.
   2. Manage CTWW under Title 22 CA Code of Regulations, Division 4.5, Chapter 34.
   3. For disposal of CTWW, submit a copy of each completed shipping record and weight receipt to the Engineer within 5 business days of disposal.
   4. Provide training to personnel who handle CTWW or may come in contact with CTWW including:
      a. All applicable requirements of Title 8 CA Code of Regulations.
      b. Procedures for identifying and segregating CTWW.
      c. Safe handling practices.
      d. Requirements of Title 22 CA Code of Regulations, Division 4.5, Chapter 34.
      e. Proper disposal methods.
   5. Store CTWW in such a way as to prevent any run-off and to keep debris secure and prevent any unauthorized access.
6. Resize and segregate CTWW at a location where debris from operations including sawdust and chips can be contained. Collect and manage the debris as CTWW.

7. Provide water resistant labels that comply with Title 22 CA Code of Regulations, Division 4.5, Chapter 34, to clearly mark and identify CTWW and accumulated areas. Labels must include:
   a. Port of San Francisco, Contract Name and Number.
   b. Pier 90, San Francisco, CA 94124.
   c. Engineer’s name, address and telephone number.
   d. Contractor’s contact name and telephone number.
   e. Date placed in storage.

8. Before transporting CTWW, obtain an agreement from the receiving facility that the treated wood waste will be accepted. Protect shipments of treated wood waste from loss and exposure to precipitation. Where 10,000 pounds or more of CTWW is generated, request a hazardous waste generator identification number from the Engineer at least 5 business days before the first shipment. Each shipment must be accompanied by a shipping record such as a bill of lading or invoice that includes:
   a. Port of San Francisco
   b. Construction Contract Number
   c. Port of San Francisco address
   d. Engineer’s name, address and telephone number
   e. Contractor’s contact name and telephone number
   f. Receiving facility name and address
   g. Waste description: treated wood waste (preservative type)
   h. Project Location
   i. Estimated quantity of shipment by weight or volume
   j. Date of transport
   k. Date of receipt by the receiving waste facility
   l. Weight of shipment as measured by the receiving waste facility
   m. For projects with 10,000 pounds or more of CTWW, include the generator identification number.

9. The shipping record must be at least 4-part carbon or carbonless 8-1/2” x 11” form to allow retention of copies by the Engineer, transporter, and disposal facility.

10. Dispose of CTWW at an approved facility. A list of currently approved facilities may be viewed at:

11. Dispose of CTWW promptly, and within no more than 90 days after generation.

12. Full compensation for handling, storing, transporting, and disposing of CTWW, including personnel training, is included in the contract price.

F. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's and other tenant’s on-site operations.
PART 3 - EXECUTION

3.1 DEMOLITION FIRMS

A. Demolition Firms:
   1. Qualified Demolition Firms will be selected by Owner to perform the Work of this Section.

3.2 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of pier demolition required.

B. Review Project Record Documents of existing construction provided by Owner (The Port of San Francisco). Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged.

D. When unanticipated mechanical, electrical or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Owner.

E. Engage a professional engineer to perform an engineering survey of condition of the pier to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

F. Verify that hazardous materials have been remediated before proceeding with pier demolition operations.

3.3 PREPARATION

A. Existing Utilities: Refer to other Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.

C. Removed and Salvaged Items: Comply with the following:
   1. Clean salvaged items of dirt and demolition debris.
   2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Engineer, items may be removed to a suitable protected storage location during demolition, cleaned, and reinstalled in their original locations after demolition operations are complete.

C. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
   a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent piers, buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around pier demolition area and to and from occupied portions of adjacent buildings and structures.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to pier demolition operations.

E. Protection of the Bay
1. Contractor will provide and deploy a floating debris barrier and absorbent boom and blanket to capture any debris, soil, or oil that could be released from the demolition, access or staging areas. Discharge of sawdust, wood, and other particulates is to be minimized to the greatest extent practicable. The absorbent and containment boom shall be deployed and maintained to prevent any floating debris from escaping the work area, and material will be collected from within the containment at least twice daily. The floating debris barrier shall not be removed until a final inspection of the demolition by the Engineer has been made.
2. The Contractor will provide spill containment and clean-up materials on-site through the duration of the Work.
3. Construction equipment will be maintained and fueled in areas where accidental spills could not reach the bay.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated existing structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain adequate ventilation when using cutting torches.
3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from pier demolition activities.

C. Site Access and Temporary Controls: Conduct pier demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Remove structures and site improvements intact when permitted by authorities having jurisdiction.

B. Proceed with demolition of structural framing members systematically, from higher to lower level.

C. Remove debris from elevated pier by chute, hoist, or other device that will convey debris to container in a controlled descent.

1. Remove structural framing members and lower to container by method suitable to minimize ground impact and dust generation.

D. Below-Grade Construction: Abandon timber piles and other below-grade construction. Cut below-grade construction five feet below mudline.

E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.7 DEMOLITION BY EXPLOSIVES
A. Explosives: Use of explosives is not permitted.

3.8 SITE RESTORATION
A. Remove all debris from within the boundary of the pier demolition.
B. Remove all debris generated from demolition activities.

3.9 REPAIRS
A. General: Promptly repair damage to adjacent construction caused by demolition operations.
B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.10 DISPOSAL OF DEMOLISHED MATERIALS
A. Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, remove demolished materials from Project site and legally dispose of them in a State-regulated landfill or recycling facility.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. See other requirements in this section for creosote treated wood waste.
B. Do not burn demolished materials.

3.11 CLEANING
A. Clean adjacent structures and improvements of dust, dirt, and debris caused by pier demolition operations. Return adjacent areas to condition existing before pier demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 22 10
SECTION 02 32 27

FORFORCE MAIN MONITORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes monitoring of existing San Francisco Public Utilities Commission (SFPUC) 60” Force Main during pile driving and subsequent construction activities.

B. Related Requirements:
   1. Section 03 30 00 “Cast-in-Place Concrete”
   2. Section 03 41 00 “Precast Structural Concrete”
   3. Section 05 12 50 “Prefabricated Steel Truss Bridge”
   4. Section 09 90 00 “Coatings”
   5. Section 31 62 16 “Steel Pipe Piles”

1.3 SUBMITTALS

A. Monitoring Instruments and Equipment Data.

B. Monitoring Program Plan.

C. Emergency Response and Repair Plan.

D. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.4 FIELD CONDITIONS

A. Protect structures, underground utilities, and other construction from damage caused by pile driving.

   1. The Contractor’s attention is directed to the presence of a San Francisco Public Utilities Commission (SFPUC) 60-inch sewer force main located on the Tulare Park project site.
PART 3 - EXECUTION

3.1 GENERAL

A. The work on the pedestrian bridges over and adjacent to the SFPUC’s 60-inch force main may only be done during the dry weather period, as a precaution, in case damage is done to the pipe and the force main could not be used, and the SFPUC would need to discharge to Islais Creek.

3.2 REGULATORY COMPLIANCE

A. The Contractor shall be responsible for any direct or indirect damage and the maintenance and repair of work required to repair any damage caused by the Contractor’s work to the City's existing 60 inch Southeast Plant Booster Pump Station force main system, and related facilities and improvements (collectively, "City Facilities").

B. Regulatory Compliance. Contractor acknowledges that City's operation of the City Facilities is subject, in part, to regulatory permitting requirements, including without limitation, and that upon violation of any such permits, City may be subject to significant fines and liability for unauthorized discharges. Contractor agrees to reimburse City, promptly upon request, for any regulatory fines, penalties or liability related to or in any way caused or exacerbated by the work performed by the contractors or agents under this contract.

3.3 FORCE MAIN VIBRATION AND LEVEL MONITORING

A. Contractor shall use extreme care and take all precautions. Contractor shall carefully pothole at pile locations to the necessary depth to locate all existing utilities and other improvements prior to pile driving operations.

B. Existing Pipelines:

1. Contractor is advised that an existing large diameter combined storm and sewer force main is installed in Tulare Park in close proximity of the pile driving operations. The force main alignment begins at the existing booster pump station. The force main alignment then proceeds to the north, crossing under the Islais Creek channel. The alignment then turns to the east, crossing under Third Street and proceeding easterly paralleling the north shoreline. The pipeline is installed without pile supports, and therefore may be subjected to settlement due to pile driving operations. The contractor is advised that the pipeline has experienced significant total and differential settlements and has limited tolerance of additional total and differential settlements.

2. Reference drawings indicating the as-built alignment of the pipelines can be obtained from the Engineer and will be made available upon request.

C. Contractor’s Monitoring Program Plan

1. Contractor shall prepare and submit to the Engineer a plan for monitoring and protection of the pipelines during pile driving operations at the Pedestrian Bridge. The plan shall be
submitted to the Engineer for approval before the Contractor begins foundation work at the bridge. No work shall be initiated at the site without the SFPUC’s approval of the plan. The SFPUC requires two weeks for the review of the plan. The contractor shall engage an instrumentation specialist subcontractor to install the instrumentation and perform the required monitoring. The plan, as a minimum, shall provide the following information:

a. List of equipment to be used.
b. Special accessories to be used to reduce vibration.
c. Methods to be used for pile driving to meet specified deflection and vibration limits on pipe. The minimum requirement is to pre-drill, use H-piles, or open ended steel pipes to minimize soil displacement during pile driving, and to also minimize vibrations. If this method produces vibration beyond the specified limits then the contractor must use another method to reduce the vibration.
d. Monitoring Program limits.
e. Monitoring Program execution (type of measurements and frequency of measurements). The contractor shall provide the qualifications of the specialist instrumentation subcontractor, and shall include a minimum of five years of experience with instrumentation projects of the scope and type expected for this project.
f. Name and qualifications of Contractor’s representative responsible for setting the instrumentation and performing the monitoring of pipe movements and vibrations during pile driving operation. Contractor’s representative setting the instruments and monitoring movement shall be instrumentation engineer with expertise in installing and monitoring instruments. If survey methods are planned to be used to monitor settlements and lateral deformations, they shall be performed by an independent State of California licensed surveyor. Contractor’s representative monitoring the vibration shall be an independent State of California licensed Geophysicist, or an instrumentation specialist with at least five years of experience in vibration monitoring.

2. Contractor shall monitor the movements of the pipeline continuously on a daily basis during pile driving operations. At a minimum, measurements shall be made prior to and after driving of each pile. If any movement is detected, Contractor shall notify the Engineer immediately, and continue to monitor the movement of the pipeline until such time the monitoring results indicate no movement during a 10-day period. City reserves the right to stop pile driving operations if movement or vibration exceeds specified limits, or the force main begins leaking or is damaged in any way. Contractor shall immediately notify the Engineer and stop pile driving operations if damage or leaking is observed. Contractor shall immediately implement the emergency response and repair program and take the necessary protection provisions to stop further movement and damage.

3. Contractor shall furnish all tools, equipment, and materials necessary to install, calibrate and maintain all monitoring instruments, protect them from damage during construction, and all necessary instruments required for the monitoring program. The installation work shall include all surveying, excavating, backfilling, dewatering, and mounting hardware required to install the monitoring instruments. Contractor shall provide full access, cooperation and full support to the instrumentation specialist during instrument installation and monitoring. The instrumentation shall remain on the force main after completion of the pile driving.
4. Contractor shall provide the instrument specifications including manufacturer, model and serial numbers, range, accuracy (at least ± 0.1 in/sec qualify over 1 in/sec for geophones and at least ± 0.05 inch qualify over ½ inch for survey), calibration procedures, minimum number of sensors, installation requirement including adhesion type, power supplies (voltage, amperage, frequency), calibration test requirement, maintenance requirement, and other parameters. Monitoring instruments shall be waterproof, dustproof, vibration and shock-proof, and designed for operation in the project environment. Manufacturer of instruments shall have a proven track record of at least 5 years in the manufacturing of instruments and in the providing of technical support in the United States. The SFPUC reserves the right to reject any manufacturer that is not in compliance with the above requirements.

5. Contractor’s personnel responsible for the installation of the monitoring instrumentation and personnel performing the monitoring shall have a minimum of five years experience and have completed successfully at least five projects with the same scope of services as this project for instrumentation work. Contractor shall provide substantiation in the form of certification and resumes to the Port’s Representative for approval of such personnel.

D. CONTRACTOR’S EMERGENCY RESPONSE AND REPAIR PLAN

1. Contractor shall prepare and submit to the Engineer an emergency response and repair plan indicating the procedures to be taken in the event excessive settlement, damage to the pipeline, or leaking is observed. The plan shall be submitted to the Engineer for approval before the Contractor begins foundation work at the bridge. The plan will be reviewed by the Engineer and representatives from the San Francisco Public Utility Commission. The plan shall be comprehensive and include the following as a minimum:

   a. List of stand-by emergency equipment to be used in the event of a pipeline incident. Include response times and locations where equipment is stored.
   b. List of stand-by personnel and response times for all personnel required to implement the emergency response and repair plan.
   c. Mitigation measures to be taken to stop movement of the pipeline, including recommending methods of supporting the pipeline to stop further movement, and repair methods to repair damaged segment of the pipeline. Special repair procedures and repair materials and parts necessary for the repairs of the pipeline, and the time line for their purchase and delivery shall be addressed in the plan. Contractor’s plan shall clearly address repair provisions including methods and materials to be used at the pipe joints.
   d. Name and qualifications of Contractor’s representative responsible for coordinating the response and repair team.
   e. Recovery plan defining operations to stop settlement and vibrations that are exceeding allowable limits.
   f. Corrective action plan to provide support to the pipeline required to prevent damage and leakage.

2. Contractor, along with the response and repair personnel and equipment shall remain working at the site, on a multiple shift, 24-hour basis until proper repairs are implemented and no further leaking is observed.

E. LOCATION OF VIBRATION MONITOR
1. Force Main: The contractor is directed to conduct vibration monitoring during the driving of the first pile, and during the driving of all piles that are located within twenty-five feet of the force main. Vibration monitoring equipment must be placed on the force main face at each location where piles are planned to be driven within 25 feet from the pipe, at the closest point of the pipe to the pile driving. The vibration monitoring plan shall be submitted to the Engineer for approval.

F. LOCATION OF FORCE MAIN LEVEL MONITOR

1. A survey of the top of the pressurized manhole at 10 foot intervals along the section of the pipe that is located within 30 feet from each pile cap.

G. MONITORING CRITERIA FOR FORCE MAIN AND OUTFALL PIPELINE

1. Allowable Deflection: Contractor shall take all measures to protect the force main and outfall pipeline during pile driving operations. The maximum allowable differential settlement of the pipeline is ½-inch along 30 lineal feet or total movement (horizontal and vertical) at any measuring points exceeding 1-1/2 inches. Contractor shall perform the monitoring continuously and provide the monitoring results to the Engineer at the end of each pile driving shift. The raw data shall be presented along with an easy graphical representation. The results shall be certified by an independent State of California licensed surveyor. If the measurements show deformations or vibrations exceeding the specified limits, the Contractor shall immediately notify the Engineer and stop pile driving operations. Contractor shall immediately make the necessary protection provisions to stop further movement.

2. Allowable Vibration: Contractor shall also take all precautionary measures to protect the force main and outfall pipeline from excessive vibration during pile driving operations. The maximum allowable vibration recorded at any pipe section is 0.5 inch per second. Contractor shall perform the monitoring continuously and provide the monitoring results to the Engineer at the end of each pile driving shift. The raw data shall be presented along with an easy graphical representation. The results shall be certified by an independent State of California licensed Geo-Physicist, or an instrumentation specialist with a minimum five years of experience in vibration monitoring and shall be certified by an independent State of California Certified Geotechnical Engineer. If vibration exceeding 0.5 inch per second is detected, Contractor shall immediately notify the Engineer and stop pile driving operations. Contractor shall immediately make the necessary protection provisions to reduce vibration.

3. Work Stoppage Due to Pipeline Damage: Contractor is advised that damage to the force main that results in the discharge of effluent into the Islais Creek channel will result in work stoppage and may result in fines, assessed by Federal/State and local agencies. Damage to the outfall pipeline shall be repaired immediately. Contractor shall submit repair plan and pay all costs associated with the repairs, in addition to all fines assessed at no additional cost to the City. Cost associated with work stoppages and schedule delays shall be borne by the Contractor.

H. Contractor shall contact the designated PUC Inspector 48 hours prior to any work affecting the Islais Creek force main. Inspector can be reached through the Port’s Representative.

I. In the event of damage, displacement or leakage of the Islais Creek force main, Contractor shall notify the Southeast Water Pollution Control Plant at (415) 920-4600 immediately.
J. Contractor shall be responsible for protecting instruments from damage caused by any reason. In case damage occurs to the instruments, Contractor shall promptly repair or replace the damaged instrument prior to the next pile driving activities. The Port’s Representative reserves the right to stop pile driving operations until instruments are replaced or repaired. Cost associated with work stoppages and schedule delays shall be borne by the Contractor.

K. The Port’s Representative reserves the right whether or not to relocate instruments, abandon or repair damaged instruments or modify installation procedures.

L. Contractor shall be responsible to avoid any heavy activity or traffic adjacent to the project site to the greatest extent possible during pile driving activities. Heavy pile driving equipment shall be kept no closer than 10 feet from the existing pipe, and no materials shall be allowed to be stored on top or in the immediate vicinity of the pipe.

M. Contractor shall be responsible for the repair of all adjacent structures and utilities that might be damaged due to failure of force main or outfall pipeline.

3.4 FORCE MAIN EMERGENCY RESPONSE REQUIREMENTS

A. Plan Description: Pile driving and excavation are planned in close proximity to the Southeast Plant Booster Pump Station 60-inch force main. In the event that these activities damage the 60-inch force main, this section outlines the required emergency procedures.

B. Procedures: Two sets of procedures are required depending on whether a leak or a break has occurred.

1. Pipe Leak: This is damage where the pipe and joints are still intact and the leak can be repaired with seals and concrete.
   a. If the leak is small then the force main will be kept in operation until a crew can be mobilized for pipeline repair.
   b. The leaking sewage must be contained. The contractor will need to excavate, install sheet piling, and pump the leaking sewage to an appropriate sanitary sewer manhole or containment facility.
   c. Detection: The area will show moisture. Force main survey points may have moved.
   d. Repairs:
      1) Weko Seals installed inside the pipe.
      2) Smith-Blair seals installed outside the pipe.
      3) Epoxy grout may be used as appropriate to repair leaks, but pipe joints must remain flexible.
   e. Contractor Action:
      1) Call SFPUC Operations (415) 920-4700
      2) See call list for other telephone numbers needed.
      3) Contain and remove leaked sewage. Mobilize, carefully excavate around area of leak, drive sheet piles for containment, put in pumps to pump to local sewer.
4) Obtain vactor trucks (SFPUC sewer Operations may be able to respond at 415-641-2622).

f. The leaking sewage can be pumped to a manhole located at the intersection of Illinois and Marin Streets.

1) If the force main manhole is opened for access, the gasket will need to be replaced.
2) Obtain and install Weko and Smith-Blair seals. SFPUC has 2-60” Weko seals and one Smith-Blair repair seal available.
3) SFPUC Operations must coordinate all entry into the force main which is a confined space.
4) Call divers to inspect the force main and install Weko Seals.

g. SFPUC Action:

1) Shutdown SEP Lift Station, Northshore Pump Station, Channel Pump Station and SEP Booster Pump Station.
2) Supply Weko Seals and installation tool (2 Weko Seals in SEP Dryer Building, installation tool in SEP 940 Tool Room).
3) Supply Smith-Blair Seal (1 seal for 60-inch rep in Rankin Pump Station Yard, rubber gasket in box in SEP 940 Shops).
4) Sewer Operations may supply vactor trucks (Herb Dang 415-641-2622).
5) Contact SFPUC’s liaison to Water Resources Board, Laura Pagano at (415) 554-3109.

2. Pipe Break: This is damage where the pipe or joints are not intact. Leak will require new pipe sections and Smith-Blair couplers.

a. The leaking sewage must be contained. The contractor will need to excavate, install sheet piling, and pump leaking sewage.

b. Detection: The force main will be visibly discharging water and eroding the ground.

c. Repairs:

1) Replace pipe sections
2) Install Weko Seals and Smith-Blair Seals.
3) Epoxy grout may be used as appropriate to repair leaks, but pipe joints must remain flexible.

d. Contractor Action:

1) Call SFPUC Operations (415-920-4700)
2) See call list for other telephone numbers needed
3) Contain and remove leaked sewage. Mobilize, carefully excavate around area of leak, drive sheet piles for containment, put in pumps to pump to local sewer.
4) Obtain vactor trucks (SFPUC sewer Operations may be able to respond at 415-641-2622).
e. Any sewage that ponds is to be pumped into a manhole located at the intersection of Illinois and Marin Streets.

1) Replace gaskets on all pressurized covers removed off of force main.
2) Obtain and install Weko and Smith-Blair seals. SFPUC has 2-60 inch Weko Seals and one Smith-Blair coupling available.
3) Pump out residual water after shutdown to the manhole at Illinois and Marin Streets.
4) SFPUC Operations must coordinate all entry into the force main which is a confined space.
5) Call divers to survey pipe for internal damage. Replace pressurized manhole covers with new gasket.

f. SFPUC Action:

1) Shutdown SEP Lift Station, Northshore Pump Station, Channel Pump Station, and SEP Booster Pump Station.
2) Supply Weko Seals and installation tool (2 Weko Seals in SEP Dryer Building, installation tool in SEP 940 Tool Room).
3) Supply Smith-Blair Seal (1 seal for 60 inch pipe repair, rubber gasket)
4) Sewer Operations may need to supply vactor trucks (Herb Dang 415-641-2622)
5) Contact SFPUC’s liaison to Water Resources Board, Laura Pagano (415) 554-3109.

C. Contact List:

1. SFPUC Operations (Chief of watch): (415) 920-4700
2. SFPUC Bayside Operations Superintendent: George Engel (415) 920-4944
3. SFPUC Bayside Operations Chief: Wes Eng
4. SFPUC Engineering Manager: Brian Henderson (415) 920-4949
5. SFPUC Engineering Liaison: Meei-Lih Ahmad (415) 920-4913
6. SFPUC Sewer Operations (Vactor Trucks): Herb Dang (415) 641-2622
7. SFPUC Maintenance Manager: John Powell (415) 920-4942
8. SFPUC Water Resources Board Liaison: Laura Pagano (415) 554-3109

D. The Contractor shall provide the following contact information:

1. Company Name:
2. Phone Number:
3. Construction Company Superintendent Name and Phone Number:

E. Diking Plan:

1. Contractor shall respond to all leaks by initially and concurrent to all other activities constructing an earthen dike. Project Construction Documents contain a topographic map that covers the project area and area immediately adjacent to the work site.

F. Standby Equipment:
1. The Construction Contractor shall provide the following equipment to respond to and implement the procedures of this Section.

   a. Vacuum Extraction Truck
   b. Backhoe Cat 225 or similar with 25-foot reach
   c. Concrete Source with Trucks
   d. Speed Shores
   e. Trenching shield or equal

END OF SECTION 02 32 27
SECTION 02 99 00
LANDSCAPE MAINTENANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnishing and implementing a complete landscape maintenance program to maintain all planting areas from time of delivery through the (365) three-hundred-sixty-five-day Plant Establishment Period and Final Completion, in accordance with SSDPWSF, SECTION 1008 Maintenance And Plant Establishment. The Work includes but is not limited to:

1. The watering, cultivating, fertilizing, weeding, seeding, re-staking, tightening and repairing of staking, and maintenance/replacement of mulching of all plant material in this contract.

2. The resetting of plants to proper grades or upright positions.

3. Restoration of watering basins as directed by the City Representative.

4. Contractor is to take all necessary measures to keep plants pest and disease free and in thriving condition.

5. Restoration of finish grades by replenishing planting areas with soil; replacing eroded soil, or soil made sterile by herbicidal application, with approved and tested import topsoil, taking precautions as necessary to prevent windburn damage.

6. Remove surplus earth, debris, litter and trash from all planting areas and dispose properly off-site. The planting areas shall be maintained regularly and be neat and clean at all times.

7. Maintenance of irrigation system, controller and repair of any vandalized or non-functioning irrigation heads or components.

B. Section also includes notification of SF Port prior to completion of the Plant Maintenance Period.

1.02 RELATED WORK

A. Section 32 80 00 – Landscape Irrigation Design-Build
B.  Section 32 90 00 - Planting
C.  Section 32 91 19 – Planting Preparation

1.03 REFERENCE STANDARDS

A.  SSDPWSF - Section 1008 - Maintenance and Plant Establishment

1.04 WARRANTY

A.  Refer to Section 32 90 00 Planting.

1.05 SCHEDULE

A.  Submit a proposed maintenance work schedule to the City Representative in writing for review at least 10 days prior to commencement of maintenance work.  All maintenance work shall be done at times approved by the City Representative so as not to conflict with the operation of the project.

1.06 PROTECTION

A.  Maintain all planting areas from time of delivery, through the Plant Establishment Period and final acceptance, in accordance with Standard Specifications, Department Of Public Works, Sections 1008.04 and 1008.10.
B.  Maintenance also includes temporary fences, barriers, and signs as required for protection.
C.  The Contractor shall treat or replace any plant that becomes damaged or injured, as directed by the City Representative at no additional cost to the City.

1.07 FERTILIZATION
A. Groundcover and all planting area: apply certified organic compost mulch at the rate of 3 cu yards per 1000 square feet 30 days after installation. Repeat application every 60 days throughout the maintenance period.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Perform Site Observations: For the purpose of establishing the 365-day Maintenance Period and observing completion of the work of this Section through final acceptance. A minimum of (13) thirteen separate field visits, occurring chronologically as follows:

1. Observation for Maintenance at Commencement
2. 30-day Progress Maintenance Observation
3. 60-day Progress Maintenance Observation
4. 90-day Progress Maintenance Observation
5. 120-day Progress Maintenance Observation
6. 150-day Progress Maintenance Observation
7. 180-day Progress Maintenance Observation
8. 210-day Progress Maintenance Observation
9. 240-day Progress Maintenance Observation
10. 270-day Progress Maintenance Observation
11. 300-day Progress Maintenance Observation
12. 330-day Progress Maintenance Observation
13. 365-day Observation for at Final Acceptance

B. Observation for Plant Establishment Period Commencement: Request observation by City Representative after all plant material is installed and after all irrigation work and other work of this Section is completed. Plant Establishment Period shall begin upon observation and review by the City Representative and shall continue for a minimum of 365-calendar days until Final Acceptance.

3.02 PROGRESS MAINTENANCE OBSERVATION

A. General: Notify the City Representative 30 days after commencement of Plant Establishment Period for a Progress Maintenance Observation. All items determined to be deficient during the previous observation shall be completed prior to the meeting. FAILURE TO DO SO MAY RESULT IN AN
EXTENSION OF THE PLANT ESTABLISHMENT and MAINTENANCE PERIOD. In addition, prior to first Progress Maintenance observation, furnish the City Representative with the following information:

1. An “as-built” planting plan of all plantings installed, as specified.

2. All supplier invoices for the nursery stock, commercial fertilizers, soil amendments, mulches and herbicides as shown and specified and as installed.

3. Maintenance schedule for fertilization, irrigation, and for all planting areas.

B. Failure to provide the above submittals may result in the re-scheduling of the Progress Maintenance Observations and extend the Maintenance Period.

C. Notify the City Representative in writing, prior to any of the Progress Maintenance Observations of any conditions, which may impede proper plant establishment and or growth.

D. Final Maintenance Observation: Notify the City Representative at least 7 days before the expiration of the Plant Establishment Period for Final Maintenance Observation. Prior to this observation, all items determined to be deficient during the Progress Maintenance Observations shall be completed and signed-off by the City Representative.

3.03 FINAL COMPLETION

A. General: Work under this Section will be accepted by the City Representative upon satisfactory completion of all work of this Section, Section 32 90 00 Planting, and Section 32 91 19 Planting Irrigation, including 365-Day Plant Establishment Period, exclusive of replacement of plant material under the terms of the Warranty.

B. Termination of Observation: During the Final Completion Observation, any landscape item previously identified as deficient in the Progress Maintenance Observations and determined by the City Representative to be still deficient, shall automatically terminate the Final Completion and result in the extension of the Plant Establishment Period an additional 30 days. Additional costs associated with subsequent Observations that are a result of the Contractor’s failure to correct deficient items shall be paid by the Contractor. There shall be no conditional final completion agreement for any work.
3.04 NOTIFICATION TO PORT OF SAN FRANCISCO

A. At least one month prior to the end of the 365-Day “Plant Establishment Period,” the Contractor shall notify the City Representative to coordinate a meeting between the SF Port staff and the Contractor to ensure a smooth transition for plant maintenance.

END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, curing, and the installation of embedded and other items as shown on the Plans and specified herein.

B. Related Sections:

1. Section 034100 "Precast Structural Concrete".
2. Section 316216 "Steel Pipe Piles".

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. General: Submit the following to the Port’s Representative according to Conditions of the Contract and Division 1 Specification Sections for review, prior to performing work.

1. Mix designs and test data for concrete mixes, 15 days minimum prior to placement. Mix design submittals shall include, as a minimum, the following:

   a. List of materials, proposed weights and volumes of each material per cubic yard.
   b. Specification of source for each material.
   c. Gradation listing of aggregates and certification that coarse and fine aggregates meet the requirements listed in the Concrete Materials Article of this Section.
   d. List of admixtures, with manufacturer’s data sheets.
   e. Certification that all aggregates are compatible with the proposed cement.
   f. Laboratory test reports to justify the compressive strength of each proposed mix design.
2. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

3. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

4. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   a. Location of construction joints is subject to approval of the Engineer.

5. Description of curing methods proposed and products to be employed.

6. Product data and Material Safety Data Sheets (MSDS) for proprietary materials and items, including curing compounds, epoxy grout, bonding agents and proprietary anchoring systems.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   8. Grouts.

1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

B. For each class of concrete, acquire cement from one source and aggregate from one source for the entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. The Contractor shall engage a testing laboratory to provide required submittals data including concrete mix design tests and strength tests on alternative materials.
1. Materials and installed work may require testing and retesting at any time during progress of Work.

F. Testing Service: The Port will engage an approved testing lab to perform all production work tests, and inspections. The Port's Testing Service shall also be known as the Special Inspector.

1. The Port's Testing Service shall review all mix designs and confirm their appropriateness for the intended purpose.
2. Special Inspection. Special Inspection for the placement of concrete is required. The Special Inspector shall verify the following:
   a. The concrete delivered to the job has been prepared with the approved mix design appropriate for the application and is transported and placed within the time and under the conditions permitted by ASTM C94 and this specification.
   b. The concrete is placed, consolidated, and finished as indicated on the drawings.
   c. Test specimens are taken and cured as indicated in this specification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.


E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 or ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

D. Plain-Steel Wire: ASTM A 82/A 82M.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M or ASTM A 934/A 934M as appropriate.

2.4 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type II - Moderate Portland type.

B. Fine and Coarse Aggregates: ASTM C 33. Aggregates shall be hard durable material from established sources with proven records of successful use in providing concrete with minimum shrinkage.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that may cause spalling.
2. Coarse Aggregate: Cleanness value not less than 75 when tested per California Test Method (CTM) No. 227.
3. Fine Aggregate: Sand equivalent not less than 75 when tested per California Test Method (CTM) No. 21.

C. Fly Ash: ASTM C 618, Class F.

D. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.
E. Silica Fume: ASTM C 1240, amorphous silica.

F. Water: Clean and not detrimental to concrete.
   1. A mixture of potable and reclaimed water.
   2. Mixture shall contain no less than 50% potable water.
   3. Mixture shall comply with ASTM C 1602, including all optional requirements.

2.5 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. General: As reviewed by Port Representative. Conform to ACI 212.1R Concrete admixtures shall not contain calcium chloride.

C. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Accelerating Admixture: ASTM C 494/ C 494M, Type C.
   4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   5. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
   6. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. The Contractor may propose the use of admixtures not conforming to ASTM C 494/C 494M. Such admixtures may be used with prior review and approval of the Port’s Representative. Approval of such admixtures is at the sole discretion of the Port’s Representative.

F. The Contractor shall add 4 gallons/cu yd of Non-Set-Accelerating Corrosion-Inhibiting Admixture (DCI-S as manufactured by W.R. Grace or approved equal).

2.6 ACCESSORY MATERIALS

A. Bonding Agent: Two-component, 100% solids, moisture-tolerant, structural epoxy adhesive product compliant with ASTM C 881 and AASHTO M-235.
   1. Sikadur 32 Hi-Mod LPL, manufactured by Sika Corp.
   2. Euco #452 Series or Duralcrete Series, manufactured by Euclid Chemical Company.
   3. Approved equivalent.

1. Minimum Compressive Strength at 48 Hours: 2,400 psi.
2. Minimum Compressive Strength at 28 Days: 7,000 psi.
3. Acceptable Products:
   a. Sikagrout 212, manufactured by Sika Corp.
   b. Master-flow 713 Plus, manufactured by BASF.
   c. NS Grout, manufactured by Euclid Chemical Company.
   d. Approved equivalent.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Liquid Curing Compound: ASTM C 309, Type 1-D, clear or translucent with fugitive dye. Moisture loss not more than 0.5 kg per square meter of surface in 72 hours when tested per ASTM C 156.

1. Liquid curing compound shall form a uniform, continuous adherent film that will not check, crack or peel, and shall be free of holidays, pinholes or imperfections.
2. Liquid curing compound shall not affect the proper bonding of waterproof membranes, floor coverings, surface coverings or paint.

E. Joint Sealant: One-part, low modulus, neutral-care silicone sealant complying with ASTM C 920 for Type S, Grade P, Class 25.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

1. It may be necessary to support the formwork system from the piling. The Engineer will consider the use of pile attachments which rely upon friction provided the Contractor, before using any such attachments, demonstrates, to the Engineer’s satisfaction, that they will not move under construction loads and that the piles will be undamaged.
2. Whatever the formwork system adopted, the Contractor shall be responsible for the integrity of the piles and for any damage caused to them.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities to the tolerances specified by ACI 347.

D. Construct forms tight enough to prevent loss of concrete mortar.
E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

   1. Install keyways, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that do not support weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from form-removal operations. Curing and protection operations need to be maintained.

   1. Soffit formwork for structural elements that support the weight of concrete shall remain in place until the concrete has attained a minimum age of two weeks and a strength of at least 3,500 psi. This strength shall be determined by the Contractor from cylinder tests, which he shall submit to the Engineer for review.

B. Whenever the formwork is removed during the curing period, the exposed concrete shall be cured by one of the methods specified under “Concrete Protecting and Curing” in this Section. No concrete shall remain exposed and unprotected for more than two hours during the curing period.
C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laittance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Engineer.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Bonding to new concrete at horizontal construction joints: After preparing the surface, thoroughly clean, roller screed and saturate with water, remove all standing and ponded water and immediately place concrete. New concrete is defined as less than 60 days old.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.
C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraighting, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighting until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Port’s Representative before application.

E. Concrete topping slabs shall be treated with a top-surface retarder such as Grace Top-Cast, or approved equal, as per manufacturer’s instructions. The Contractor shall coordinate the level of surface etching or exposure with the Port Architect and Port Representative.
3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoad areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Port’s Representative. Remove and replace concrete that cannot be repaired and patched to Port’s Representative’s approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Port’s Representative.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place
patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Port’s Representative’s approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Port’s Representative’s approval.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mixture placed each day.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

   a. Cast and laboratory cure four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days, two laboratory-cured specimens at 28 days, and hold one specimen in reserve.
7. Test results shall be reported in writing to Port’s Representative, Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work,
design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Port’s Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Port’s Representative.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00
SECTION 03 41 00

PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Precast structural concrete.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength.

C. Shop Drawings:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.

2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

3. Indicate joints, drips, chamfers, and extent and location of each surface finish.

4. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.

5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.

6. Indicate location of each precast structural concrete unit by same identification mark placed on unit.

7. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following:
   1. Cementitious materials.
   2. Reinforcing materials and prestressing tendons.
   3. Admixtures.

B. Material Test Reports: For aggregates, by a qualified testing agency.

C. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

1.6 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on non-staining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
   1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
   2. Place adequate dunnage of even thickness between each unit.
   3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.
PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775 or ASTM A 934 epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

2.2 PRESTRESSING TENDONS


   1. Coat unbonded segment of pretensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type II, gray, unless otherwise indicated.

B. Supplementary Cementitious Materials:

   1. Fly Ash: ASTM C 618, Class F, with maximum loss on ignition of 3 percent.
   2. Metakaolin: ASTM C 618, Class N.
   4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

   1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Accelerating Admixture: ASTM C 494/ C 494M, Type C.
   4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   5. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
   6. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
   9. Corrosion-Inhibiting Admixture: ASTM C 1582/C 1582M.
2.4 BEARING PADS

A. Provide the following bearing pad for precast structural concrete units:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi, ASTM D 412.

2.5 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.6 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent replacement of portland cement by weight; metakaolin and silica fume to 10 percent replacement of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
F. The Contractor shall add 4 gallons/cu yd of Non-Set-Accelerating Corrosion-Inhibiting Admixture (DCI-S as manufactured by W.R. Grace or approved equal).

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.8 FABRICATION

A. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.

2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

B. Prestress tendons for precast structural concrete units by pretensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.

2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.

4. Protect strand ends with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

5. Protect strand ends with a minimum of 1-inch thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

C. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

D. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
E. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

F. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

G. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

H. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

I. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Port’s Representative’s approval.

2.9 COMMERCIAL FINISHES

A. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch in width that occur more than once per 2 sq. in. Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch.

B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

C. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.
3.2 INSTALLATION

A. Install bearing pads and other accessories required for connecting precast structural concrete units to supporting members.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.

C. Connect precast structural concrete units in position by bolting, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

D. Field cutting of precast units is not permitted without approval of the Engineer.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
4. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

3.4 REPAIRS

A. Repair precast structural concrete units if permitted by the Port’s Representative.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by the Port’s Representative.

3.5 CLEANING

A. Clean mortar and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 41 00
SECTION 05 12 50

PREFABRICATED STEEL TRUSS BRIDGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Design, fabrication, and erection of a fully engineered, welded, prefabricated, steel truss bridge including bridge bearings and decking as shown on the plans and as specified in these specifications.

B. Related Sections:

1. Section 330000 "Cast-in-Place Concrete".
2. Section 341000 "Precast Structural Concrete".

1.3 DEFINITIONS

A. Owner: The actual owner, or the engineer, person, or firm designated by the owner to represent the owner.

B. Plans: Any drawings included in the bid documents related to the specified work.

C. Contractor: The firm contracting and responsible for the specified work.

D. Bridge Manufacturer: The firm acting on behalf of the Contractor to manufacture the prefabricated steel truss bridge superstructure.

1.4 SUBMITTALS

A. Qualification Data: Submit all Weld Procedure Qualification Records, Welder Qualification Test Records, Quality Control Plan, and visual and nondestructive test reports to the Engineer.

B. Design Calculations: Submit details and design calculations to the Engineer for each truss bridge, including bearing and decking, separately endorsed with the seal of a Professional Engineer registered in the State of California responsible for the design. Provide at least 28 calendar days notice before the start of fabrication.
C. Shop Drawings: Prepare and submit shop drawings for approval prior to beginning fabrication. Shop drawings shall be unique drawings prepared to illustrate the specific portion of the work to be done. All relevant design information including, but not limited to, governing codes, design parameters, member sizes, bridge reactions, shop and field connection details, paint system, and general notes shall be clearly specified on the drawings. Shop drawings shall be accurately prepared by skilled drafters to be complete in every respect. Drawings shall have cross-referenced details and sheet numbers. All drawings shall be signed and sealed by a Professional Engineer registered in the State of California. Give the Engineer at least 14 calendar days to review and approve each shop drawing submittal.

D. Submit Geometry Verification stating that the dimensions, elevations, and layout of the substructure shown in the plans are consistent with the truss. Provide any necessary changes to the substructure.

E. Submit anchor bolt requirements.

1.5 QUALITY ASSURANCE

A. Bridge Manufacturer Qualifications: Each bidder is required to identify their intended bridge supplier as part of the bid submittal. Qualified suppliers must have at least 5 years experience designing and fabricating welded prefabricated steel truss bridges for pedestrian and light vehicle loads. The Bridge Manufacturer shall be currently certified by the American Institute of Steel Construction to have the personnel, organization, experience, capability, and commitment to produce fabricated structural steel for Major Steel Bridges as set forth in the AISC Certification Program.

B. Pre-approved Bridge Manufacturers:

Excel Bridge Manufacturing Company
12001 Shoemaker Avenue
Santa Fe Springs, CA 90670
(562) 944-4025
www.excelbridge.com

Continental Bridge
8301 State Highway 29 North
Alexandria, MN 56308
(800) 328-2047
www.conteches.com

Wheeler Lumber, LLC
9330 James Avenue South
Bloomington, MN 55431
(800) 328-3986
www.wheeler-con.com

C. Written request by the Contractor for acceptance of any proposed Bridge Manufacturer who is not pre-approved must be presented to the Owner at least 10 days prior to the bid. The Owner will evaluate and verify the accuracy of the submittal. If the Owner determines that the
qualifying criteria have not been met, the Contractor’s proposed Bridge Manufacturer shall be rejected. Bridge Manufacturers other than those listed above may only be used if the Owner provides written approval of the proposed Bridge Manufacturer 5 days prior to the bid. The Owner’s ruling shall be final. To insure the proposed substitution will comply with these specifications, the following documentation must be provided:

1. Proof of AISC Major Steel Bridge Certification
2. List of five successful bridge projects, of similar construction, each of which has been in service for at least three years. List the location, bridge size, owner, and a contact for reference for each project.

D. Brand Name Specifications: The use of brand names/manufacturer’s or models is intended solely to denote the quality standard of the desired product and is not intended to restrict bidders to a specific brand, make, manufacturer, or name. The brand names/manufacturers of models are intended to convey the general style, type, character and quality of product. Equivalent products will be acceptable provided that approval of the specific product has been given in writing by the Architect/Engineer. Requests for approval of equivalent items shall be accompanied by information sufficient for the Architect/Engineer to make a determination as to the equivalency of a product. The determination of the Architect/Engineer of the equivalency of a product shall be final.

1.6 BRIDGE DESCRIPTION

A. The bridge superstructure shall be a truss of painted square/rectangular steel.

B. The truss type shall be parallel chord with vertical ends with a web member style of Pratt. Pratt style trusses with an odd number of bays shall have crossed diagonals in the middle bay. Any crossed diagonals shall be of equal dimension. Unless otherwise specified, multiple spans or bridges within a project shall have a consistent style, multi-span bridges shall maintain a constant depth, and any bridge depiction shown in the Plans is conceptual only.

C. Overhead (portal) bracing is prohibited.

D. The deck type shall be Grating Pacific Aqua Grate, or approved equal, pultruded pedestrian grating meeting ADA guidelines.

E. The bridge shall be cambered to offset the calculated dead load deflection and exactly match the profile specified in the plans. Multiple span bridges shall follow a smooth continuous profile after dead load deflection. Detail vertical truss members so they appear perpendicular to the grade (horizon) after the bridge is erected and dead loads are applied.

F. Unless indicated otherwise in the plans, bridge supports will be constructed at equal elevations.

G. Bridge span lengths are as shown on the plans and are generally measured as the horizontal clearance between backwalls or to the centerline of intermediate supports.

H. Bridge clear deck width = 8’-0” as measured between railing elements other than handrails.
I. The minimum rail height shall be 42”. The safety system shall be vertical pickets and shall prevent a sphere with a diameter of 4” from passing through. Bridges shall also be equipped with 4” minimum steel toe rails, located no more than 2” clear above the bridge deck.

J. Pedestrian hand rails are required on the sloped bridge structure and shall be attached to the interior side of structure posts.

K. See Plans for additional geometry limitations pertaining to abutment backwall heights, seat widths, and lengths as well as pier widths and lengths.

PART 2 - PRODUCTS

2.1 STRUCTURAL METALS

A. Truss Materials:

1. All members of the truss and deck system shall be fabricated from square/rectangular hollow structural sections (HSS), with the exception that floor beams may be wide flange (W) shapes. Open ends of end posts and floor beams shall be capped. Open shaped (non-tubular) stringers will be allowed only if adequate lateral or torsional bracing is provided. The pultruded fiberglass decking and its attachments shall not be considered to brace the stringers.

2. All steel shall be painted. Bridge shall be fabricated from material meeting ASTM A36, A500, A529, A572, A618, A913 or A992.

3. Minimum thickness of tubular steel members shall be ¼”. Minimum thickness for other rolled sections shall be 5/16”, except the web thickness of rolled beams or channels shall not be less than ¼” as per AASHTO. Railing members are not subject to minimum thickness requirements.

4. Splices for truss members, bracing, and floor beams, when used, shall be made with ASTM A325 or A490 high strength bolts. Type 3 bolts shall be used when the truss is required to be of weathering steel. Other splices shall be made of the above mentioned material or ASTM A307.

B. Anchor Bolts: Anchor bolts shall conform to ASTM A307, A193, or F1554. Anchors shall be of the drilled type, installed with a chemical adhesive system, except that when design forces exceed the strength of typical chemical systems, cast-in-place anchors may be used. Anchor systems shall be designed and supplied by the Bridge Manufacturer.

C. Decking: Bridge Decking shall be Grating Pacific Aqua Grate, or approved equal, pultruded pedestrian grating meeting ADA guidelines.

D. Paint System: The paint system shall be a three coat system suitable for the intended use as recommended by the paint manufacturer. Application shall be in accordance with the recommendations of the paint manufacturer. Color of the finish coat shall be determined by the Owner. Paint shall be provided for field touch up. The Contractor shall warranty the paint for a period of 5 years.
E. Cover plates shall be provided to cover expansion gaps when pedestrian usage is specified. Cover plates shall fit tight to the top of the abutment backwall without any bridge weight bearing on the backwall.

F. Expansion bearings shall include Teflon or stainless steel sliding surfaces per AASHTO or elastomeric pads. Consideration of dead load rotation is required in all cases.

G. Cementitious non-shrink grout, when applicable, shall meet ASTM C-1107, 7000 psi minimum.

H. All hardware (other than type 3 high strength bolts) shall be hot-dip galvanized in accordance with ASTM A153.

I. Materials not specified shall conform to applicable ASTM or AASHTO specifications.

PART 3 - EXECUTION

3.1 DESIGN

A. Plans and Calculations Certification: The Bridge Manufacturer shall design the prefabricated bridges and prepare shop drawings in accordance with these minimum requirements. All calculations and shop drawings shall be sealed by a Professional Engineer licensed in the State of California.

B. Design shall be governed by the current AASHTO LRFD Bridge Design Specifications with California Amendments, in conjunction with the current version of the AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges. Design shall be supplemented with the current edition of the American Institute of Steel Construction (AISC) Manual including the Design Specification for Steel Hollow Structural Sections, further supplemented with the current edition of the American Welding Society (AWS) D1.1 Structural Welding Code, as modified and further supplemented herein. Structural members shall be designed in accordance with recognized engineering practices and principles.

1. Welded tubular truss connections shall meet the provisions of AISC Chapter K2: HSS-to-HSS Truss Connections.
2. If non-tubular floor beams are used, the floor beam to vertical connections shall be analyzed by treating the floor beam flanges as a pair of transverse plates and ignoring the floor beam web. The connections shall meet the applicable provisions of AISC Chapter K1: Concentrated Forces on HSS.
3. All welded tubular moment connections shall meet the provisions of AISC Chapter K3: HSS-to-HSS Moment Connections.
4. Unique connection types that are not directly addressed by the governing codes, such as unreinforced connections to the side of a beam web, shall be proven by finite element analysis or other rational design methods.

C. Superstructure Loading: In addition to the dead load and wind load as specified by AASHTO, the pedestrian bridges shall be designed for a uniform live load of 90 psf with no reductions. Consideration of dynamic load allowance is not required with this loading. Vehicle and equestrian loads are not required.
D. Seismic Design: Refer to the latest edition of the *AASHTO Guide Specifications for LRFD Bridge Design* with Interim Revisions.

E. Load Combinations: In addition to the load combinations specified by AASHTO, when bridge structural members support or serve as railing members, the bridge shall be designed for the simultaneous application of rail load plus dead load plus 50% live load.

F. Safety Rails: Safety rails shall be designed to carry a horizontal or vertical 200 lb point load each. Rub rails, hand rails, and toe rails shall be designed per AASHTO as horizontal rails.

G. Deflections: Horizontal deflections of the truss, as measured at deck level, under unfactored wind loading shall not exceed L/500. The deflection of the truss due to unfactored pedestrian live loading shall not exceed L/500.

H. Vibrations: Vibrations shall be investigated as per the recommendations in the *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges*.

I. Stability: Stability checks for half-through trusses shall satisfy the requirements found in the *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges*.

J. Field Splices: Splices not immediately at or adjacent to panel points shall be designed for 100% of the member bending moment capacity for primary compression members, and 75% for bracing members or tension members subject to load reversal, including slip resistance, and slip resistance shall further meet the same AASHTO required strength as with other failure modes.

K. Thermal Expansion: Design the bridge for expansion and contraction for a rise or fall of 40° F.

L. Verify that the dimensions, elevations, and geometry in the plans are consistent with the truss bridges to be used at the site. Submit Geometry Verification to the Engineer for approval before starting construction of the substructure.

3.2 FABRICATION

A. Submit anchor bolt requirements to the Engineer before beginning fabrication.

B. Welding:

1. Welding and weld qualification tests shall conform to the provisions of AWS D1.1. The flux core arc welding (FCAW) process, utilizing E80 electrodes with similar weathering characteristics as the base material, shall be used. Welding operators shall be properly accredited experienced operators. Each shall have certification of satisfactorily passing ASW standard qualification test(s) for the 3G and/or 4F position(s), evidence of experience and skill in welding structural steel, and have demonstrated the ability to make acceptable welds of the type required.

2. Nondestructive weld testing is required. Testing will be performed by a qualified ASNT Level II Technician or greater and paid for by the Bridge Manufacturer. All welds are to be 100% visually inspected. Ten percent (10%) of all fillet and partial penetration welds shall be magnetic particle tested. Full penetration shop welds shall be Ultrasonic tested in accordance with AWS D1.1 Section 6. Base material certifications are to be supplied by the material suppliers. Inspection test results shall be available on request.
C.  Painting:

1.  The paint system shall be a three coat system suitable for the intended use as recommended by the paint manufacturer and approved by the Owner. Application shall be in accordance with the recommendations of the paint manufacturer. Applicator shall be certified by the paint manufacturer for the approved paint system. Color of the finish coat shall be determined by the Owner.

2.  All painted surfaces shall be blast cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7, latest edition, (SSPC-SP10) Near White Blast Cleaning.

3.  Painted bridges shall be configured such that all surfaces and connections are either fully sealed or allow access for adequate paint coverage. Sealing shall be accomplished by welding except that long continuous seams may be sealed with caulk prior to painting.

4.  All surfaces shall be painted with the exception of expansion joint cover plates, Teflon surfaces, bolted connections, and faying surfaces. Touch up paint shall be provided to paint outer surfaces of bolted splices and areas of damaged paint.

D.  Field splices shall be fully bolted slip critical connections, utilizing tension indicating washers. Tack welding of high strength hardware is prohibited.

E.  Cover plates shall be provided to cover expansion gaps when pedestrian usage is specified. Cover plates shall fit tight to the top of the abutment backwall without any bridge weight bearing on the backwall.

F.  Provide drilled ½” diameter weep holes (flame cut holes are prohibited) at the low points of all steel tubing members as oriented in the in-place, completed structure. Provide one weep hole at each end in members that are level or flat. Show weep holes and weep hole locations on the Shop Drawings.

G.  Do not place masonry bearing plates upon bridge seat bearing areas that are improperly finished, deformed or irregular. Set bearing plates level in exact position with full even bearing.

3.3  DELIVERY AND ERECTION

A.  The Contractor shall coordinate the delivery and erection schedule with the Bridge Manufacturer.

B.  Bridges will be delivered by truck to a location nearest to the site accessible by roads. Hauling permits and freight charges are the responsibility of the Bridge Manufacturer.

C.  The Bridge Manufacturer will advise, in writing, the Contractor of the actual lifting weights, proper attachment points and all necessary information to install the bridge. Unloading, splicing, bolting, and proper lifting equipment is the responsibility of the Contractor.

D.  The Contractor will maintain responsibility for all aspects of structure erection during all stages of construction including the protection of structural steel members, the workers, and the traveling public.

E.  The Contractor shall develop and provide a detailed, written Erection Plan including instruction procedures for proper lifting and splicing of bridge components.
F. The Contractor shall erect the structure in compliance with the Erection Plan and in a manner that prevents damage to all elements of the structure. The Contractor will provide any additional materials that are required to keep both the temporary and final stresses within the allowable limits used in design.

G. Clean bearing surfaces and surfaces that will be in permanent contact before members are assembled.

H. Carefully handle materials so that no parts will be bent, broken or otherwise damaged.

3.4 WARRANTY

A. The Contractor shall warrant their steel truss structure(s) to be free of design, materials, and workmanship defects for a period of ten years from the date of delivery. The warranty shall cover overloading of open shaped stringers as discussed heretofore. The Contractor shall warranty the paint for a period of 5 years. Inadequate performance is defined as failure of paint in excess of 5%.

B. The warranty will not be expected to cover defects caused by abuse, misuse, overloading except as mentioned, accident, improper installation, improper maintenance, deicing or other corrosive chemicals, alterations, or any other cause not the result of defective design, materials or workmanship.

C. Existing Utilities: Maintain utility services to remain and protect from damage during construction operations.

END OF SECTION 05 12 50
SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

   A. Furnishing and installing redwood header (at stabilized decomposed granite paving, railway post and cable barrier, and planting).
   B. Refurbishing existing Weigh Station building including repair/replacement of exterior siding, trim, eaves, or other wood elements as required.

1.02 RELATED SECTIONS

   A. Section 09 90 10 – Landscape Painting
   B. Section 31 22 13 - Rough Grading of Soil
   C. Section 32 12 16 – Landscape Asphalt Paving
   D. Section 32 12 85 – Resin Paving
   E. Section 32 90 00 - Planting
   F. Section 32 91 19 - Planting Preparation

1.03 REFERENCES

   A. AWI - Quality Standards.
   C. Woodwork Institute of California (WIC) "Manual of Millwork".
   D. DPW Standard Specifications, 1986, Section 218, 414, 415.06

1.04 SUBMITTALS

   A. Product Data: Submit manufacturer's technical information including label analysis and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

   A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide air circulation within stacks.

   B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

      1. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of stain in clean condition, free of foreign materials and residue.
2. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, and application of stain.

3. Manufacturers offering products which may be incorporated in the work include, but are not limited to, the following: Fuller O'Brien, Sherwin Williams, Co., Olympic Stain, or equal.

PART 2 PRODUCTS

2.01 LUMBER MATERIALS

A. Lumber material and nominal sizes are indicated on drawings, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.

B. Moisture Content of Softwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

2.02 ACCESSORIES

A. Nails and screws: Size and type to suit application galvanized finish.

B. All hardware, column base, bolts, nuts, washers, blind fasteners, lags, and screws: Size and type to suit application; stainless steel or galvanized finish.

2.03 SHOP TREATMENT OF WOOD MATERIALS

A. Shop pressure treat wood materials requiring preservatives with non-arsenic products.

B. Kiln dry wood after pressure treatment to maximum 15 percent moisture content.

2.04 FABRICATION

A. Fabricate to AWI standards.

2.05 WOOD TREATMENT

A. Olympic Transparent Sealant or equal
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and field measurements are as shown on shop drawings.

B. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

B. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds stripping and blocking with countersunk concealed fasteners and blind annealing as required for a complete installation.

3.03 SITE TREATMENT OF WOOD MATERIALS

A. Treat site-sawn ends. Allow preservative to cure prior to erecting materials.

B. Verify that materials requiring stain finish do not exceed 15 percent moisture content before applying wood preservative treatment.

3.04 PREPARATION FOR SITE FINISHING

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

C. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

D. Perform preparation and cleaning procedures in accordance with stain manufacturer’s instructions and as herein specified.

3.05 CLEAN-UP AND PROTECTION

A. Cleanup during progress of work, remove from site discarded stain materials, rubbish, cans and rags at end of each workday.

B. Protection: Protect work of other trades, whether to be stained or not, against damage by stain and finishing work. Correct any damage by cleaning, repairing or replacing, and stain as acceptable to the Engineer.
C. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

END OF SECTION 06 20 00
SECTION 09 90 00

COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes surface preparation and application of high-performance coating systems on the following substrates:
      1. Exterior Substrates:
         a. Steel Pipe Piles.
   B. Related Requirements:
      1. Section 31 62 16 "Steel Pipe Piles".

1.3 REGULATORY REQUIREMENTS
   A. Paint products and applications shall comply with the following regulations:
      2. Bay Area Air Quality Management District.

1.4 SUBMITTALS
   A. Product Data: For each type of product indicated.
      1. Include preparation, handling, and storing requirements and application instructions.
      2. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
      3. Volatile Organic Compounds (VOC) content. Provide certification by Coating Manufacturer that products supplied comply with local regulations controlling the use of VOCs.
   B. The Coating Manufacturer shall provide a “Coating Applications, Maintenance and Repair Procedures Manual” for each coating system used. Include the following information:
1. Coating Application: Application shall describe surface preparation requirements, the maximum time allowed between surface preparation and primer application, primer and top coat(s) curing time, and procedure for checking maximum and minimum wet and dry film thickness of the primer and top coats(s). Identify procedures for coating critical unit thickness locations (e.g., edges, welds, etc.).

   a. Field condition requirements including surface and surrounding air temperature, relative humidity and any other limitations.
   b. Method of Application (brush, roll or spray including type of equipment).
   c. Mill thickness and time between surface preparation and application of primer.
   d. Surface preparation prior to application of each coat.
   e. Drying time between primer and finish coat(s) and after application of finish coat.
   f. Pot life.
   g. Thinning.
   h. General application techniques for critical areas to be coated.
   i. Curing requirements.

2. Maintenance: The maintenance procedure shall provide a systematic process for inspection, record keeping and observation, coating application, and repair procedures.

3. Repair: Repair procedures shall establish when a repair is required, what type of repair should be done, with what materials, at what time, and in what manner. Type of failures may include, but are not limited to, undercutting, blistering, pinpoint rusting, delamination, chalking, checking, and abrasion.

   a. Field welding and splicing of steel pipe piles shall require repair and reapplication of shop coatings per manufacturer's recommendations.

C. Samples for Initial Selection: For each type of topcoat product indicated. Provide the manufacturer’s color chart for representative colors available and samples of each color on representative samples of the actual substrate for review by the Port Architect.


D. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

   1. Submit Samples on steel substrate, 4 inches square, for the Port Representative’s review and final color selection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Coatings: 5 percent, but not less than 1 gal., of each material and color applied.
1.6 QUALITY ASSURANCE

A. Paint contractors shall be qualified by audit according to criteria accepted under SSPC guidelines.

B. Single-Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coat(s) for each type of coating. The Contractor shall provide documentation that the individual coats (i.e., primer, intermediate and top coat) are compatible. Use only thinners recommended by the manufacturer and only within the recommended limits.

C. Final acceptance of job-applied colors will be based on samples.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All pipe piling and structural steel shall have all surface preparation and coatings applied in a shop prior to delivery to the site. Field painting and coating to be minimized and limited to touch up work and coatings applied after field welding.

1. Apply a primer coat only to areas that fall within 6 inches of where field welding of structural steel will occur.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 WARRANTY

A. The contractor shall warrant the coating system for a period of not less than 5 years.

PART 2 - PRODUCTS

2.1 PREPARATION AND COATING THICKNESS

A. The preparation and coating of surfaces shall be as required herein. Before the application of any coat, all defects on the preceding coat shall be repaired. Where coating is damaged and repairs are made, the affected areas are to be touched up with paint to match the surrounding area.

2.2 COATING SCHEDULE

A. The following materials subsection lists the paint for priming, intermediate and/or finish coats. All exposed steel surfaces including sides and edges, shall be coated. Coating shall be applied in accordance with the coating manufacturer's recommendations. Minimum dry film thickness per coat shall be 5 mils.
2.3 COATINGS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
   3. Provide products of same manufacturer for each coat in a coating system

2.4 MATERIALS

A. “PPG Industries” products are listed. Other products may be substituted provided they are preapproved by the Engineer.
   1. Steel Pipe Piles:
      a. Prime Coat: Amercoat 235
      b. Top Coat: Amercoat 235

PART 3 - EXECUTION

3.1 PREPARATION

A. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer and in accordance with the Steel Structures Painting Council Specifications.

3.2 APPLICATION

A. Refer to and follow the Coating Manufacturer’s “Coating Application, Maintenance and Repair Procedures Manual” for each coating used in this Project.

B. Unless otherwise indicated by the Coating Manufacturer:
   1. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 50 deg F and 90 deg F. Maintain this temperature range 24 hours before and 72 hours after application of coating.
   2. Do not apply coatings in snow, rain, fog, or mist; when the relative humidity exceeds 70 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections.

3.3 MAINTENANCE

A. Responsibility: Maintenance shall be the responsibility of the following parties:

1. The coating manufacturer shall be responsible for establishing surface preparation, coating application, maintenance and repair procedures based on the requirements specified in this section and by the manufacturer's product requirements.

B. Coating Evaluation: Where evaluation of the coating prior to or during the warranty period indicates coating deterioration or failure, the extent of failure shall be determined by visual inspection and the use of one the following ASTM standards, as required by the type of failure involved:

   1. ASTM D610 - Evaluating Degree of Rusting on Surfaces of Painted Steel.
   5. ASTM D714 - Evaluating Degree of Blistering of Paint.
   6. ASTM D772 - Evaluating Degree of Flaking (Scaling) of Exterior Paint.

3.4 REPAIR

A. The Contractor shall be responsible for coating repair from the date of Notice to Proceed through the warranty period.

B. Repair procedures shall be specified by the Manufacturer.

C. Prior to substantial completion of the Project, the Contractor shall make repairs to any damaged or defaced coated surfaces.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 09 90 00
SECTION 09 90 10
LANDSCAPE PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Application of architectural paint to galvanized steel, and refurbished Weigh Station wood structure. Items to be painted include but are not limited to: metal guardrail, handrail, gates, pipe barricade, post and cable barrier, including all appurtenances and accessories furnished and installed, worked on under this Contract shall be painted by the Contractor.

1.02 RELATED WORK

A. Section 12 93 00 – Site Furnishings
B. Section 32 31 13 – Chain Link Fences and Gates
C. Section 32 31 19 – Fabricated Metals
D. Section 06 20 00 – Finish Carpentry

1.03 REFERENCE STANDARDS

A. SSDPWSF - SECTION 809 – PAINTING
C. American Society of Testing and Materials (ASTM), comply with applicable provisions of the following:
   1. ASTM D 4585 Condensing Humidity
   3. ASTM D 4060 Abrasion.
   4. ASTM D 4541 Adhesion
   5. ASTM D 6386 Brush Blast for galvanizing
D. Steel Structures Painting Council (SSPC)
   1. SSPC-SP 1 - Solvent Cleaning
   2. SSPC-SP 3 - Power Tool Cleaning
   3. SSPC-SP 6 Commercial Blast Cleaning
   4. SSPC-SP11 Power Tool to Bare Metal
E. CTSS Sections 91, 86-2.16, and 59 except 59-1.05

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: It is the Contractor's responsibility to comply with all applicable regulations including: local laws governing surface preparation, paint materials and applications. Should the Contract documents or instruction be in conflict with regulations, report to the City Representative in writing, and obtain the City Representative's instructions before proceeding with the work affected.
B. Performance Criteria: As applied to abrasive steel panels and cured at 77 degrees Fahrenheit.
1. **Humidity**: Method ASTM D 4585. The condensing humidity requirement is that the painted surface is free from any blistering, cracking, rusting or delamination of film after 4,500 hours of exposure.

2. **Salt-spray “Fog” Method**: ASTM B 117. The requirement is, that after 6,000 plus hours of exposure, no more than a 1/16” rust creepage is allowable at the scribe mark and that the painted surface is free from any blistering, cracking, rusting, or de-lamination of film.

3. **QUV Exposure**: No blistering, cracking, chalking, or delamination of film. No more than 0.59 DED CIE L* color change after 2,000 hours.

4. **Adhesion**: Method: ASTM D 4541, Type V. The requirement is that the painted surface shall have no less than 1930 psi adhesion after an average of three trials.

C. The Contractor shall arrange for the paint manufacturer to provide a representative to visit the job site at intervals during surface preparation and painting as may be required for product application quality assurance. This representative shall determine compliance with manufacturer's instructions and as required shall assist to resolve field problems attributable to or associated with, the manufacturer's products furnished under this Contract.

### 1.05 SUBMITTALS

A. **General**: Submittals to be in accordance with the requirements of Section 1300.

B. **Manufacturer’s Data**: Submit six copies of data sheets for each paint system used herein. The Contractor shall obtain from each paint manufacturer, for submittal to the City Representative, manufacturer's specifications, paint label analysis, preparation, and application instructions for each material proposed.

C. Manufacturer’s certification that submitted products (excluding galvanizing) will meet or exceed the performance criteria per Quality Assurance, paragraph B.

D. **Color Samples**: Submit samples for approval by City Representative for specified color, texture and finish. Provide on 8-1/2” x 11” hardboards, 3 samples of each color and material with texture to simulate conditions. Resubmit each sample as requested, until required sheen, color and texture is achieved and approved by the City Representative.

E. When equipment to be painted by the manufacturer is not manufactured locally, the Contractor shall secure and submit to the City Representative, the equipment manufacturer’s certification that the preparation of surfaces and application of the prime coats have been made in accordance with the recommendations of the paint manufacturer.

F. **Mock-up**: Before proceeding with the work under this section, the Contractor shall furnish at full scale portion of no less than 3'-0" in length a section of rails showing selected colors, finish texture, materials, and workmanship. After approval, the sample items shall serve as a standard for similar work throughout the project.

### 1.06 OPERATION AND MAINTENANCE MANUAL

A. Operation and Maintenance Manual (four manuals each) shall contain the following information:

1. Manufacturer’s product data sheet for each type of paint used.

2. Preparation, application, and touch-up information for each paint system.
3. The color tint formulation along with 8-1/2” x 11” sample board for each custom color.
4. The local supplier of each type of paint.
5. One gallon of each color used for Port Maintenance group. The spare gallon shall be new unopened can.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label.
1. Provide labels on each container with the following information:
   a. Name or title of material.
   b. Manufacturer's stock number.
   c. Manufacturer's name.
   d. Contents by volume, for major pigment and vehicle constituents.
   e. Thinning instructions.
   f. Application instructions.

1.08 JOB CONDITIONS

A. General: Climatic Conditions: The project site has coastal marine weather which will affect painting conditions. Contractor shall furnish and use temporary facilities such as: covers, heaters, and dryers so that paint materials may be properly applied under the prevailing conditions at the project site. No separate payments will be made for these temporary facilities. Similarly, equipment manufacturers shall provide their own temporary facilities at remote locations for surface preparation and shop primer painting with no separate payment made for these temporary facilities. Contract time extensions will not be allowed for delay caused by failure to comply with requirements.

B. Do not apply paint in rain, fog, mist, or windy conditions; or when the relative humidity exceeds 85%, or when surfaces are too wet or damp.

C. Do not apply paint when conditions are such that dust, dirt or other deleterious substances which may impair the quality of the paint coat or finish are present or will be present before the coating is fully dry.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
1. All metal finish paints shall be supplied by Tnemec Company, Inc. (866) 317-3206, or equal.
2. Concrete Patching for existing walls shall be supplied by Burke, www.daytonsuperior or approved equal.
3. All wood and concrete paints shall be supplied by Sinclair Paints available from ICI Paint Stores (415) 673-6927.
4. Finish coats shall be compatible with primer paints. The Contractor is to provide undercoat primers produced by the same manufacturer.
5. Primer shall not be tinted to the same color as that of the finish coat, but may contrast slightly.

B. For metal work, the paint system shall be Tnemec or equal as follows:
1. **Primer Coats**: Apply a prime coat at a dry film thickness dft at 4.0 to 6.0 mils of Tnemec Series 27WB Typoxy.

2. **Finish Coats**: Apply two coats between 3.0 and 5.0 mils dft per coat of Tnemec Series 740 UVX, or approved equal, no known equal. Color: Relativity Blue 46BL.

C. **Concrete patching for walls shall be Burke or equal as follows**:
   1. Apply “Feather Patch” product per manufactures instructions.

D. **For painted wood, the paint system shall be by Sinclair Paints. Color: to match existing weigh station**.

E. **ANTI-GRAFFITI COATING and PRE SEALANT**

   1. Non-Sacrificial, water-based, low VOC, water, stain and scratch resistant nanotechnology-based clear coat, with non-bioaccumulative nanoparticles, free of any carcinogens identified by California Proposition 65. “Trunano Grafitti Armor”, AND “Trunano Concrete and Stone Enhancer Plus” pre-sealant, by Evolution Surface Solutions, Midvale, UT, (855) 778-6266, [www.evolutionsurface.com](http://www.evolutionsurface.com); or equal, no known equal.

   2. Anti-Graffiti Coating shall be applied to all concrete walls, weigh station, and other vertical elements as required by the City Representative.

3.01 **SURFACE PREPARATION**

A. **General**: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. **Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces**.

   1. All cast iron surfaces shall be solvent cleaned, provide a surface profile of 2.0 mils. Brush off blast cleaning to remove all loose annealing oxides, loose rust, dirt and other foreign matter by compressed air nozzle abrasive blast cleaning using a fine abrasive.

   2. Galvanized surfaces shall be cleaned:

      For normal interior dry and for normal exterior exposure when no passivator is present on the galvanized surface, clean per SSPC-SP1 (Solvent Cleaning) then either chemical etch or brush blast per ASTM D 6386. The chemical etching products that performed well are Clean ‘n Etch and Galvaprep 5.

      For interior other than dry and benign (frequently wet, chemical exposure, over a pool etc.), exterior corrosive environment and all immersion service, brush-off blast per ASTM D 6386. We require a profile/anchor pattern between 1.0 and 1.5 mils.

      No substitutions without City Representative’s approval.
3. Surfaces having baked-on shop prime coats shall be properly prepared for subsequent paint adhesion by lightly sanding, steel wooling or use of solvents recommended by manufacturer within time limit recommended.

3.02 TOUCH-UP

A. All surfaces to be touched-up shall be cleaned per SSPC-SP1 (Solvent Cleaning.) Any bare metal areas shall be cleaned per SSPC-SP11.

B. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with the same type of shop primer.

C. The edges of the undamaged painted areas bordering the marred or damaged surface shall be sanded to conform smoothly to the damaged or marred surface (feathered-in). The damaged and sanded portion of the surface shall then be touch-up primed and finished-painted.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Store materials in a protected area that is kept above 40 degrees F and below 100 degrees F.

C. Mix materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Follow manufacturers printed instruction for mixing and thinning material.

3.04 APPLICATION

A. General:
   1. Prior to relocating any existing equipment, the equipment shall be jointly surveyed by the Contractor and the City Representative for existing damaged paint.
   2. The Contractor shall provide and properly locate sufficient drop cloths to protect the work and other property from paint splashes or damage. Special care shall be taken to protect hardware, light fixtures, glassware, finished surface, sidewalks, and parked automobiles.
   3. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. Do not exceed manufacturer's recommended coverage per gallon.
   4. Apply additional coats at no additional cost to the City when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.
   5. Sufficient paint shall be applied, in successive coats, to provide a satisfactory cover when the work is completed, but the quantity used for any individual coat or portion thereof shall not be excessive or such as to result in a thicker application than will properly set within a reasonable period, forming a hard, firm and uniformly smooth coating free of blisters, flat spots and similar defects.
   6. The finish work shall show no cloudiness, spotting, laps, brush marks, runs, curtains, sags, ropiness, or other surface defects not consistent with first class workmanship.
7. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind frequently fixed equipment or furniture with prime coat only.
8. Sand lightly, as recommended by the paint manufacturer, between each succeeding coat.
9. Omit the first coat (primer) on metal surfaces which have been shop-primed and/or touch-up primed unless otherwise specified.
10. Unsatisfactory work, and defects, caused by improper conditioning of surfaces for painting, faulty materials or workmanship, or completed painted surfaces not in accordance with the specifications, shall be satisfactorily corrected by the Contractor at his sole expense, to the extent required by the City Representative, including removal of unsatisfactory paint coatings and subsequent repainting.

B. Anti-Graffiti Coating:

1. Over New Unfinished Concrete or Masonry Surfaces: powerwash unpainted concrete and masonry surfaces to remove all surface dirt and particles; allow to dry completely.
   a. Pre-sealant: Trunano Concrete & Stone Enhancer Plus, Required on unpainted porous concrete or masonry surfaces only. Apply per manufacturer instructions.
   b. Anti Graffiti Coat: Trunano Graffiti Armor. Apply with high volume low pressure sprayer, and per manufacturer instructions. Apply in ambient temperature of between 45-degrees F, and 105-degrees F, and when there is no chance of rain, or atmospheric condensation (e.g.: fog or dew formation) for at least 5 hours following application.

2. Over Painted Surfaces:
   a. Surface must be clean, dry and in sound condition. Remove all oil, dust, grease, dirt, particles, and other foreign material. Clean with mild cleaner per manufacturer instructions, and allow to completely dry.
   b. Anti Graffiti Coat: Trunano Graffiti Armor. Apply with high volume low pressure sprayer, and per manufacturer instructions. Apply in ambient temperature of between 45-degrees F, and 105-degrees F, and when there is no chance of rain, or atmospheric condensation (e.g.: fog or dew formation) for at least 5 hours following application.

3.05 SHIPPING AND HANDLING

A. Specialty packaging and handling is required to protect finish paint system during shipment and installation, as recommended by the finish paint system supplier.

B. Keep primed steel off the ground by placing on wooden supports and keep members from touching each other by using wooden separators for stacking, slings for moving, and other devices as recommended by the manufacturer.

C. Take measures to avoid damaging coating while stacking, loading or unloading and use wooden protectors or other means to prevent damage from chain or cable cinches.
3.06 DETERIORATION OF PAINTED SURFACES

A. Painted surfaces that, within two (2) years after acceptance, are found not to be of uniform color or texture or show evidence of excessive deterioration such as cracking, crazing, blistering, running, peeling, scaling, checking, alligatoring, streaking or staining, will be considered the result of faulty materials or workmanship and shall be satisfactorily refinished by the Contractor in accordance with the requirements of these Special Provisions. All painted surfaces shall be capable of withstanding the chemical and physical action of washing with alkali-free soap and water to remove surface dirt without causing the aforementioned deterioration.

END OF SECTION 09900
SECTION 12 93 00
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work specified in this section is the provision of all material, labor, equipment, and services necessary for furnishing and installing items, as shown on the Drawings and specified herein. The work includes but is not limited to:

1. Bike Racks
2. Trash/Recycling Receptacles
3. Drinking Fountain
4. Picnic Tables
5. Benches

1.02 RELATED SECTIONS

A. Section 32 33 00 – Landscape Concrete
B. Section 32 35 00 – Concrete Finishing

1.03 QUALITY ASSURANCE

A. Workmanship and materials: All workmanship and materials within this Section shall conform strictly to the manufacturer's specifications, installation instructions and guarantees.

1.04 SUBMITTALS

A. Submit per Section 013300, “Submittals,” and Standard Specifications.

1. Site Furnishings: Manufacturer's literature, specifications, installation, maintenance manuals, footing instructions and warranties.

2. Paint: Four-inch square, or linear (where applicable) samples of each specified color, including powder coated metal colors.

B. Shop Drawings:

1. Horizontal and vertical layout of site furnishings; plan and section drawings to scale.

1.05 INSTALLER QUALIFICATIONS

A. Engage experienced subcontractors, with minimum 5 years of experience, for site furnishing installation. Approved subcontractors must have a proven record of installing site furnishing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
1.06 PRODUCT DELIVERY, STORAGE AND HANDLING
A. Site furniture shall be delivered in good condition in original unopened packages with labels intact and unloaded at job site in such a manner that no damage occurs to the product during hauling, handling or unloading at the job site.
B. Protect materials from adverse weather.

1.07 SUBSTITUTIONS, ADDITIONS AND DELETIONS
A. General: Submit proposals for substitutions in accordance with the Specification 013300. Acceptance by the City Representative is required prior to proceeding with the work under this section.

1.08 SPECIAL TOOLS AND EQUIPMENT
A. Special Tools and Equipment:
1. Three sets of keys to operate any item specified with lock and key mechanism.
2. Extra cans of paint for touch of powder coat colored furnishings; provide a minimum of one can for each color of paint, as specified.

PART 2 PRODUCTS
2.01 GENERAL
A. The layout and design as shown on the Plans are based on products currently available from the manufacturers listed below. Products of other manufacturers will be considered if equal, provided that the Contractor shall be responsible for extra costs or delays associated with making necessary changes in design or layout to accommodate the proposed substitutions.
B. Provide site furniture as follows or equal:
1. Site Furnishings & Miscellaneous
   a. Bike Rack (6)
      Mfr: Palmer Group
      Model: Welle Circular Rack Square Tube, Surface Mount
      Finish: Hot Dip Galvanized
      1072 Folsom St., #328
      San Francisco, CA 94103
      888-764-BIKE (2453)
      415-333-2032 fax
      info@bikeparking.com
   b. Trash Receptacle (8)
      Mfr: Forms + Surfaces or equal.
      Model: Metro litter and recycling receptacle with a 36" gallon capacity. Stainless Steel Metal Body and Cast Aluminum Lid and round opening on two sides to Match GGNRA Standard and include ‘Toter’ liners and tamper-proof latches and fastening hardware.
Material: Perforated Stainless Steel with Powdercoat Finish  
Base: Surface Mount.  
Color/Finish: Aluminum Texture;  
Contact: Michael Risso - 800-430-6206  
michael.risso@forms-surfaces.com

c. Drinking Fountain (1)  
Mfr: GlobalTap  
Model: GT1100 Bottle Filler/Fountain  
PH: 312-850-1110  
www.globaltap.org

d. Picnic Table: (3)  
Mfr: Quickcrete Products Corp., or equal.  
Model: LBT Picnic Table 72"W x 96"L x 33"H;  
Material: Ecocast  
Color/Finish: Erosion;  
Texture: T3-Santa Fe Sandblast; Standard Gloss Sealer;  
Contact: Todd Provines - (925) 528-8380  
tprovines@quickcrete.com

e. Bench with armrests: (14)  
Mfr: Forms & Surfaces  
Model: Knight Bench w/ backs and armrests  
Wood/Color: Reclaimed Teak slats/Powdercoat “Argento Texture”  
Mounting: Surface Mount  
Representative: Michael Risso - 800-430-6206  
michael.risso@forms-surfaces.com

PART 3 EXECUTION

3.01 LAYOUT OF SITE FURNISHINGS

A. Layout: Layout site furnishings according to the locations shown on the drawings.

B. Adjustments: The City Representative reserves the right to make adjustments in the locations of site furnishings without additional cost to the City.

C. Final Layout: Notify the City Representative to approve the final layout of furnishings prior to installation.

D. See irrigation plans for drinking fountain water supply.

3.02 PROTECTION

A. Protect site furnishings during the construction period to prevent damage and wear.

3.03 REPLACEMENT

A. Replace all defective or damaged site furnishings prior to acceptance.

3.04 INSTALLATION

A. Installation procedures shall be according to manufacturer's directions.
B. All components of the equipment shall be installed accurately to produce true plumb and level installation.

C. Clean-up: Prior to final inspection and acceptance, remove all rubbish and excess material for disposal as approved, and leave area in a neat, satisfactory condition.

END OF SECTION
SECTION 31 10 00

SITE CLEARING

PART 1  GENERAL

1.01  DESCRIPTION

A. Contractor shall furnish all labor, services, materials, tools, equipment, appliances, trucks, and all other appurtenances necessary for the safe demolition and/or removal of site features and for the maintenance of the existing conditions, as shown on the contract drawings and in accordance with Sections 701, 704 of the Standard Specifications.

1.02  SCOPE OF WORK

A. General: Refer to Drawings for a graphic representation of all areas to be demolished, and/or salvaged.

B. The demolition consists of saw cutting and removing existing paving, play equipment, removing concrete walls and curbs, site furnishings, fencing, trees, stump grinding and asphalt debris, and all items as designated on the Plans.

C. The demolition work to be performed under this Contract includes the removal and disposal of all designated items and debris.

1.03  RELATED SECTIONS

A. Section 31 13 00 – Selective Tree and Shrub Removal and Trimming

B. Section 31 25 00 – Erosion Control

C. Section 32 22 13 – Rough Grading

D. Section 32 91 00 – Planting Preparation

E. Section 12 93 00 - Site Furnishings

1.04  REFERENCES

A. DPW Standard Specifications - 1986 Section 704

1.05  REGULATORY REQUIREMENTS

A. The contractor shall comply with all federal, state and local resource agency regulations and permit conditions, including, but not limited to the SF Regional Water Quality Control Board (SFRWQCB), Section 401 Permit, the SFRWQCB General Construction Permit, the US Army Corps of Engineers Permit, and the Bay Conservation Development Commission permits. Any fines or remedial actions associated with non-compliance with these permits during construction and demolition shall be the responsibility of the contractor. (Additional Permit conditions may apply pending permit acquisition.)

B. The contractor shall implement at a minimum the following Best management Practices: Standard Best Management Practices (BMPs) shall be implemented to protect fish species and their habitat(s) from pollution due to fuels, oils, lubricants, and other harmful materials. Vehicles and equipment that are used during the course of a project shall be
fueled and serviced in a manner that will not affect federally protected species at the project site or their habitats. The contractor shall implement the following BMPs:

1) The USACE “Proposed Procedures for Permitting Projects that will Not Adversely Effect Selected Listed Species in California” establishes general procedures for minimizing impacts to natural resources associated with projects in or adjacent to jurisdictional waters. Repair crews shall follow procedures outlined in this document.

2) Demolition will be conducted from both land and water, and equipment operators shall control debris so that it does not enter the creek. The work area shall be isolated by using a debris containment boom. Floats with debris screens should be used to catch any falling concrete or debris during cutting and removal operations. In the event that debris does reach the creek, personnel in workboats within the work area shall immediately retrieve the debris for proper handling and disposal.

3) Well-maintained equipment shall be used to perform the work, and except in the case of a failure or breakdown, equipment maintenance will be performed off site. Equipment shall be inspected daily by the operator for leaks or spills. If leaks or spills are encountered, the source of the leak shall be identified, the leak cleaned up, and the cleaning materials collected and properly disposed.

4) Fueling of marine-based equipment shall occur at designated safe locations adjacent offsite. Fueling of land-based equipment shall occur in a staging area or over pavement, and the location will be inspected after fueling to document that no spills have occurred. Spills shall be cleaned up immediately using spill response equipment.

5) Grading and Demo crews shall reduce the amount of disturbance within the project site to the minimum necessary to accomplish the project.

6) All construction material, wastes, debris, sediment, rubbish, trash, etc., shall be removed from the site once the project is completed and transported to an authorized disposal area, as appropriate, in compliance with applicable federal, state, and local laws and regulations.

7) Any building, wharf, or pier demolition debris or excavated soil from land above mean high water (MHW) that is stockpiled onshore prior to offsite disposal shall be stored in a manner that utilizes Best Management Practices (BMPs) for construction operations and is in compliance with standard NPDES General Construction Stormwater Permit guidelines. No runoff of non-stormwater origin shall be allowed to enter the Bay. All such non-stormwater material shall be disposed of at an appropriate, permitted facility.

8) Herring Restrictions.
   If work occurs in the water during the herring spawning or hatching season (December through March,) a professional biologist or other individual competent to identify herring spawning activity, shall inspect the project site three times a week during the construction operations occurring between December 1 and March 1 of any year. If Herring Spawning is detected by the on-site biologist, or qualified individual, Department of Fish and Game (DFG) personnel or the Commission Staff, all construction in the water shall cease for a minimum of 14 days and shall continue suspended until it can be determined by the on-site biologist, or qualified individual, DFG personnel, or the Port staff, that the herring hatch has been completed and larval herring concentrations have left the site.

9) Pile Removal.
   Existing piles shall be cut at the mud-line only, at low low tide, and no jetting will be performed.

10) SWPPP.
Impacts to water quality may also result from pollutant runoff associated with construction activities upland of Islais Creek. As the total project size is greater than 1 acre, the construction contractor will be required to file for inclusion under the Phase II General Construction Storm Water Permit, and to prepare and implement a storm water pollution prevention plan (SWPPP) for the project site.

11) Debris Management
Contractor shall comply with all federal, state and local regulations pertaining to the characterization, handling, storage, transport and disposal of contaminated soils known on site.

PART 2 PRODUCTS
Not Used.

PART 3 EXECUTION
3.01 PROTECTION
A. Protect active sewer, water, gas, electric, and other utilities; and drainage system indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the City Representative and the utility owner for corrective action.

B. Protect all trees, plant materials, and lawn areas that are to remain. Water trees, plant materials, and lawn areas that are to remain for the duration of the contract. The contractor shall replace at his own expense any plant material or existing lawn that is damaged as a result of construction or a lack of irrigation.

D. Provide temporary construction fence for tree protection at trees noted to remain. See Drawings.

E. Provide temporary fencing, signage, and flag persons as necessary for pedestrian traffic control prior to beginning demolition.

3.02 DEMOLITION REQUIREMENTS
A. Cease operations immediately if adjacent structures appear to be in danger. Notify City Representative and do not resume operation until directed.

B. Conduct operations with minimum interference to public or private access. Maintain protected egress and access at all times.

C. Ensure safety of persons and adjacent property against damage by falling debris or other causes in connection with this work.

D. Demolish any concrete in small sections.

E. Protect from damage existing parts of work to remain.

F. Promptly remove from the site all demolished material in a neat, orderly manner.
3.03 CLEARING AND GRUBBING

A. Perform clearing and grubbing as necessary to remove vegetation and objectionable material from the site. Clear the site within the limits indicated, and remove cleared materials and debris from the site.

B. Coordinate any salvaging of materials, construction backfill or planting soils with work in Section 31 22 13 – Rough Grading.

3.04 CONCRETE AND TREE REMOVAL

A. Remove all concrete debris.

B. Remove trees/shrubs as indicated on plans, and per Section 31 13 00.

C. Remove excess topsoil or sandy fill as required to complete finish grades as shown on plans.

3.05 SALVAGE

A. Items to be salvaged are indicated on the Plans. Repair or replace to the satisfaction of the City Representative, any item damaged due to Contractor's negligence.

3.06 DISPOSAL OF DEBRIS

A. Dispose of all removed material in a legal manner. Burning or burying of material on site is strictly prohibited.

3.07 RESTORATION AND CLEANUP

A. Reuse all site soil to establish finish grades.

B. Repair and clean adjacent surfaces damaged or soiled by demolition work.

C. Restore utility service to normal operation.

D. Remove equipment, temporary protection and barriers and debris.

END OF SECTION 31 10 00
SECTION 31 13 00

SELECTIVE TREE AND SHRUB REMOVAL AND TRIMMING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all material, labor, equipment, and service necessary for tree removal and pruning as shown on the Drawings and as specified herein. The work of this Section includes but is not limited to:

1. Pruning of existing trees
2. Removal of existing trees and stumps
3. Coordinating and scheduling of pruning inspections
4. Inspection of trees by Certified Biologist during bird nesting season

1.02 RELATED SECTIONS

1. Section 01 56 39 Temporary Tree and Plant Protection
2. Section 32 90 00 Planting

1.03 REFERENCE STANDARDS

All work shall comply with:

g. City and County of San Francisco, Urban Forest Council. 2006. Pruning Standards.
h. City and County of San Francisco, Department of Public Works, Bureau of City Representativeing, 1986. STANDARD SPECIFICATIONS (DPWSS). Section 1007 Planting, Section 1008 Maintenance and Plant Establishment.
1.04 SUBMITTALS

A. Product Data: For each type of product indicated and proposed.

B. Qualification Data: For firms and persons specified in 1.05 A, "Quality Assurance", of these specifications, to demonstrate their capabilities and experience. Include lists of four completed San Francisco Bay region projects with project names and addresses and names and addresses of architects and owners. Provide a copy of Contractor's specialty class C61-D49 Contractor's License.

C. Pruning Method: The Contractor shall submit a written description for review and approval of proposed pruning method of trees.

D. Temporary Fencing: See Specification Section 01 56 39 "Temporary Tree and Plant Protection".

1.05 QUALITY ASSURANCE

A. Tree Service Qualifications: Contractor performing tree work shall possess a valid specialty class C61-D49 Contractor's License. An experienced and professional tree service firm that has successfully completed tree removal and pruning work similar to that required for this Project.

B. Preconstruction Meeting: Conduct meeting at Project site to comply with requirements in Section 01200 "Project Meetings."

1. Prior to start of construction the Contractor to conduct a meeting with the City Representative to review tree work. Notify City Representative at least ten-working days before convening meeting.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Temporary Fencing: See Section 01 56 39 "Temporary Tree and Plant Protection".

B. Pre-Emergent Herbicide: See Section 32 90 00 "Planting."

C. Water: Clean, potable and free of deleterious matter. Source, in accordance with regulations and codes governing water conservation measures for the City and County of San Francisco.

PART 3 - EXECUTION

3.01 PREPARATION

A. Temporary Fencing: See Section 01 56 39 "Temporary Tree and Plant Protection".

B. Inspection for bird/nests during bird nesting season: If tree work will be performed during bird nesting season (January 15 through August 15), a Certified Biologist must be obtained by the Contractor to provide an nesting inspection for the trees to be affected during construction work.
1. If active nests are identified by the Biologist, no work may occur at that tree or surrounding area. A 100-foot exclusion buffer of temporary fencing shall be erected around the tree with the active nest, and no work may occur within the 100-foot buffer until the Biologist has verified that young birds have left the nest and that active nesting has been completed.

C. Wood Chip Mulch: If temporary haul or access roads must pass over root area, provide 4 to 6-inch mulch over filter fabric to cover root area of trees if. Approved chippings from removed trees may be used. Remove wood chips after completion of work, as directed.

D. Do not allow fires under or adjacent to remaining trees or other plants.

E. Make provisions for salvaging and disconnecting, capping and temporarily supporting any irrigation lines as directed by City Representative.

3.02 BACKFILLING AND REGRADING

A. Backfill holes and depressions with approved site soil or imported topsoil. Compact dampened soil to 85 percent. Water to settle. Add soil and grade to conform continuously to adjacent existing grades.

30.3 PRUNING OBSERVATIONS

A. Progress Observations: The Contractor shall request the following observations during pruning operations:

1. Observation after 30% of trees have been pruned.

2. Inspection at completion of pruning.

3. Inspection as part of Landscape Maintenance.

3.03 TREE REMOVAL, STUMP REMOVAL AND TREE PRUNING

A. Prune existing trees that are indicated on drawings, and confirmed by pre-construction walk through. Remove trimmings and debris from under canopy. Apply 2-inch weed-free mulch layer under canopy, as directed.

B. Trees shall be pruned for safety considerations, such as crown cleaning, limb end weight reduction, and as determined by the pre-construction walk through.

C. Prune trees to compensate for limb or root loss caused by damage due to construction work. Provide subsequent maintenance during Contract period as directed City Representative.

D. Cut branches with sharp and clean pruning instruments; do not break or chop.

F. Removal of trees (see tree sculptures section below) and stumps:

1. For trees/stumps to be removed in areas of new path alignments or where paving, footings, foundations, piers, or other new structures are to be installed, grind stumps to 24” (minimum) below finish grade and to depth sufficient to allow new proposed construction. Backfill voids with approved backfill and topsoil per the Specifications. See Existing Condition and Demolition Plans.

2. For other trees/stumps of Poplar (and other species with aggressive resprouting) to be removed, cut stump flush to finish grade and immediately apply approved
herbicide* ("Aquamaster") to prevent re-sprouting. If herbicide will not be applied immediately, leave greater amount of trunk above grade, and make the final cut immediately prior to applying herbicide. Additionally grind any surface roots 12" below grade.

3. Public Protection and Required Noticing of Herbicide Application:
   a. Area to receive approved herbicide must be closed off from public access with temporary construction fencing approved by the City Representative.
   b. Minimum of (4) four days prior to herbicide application, Contractor shall post required notices at area where herbicide will be applied, and/or entrances to overall site, as approved by the City Representative. Herbicide notice template forms to be provided to the Contractor by the City Representative. Request notice template forms at least (10) ten-days in advance of herbicide application. Contractor shall write the application window dates in the spaces provided on the Notice. A one week window is advised.
   c. Upon application of herbicide, the Contractor shall fill out the “Date Completed” on the Notice, and the Notice shall remain for four (4) calendar days following the application.
   d. The Notices shall be removed by the Contractor on the fifth (5th) day following application.

4. *Approved pesticide shall be per the CCSF Integrated Pest Management Reduced Risk Pesticide/Herbicide List.

5. Cut and re-apply approved herbicide as needed in the event of re-sprouting.

6. Remove excess topsoil or sandy fill as required to complete finish grades as shown on plans.

3.04 TREE REPAIR AND REPLACEMENT

A. Repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots as directed City Representative. Aerate, water and mulch as directed by City Representative.

B. Remove and replace dead and damaged trees that the City Representative determines to be incapable of restoring to a normal growth pattern.

C. Aerate surface soil compacted during construction, 10-feet beyond drip line and no closer than 36-inches to tree trunk. Drill 2-inch diameter holes a minimum of 12- inches deep at 24-inches on center. Backfill holes with an equal mix of augered soil and sand. Deep-root water or as directed by City Representative.

3.05 CHIPPING, SALVAGING AND DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Any tree material indicated to be removed on the Drawings, or encountered during clearing/grubbing operations, MUST BE offhauled and disposed of as Contractor’s Property.
C. Disposal: Remove excess excavated material, trees, and tree parts as Contractor’s property or as directed.

END OF SECTION
SECTION 31 22 13
ROUGH GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Cutting, grading and rough contouring the site in accordance with Section 700, 701, 705, 706, 707, 708, 709, 710 of the Standard Specifications.

1.02 RELATED SECTIONS
A. Section 32 91 19 – Planting Preparation

1.03 REFERENCES

1.04 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

A. Furnish required material for the cutting, grading and rough contouring of the site in accordance with Section 700, 701, 705, 706, 707, 708, 709, 710 of the Standard Specifications.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify site conditions.
B. Establish elevations for the work as indicated by the drawings and directed by the City Representative.

3.02 PREPARATION
A. Identify required lines, levels, contours, and datum.
B. Identify known underground, above ground, and aerial utilities.
   Stake and flag locations.
C. Protect above and below grade utilities which are to remain.
D. Protect existing structures, fences, and curbs from excavation equipment and vehicular traffic.

3.03 CUTTING
A. Make grade changes gradual. Blend slope into level areas.

3.04 TOLERANCES

A. Top surface of subgrade: Plus or minus 1/10 foot.

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.
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.
F. SFDPW Order No. 178,940, ‘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:
### 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.

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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. Asphalitic 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 31 23 35
UTILITY TRENCHING AND BACKFILLING

PART 1  GENERAL

1.01  DESCRIPTION
A. The work of this section consists of trenching and backfilling for the construction and installation of pipelines. All trenching will be open cut.

1.02  DEFINITION
A. Materials used in backfill are defined as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2-inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>50-80</td>
</tr>
<tr>
<td>No. 40</td>
<td>10-25</td>
</tr>
<tr>
<td>No. 200</td>
<td>5 (Maximum)</td>
</tr>
</tbody>
</table>

1.03  QUALITY ASSURANCE:
A. All compaction testing and gradation analysis will be arranged and paid for by the City. Contractor shall submit required samples of bedding, fill, and backfill materials for testing.
B. Compaction of fill and backfill materials in accordance with the requirements of Section 707 of the Standard Specifications.

1.04  PROJECT CONDITIONS
A. Arrange construction sequences to provide the shortest practical time that the trenches will be open to avoid hazard to the public, and to minimize the possibility of trench collapse.

1.05  EXCAVATION CLASSIFICATION
A. Regardless of the nature of material excavated, all excavation will be considered unclassified.

PART 2  PRODUCTS

2.01  GENERAL
A. All backfill material shall be approved before use and be free of cinders, ashes, large hard clods, organic debris, or other deleterious items. Trench excavation materials may be used as approved.

2.02  MATERIALS FOR BACKFILLING
A. Furnish required backfill materials listed under the appropriate types of utility line in Section 703 of the Standard Specifications.
PART 3  EXECUTION

3.01  TRENCH EXCAVATION

A.  Trenching Guidelines:  Excavate the trench to the approximate level of the top of the utility line to be installed, using adequate trench width and side slopes to safely accommodate worker access. Continue excavating for the utility line, to a width not greater than is shown on the appropriate trench detail.

   1.  Unstable Trench Bottom:  Secure approval of depth of over-excavation and stabilization method.  For wet trench construction, use approved method of dewatering through diversion, damming and pumping, well points, or subsoil drain systems.  Dispose of removed fluidized materials as approved.  Use backfill material to build a suitable foundation to within 6 inches of finished utility grade, prior to bedding with the specified material.  Compact layers until unstable conditions are under control.

3.02  SHORING AND SHEETING

A.  Construct and maintain all shoring, sheeting, and slope lay-back necessary to protect the excavation, as needed for the safety of the employees and as required by applicable State and Federal laws.

3.03  BACKFILLING

A.  Compaction:  Use vibratory compactors for sands and gravels (noncohesive soils).  Use mechanical tampers for sand and gravel containing a significant portion of fine-grained material, such as silt and clay (cohesive soils).  Hand tamp around pipe or cable to protect the lines until adequate cushion is attained.  Puddling or water flooding for consolidation of backfill or compaction by wheel rolling with construction equipment will not be permitted.

   B.  Bedding:  compact the specified material to 95 percent of maximum density to the finished utility grade.

   C.  Utility Installation:  Shape the trench bottom to ensure uniform contact with the full length of the installed line and remove any sharp-edged materials that might damage the line.  Compaction shall be maintained beneath the line.

   D.  Backfill:  Fill by hand placement around the utility to just over half depth, and compact in a manner to ensure against lateral or vertical displacement.  Place backfill to 12 inches above the utility line by hand placement in not more than 6-inch layers.  Compact each layer to 95 percent of maximum density.

   E.  Backfill:  Place and compact the specified material as follows:

          1.  Pedestrian Areas:  Fill and compact in 8-inch maximum layers to 90 percent of maximum density.

   F.  Clean-Up:  Prior to final inspection and acceptance, remove all rubbish and excess material for disposal as approved, and leave area in a neat, satisfactory condition.

END OF SECTION
SECTION 31 25 00
EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work Included: Provide all material, labor, equipment and services necessary for the furnishing and installation of a complete erosion control installation as shown on the Drawings and as specified. The work includes but is not limited to:

1. Rough grading and landscape grading of areas to receive erosion control.
2. Installation of erosion control fabric and accessories.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading
B. Section 32 91 19 – Planting Preparation

1.03 SUBMITTALS

A. Samples: Submit the following to the Engineer for acceptance.
   1. Erosion Control Fabric: one square foot size minimum, accompanied by product data and fabric staple.

1.04 PROJECT/SITE CONDITIONS

A. Contractor to install erosion control on all areas impacted by construction work, and where indicated on the Drawings.

1.05 QUALITY ASSURANCE

A. The Contractor shall have a minimum of 5 years experience in erosion control projects and have complete a minimum 3 projects of similar type within the last 5 calendar years.

PART 2 PRODUCTS

2.01 MATERIAL

A. Erosion Control Fabric shall be heavy duty coconut coir blanket of a uniform plain weave: "RG Coir 700" as available from Reed & Graham Geosynthetics, Sacramento, CA, (888)381-0800; or approved equal.

B. Yarn: Cleaned, weed-free and unbleached, evenly spun, and uniformly twisted, 100% spun coir conforming to the following standards:
   Open Area: ~50%
   Wide Width Tensile, Dry (KN/M) Warp x Fill: ASTM 4595, 27.8x9.3
   Wide Width Tensile, Wet (KN/M) Warp x Fill: ASTM 4595, 21.4x6.8
   Elongation at Failure, Dry (%): ASTM 4595, 68x32
Elongation at Failure, Wet (%): ASTM 4595, 82x49
“C” factor (runoff coefficient), 1.5:1 slope: 0.002

C. Furnish in either 2-meter and/or 4-meter wide rolls, meeting the following requirements: Length - 50 meters per roll. Weight of fabric – 700g (~2lbs)/square meter.

D. Erosion Control Fabric Staples: 8-gauge galvanized steel wire formed into a "U" with 12-inch (min.) legs and a one-inch crown.

E. Fiber Roll Materials

1. Pre-manufactured rice straw or coconut fiber rolls, weed-free, and encapsulated within a biodegradable coir fiber netting. Dimensions of each roll: 8-inch to 10-inch diameter, available in segments approx. 20-50 feet long. Netting shall be secured tightly at each end of individual rolls and be durable for 3-5 years after installation.

2. Fiber roll stakes: 1 inch by 2 inch by 30-inch wood stakes.

3. Suppliers:

   R. H. Dyck, Inc., Earth Saver® Erosion Control Products
   P.O. Box 665, Winters, CA 95694
   1-866-WATTLES,
   www.earth-savers.com


   Reed & Graham Geosynthetics
   Sacramento, CA, (888) 381-0800
   www.rginc.com/geo/

PART 3 EXECUTION

3.01 PREPARATION

   A. Prepare slopes to receive erosion control fabric per Section 31 22 13 - Rough Grading and Section 32 91 19 – Planting Preparation.

3.02 INSTALLATION

   A. Install per manufacturer's direction and as follows:

   1. Lay out rolls of fabric from top of slope to bottom and perpendicular to direction of slope. Stagger joints of rolls.

   2. Pull fabric tight to soil and staple per manufacturer's direction and as required.

END OF SECTION 31 25 00
SECTION 31 62 16

STEEL PIPE PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pre-drilled, driven, open-ended steel pipe piles, partially filled with a concrete plug.

B. Related Requirements:

1. Section 02 32 27 “Force Main Monitoring”
2. Section 03 30 00 “Cast-in-place Concrete”
3. Section 03 41 00 “Precast Structural Concrete”
4. Section 09 90 00 “Coatings”

1.3 UNIT PRICES

A. Contract Sum: Base Contract Sum on number and dimensions of piles indicated from tip to cutoff, plus not less than 12 inches of overlength for cutting piles at cutoff elevations.

B. Work of this Section is affected as follows:

1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, is calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Port’s Representative and measured to nearest 12 inches.

   a. Additional payment for splices required to extend pile lengths in excess of that indicated is calculated at unit prices stated in the Contract.

2. Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, is calculated at unit prices stated in the Contract.

3. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.

4. No payment is made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving.
1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Contractor shall submit Shop Drawings as required:

1. For steel pipe piles, show fabrication and installation details, including splices.
   a. Indicate welds by standard AWS symbols, distinguishing between shop and field
      welds, and show size, length, and type of each weld.

2. For field splice details, show stabbing points, blocks, shims, etc., required to align pile
   sections when working flat and in the leads. Show weld preparations and alignment
   tolerances for approval by the Port’s Representative.

3. Show details of driving helmets, cap blocks, and pile cushions. Submit no less than 2
   weeks prior to the first indicator pile installation.

4. Pile driving procedure.
   a. Proposed pile driving and survey equipment procedures, including the pile
      numbering scheme.
   b. Proposed method for maintaining pile alignment (location), with details of
      methods and equipment to be used to measure alignment.
   c. Proposed survey methods for locating pile head, tip, and mudline elevations for
      verification of penetration depths and corresponding penetration resistance profiles
      and installation sequence methods.
   d. Proposed method for maintaining the pile plumb during installation.
   e. Submit proposed method for penetrating the rock slope protection adjacent to the
      concrete seawall, such as using either/or a combination of: 1) spudding, 2) stingers,
      3) driving shoes, 4) jetting or 5) predrilling (with casing). The submittal should
      include details on the measures used to prevent damage to the adjacent
      improvements.
   f. Submit a proposed method for monitoring inclinometers mounted on the concrete
      seawall for review of horizontal and vertical movements. A baseline survey points
      shall be established before construction begins and read on a regular basis with the
      results submitted to the project team in a timely manner for review.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Design Mixes: For each concrete mix. Include revised mix proportions when characteristics of
   materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
C. Material Certificates: For steel pipe piles and accessories, steel reinforcement and concrete admixtures.

D. Material Test Reports: For concrete materials.

E. Pile-Driving Equipment Data:
   1. Pile Driving Analyzer.
      a. Provide complete description of all pile driving analyzer equipment and procedures.
      b. Firm qualifications - provide qualifications of firm to operate the pile driving analyzer and analyze the data.
   2. Internal drilling or jetting equipment.
      a. Data of jetting equipment and system, including certificates of calibration of flow meter and pressure gauge used for measuring flow rates and water pressures at jetting pump.
   3. Pile Hammer and Driving System.
      a. Submit the proposed pile hammer and driving system at least 28 days prior to the start of pile driving for the approval by the Engineer.
      b. Complete Pile Hammer Data Sheet, for all hammers proposed for use on the project. For hammers with variable energy output, also supply manufacturers operating data and rated energy at each fuel setting.

F. Noise control and monitoring plan for Aquatic Species, including plans for an underwater air-bubble curtain, cushion blocks and/or jetting to reduce noise below the threshold levels outlined in The Port of San Francisco Specifications and/or the California Department of Transportation, “Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish Fisheries”, February 2009. The pile contractor should retain a qualified professional to perform the noise monitoring program.

G. Pile Driving Noise Control above water: Per CEQA Mitigation Measure M-NO-1, Contractor is required to use noise-reducing pile driving techniques such as installing intake and exhaust mufflers on pile driving equipment, installing shrouds around the pile driving hammer where feasible, and using cushion blocks and/or jetting.

H. Indicator piles: Submit a report of indicator pile records and results of analyses in accordance with "Indicator Pile Program" and "Indicator Pile Monitoring".

I. Pile-Driving Records: Submit within three days of driving each pile.

J. Certified Piles Survey: Submit within seven days of pile-driving completion.

K. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.
1.7 QUALITY ASSURANCE

A. Comply with requirements in ACI 301, "Specifications for Structural Concrete."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel"

1.8 INSPECTIONS

A. Shop Inspection:

1. The fabricator shall perform, at his expense, normal quality control procedures in accordance with industry standards and fabricator’s quality control manual. The Port's Representative shall be allowed access to all parts of the Work at all times and shall be furnished such information and assistance by the Contractor and fabricator as may be required for a complete and detailed inspection.
2. Special inspections will be performed by the Port's Representative in accordance with 2010 California Building Code Chapter 17. Ultrasonic Testing may be performed in the shop.

B. Field Inspection:

1. The Port Representative will perform visual inspection of welding, in accordance with AWS D1.1, on a spot check basis throughout the work.
2. After welds are completed, they shall be hand or power-brushed and thoroughly cleaned by the Contractor before the Port Representative makes the inspection.
3. Ultrasonic testing will be performed in accordance with Special Inspection Agreement and AWS D1.1 to augment the visual inspection of all pile splice welds. Port Engineer or Port Representative shall engage the services of an independent inspector/laboratory to perform the ultrasonic testing.

C. Correction of Defective Welds:

1. Weld areas which contain defects which exceed the standards of acceptance in AWS D1.1 shall be repaired by the Contractor at Contractor’s expense.

D. Repair of the Coating System:

1. Repair of the Coating System shall be at Contractor's expense and in accordance with manufacturer's instructions.

E. Pile Driving Observation:

1. All pile driving shall be done under the observation of the Port's Designated Engineering Representative.
1.9 DELIVERY, STORAGE, AND HANDLING
   
   A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent physical damage.

   1. Coated Piles: Protect finish and touch up damage before driving piles.

   B. In the event of damage, immediately make all repairs and replacement necessary and at no additional cost to the Port.

1.10 FIELD CONDITIONS
   
   A. Protect structures, underground utilities, and other construction from damage caused by pile driving.

   1. The Contractor’s attention is directed to the presence of a San Francisco Public Utilities Commission (SFPUC) 60-inch sewer force main located on the Tulare Park project site.

   B. Site Information: A geotechnical memorandum has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.

   C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Document conditions that might be misconstrued as damage caused by pile driving. Comply with Section 013233 “Photographic Documentation.”

   D. Rock Slope Protection Pile Installation:

   1. Placement of the steel pipe piles will require placement through the existing Rock Slope Protection adjacent to the concrete seawall as indicated on the Project Drawings. Contractor shall provide all means as may be necessary to place the piles in the locations shown and to the tip elevations shown, all within specified tolerances. Contractor shall determine the needs of placement conditions for himself and provide all materials and equipment that may be necessary: including such things as special enhancements to pile tips, driving shoes or tips, jetting, pre-drilling, pre-spudding and all other additional means that he determines to be necessary in addition to meeting the requirements shown.

PART 2 - PRODUCTS

2.1 STEEL PIPE PILES

   A. Steel Pipe: ASTM A 252, Grade 3; seamless or welded.

2.2 STEEL REINFORCEMENT

   A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

   B. Plain Steel Wire: ASTM A 82/A 82M, as drawn.
2.3  CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type II.
   1. Fly Ash: ASTM C 618, Class F.
   2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Water: Potable, complying with ASTM C 94/C 94M requirements.

C. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent chloride ions by mass of cementitious material.
   2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   3. Retarding Admixture: ASTM C 494/C 494M, Type B.
   4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4  CONCRETE MIXES

A. Prepare concrete design mixes according to ACI 301, determined by either laboratory trial batch or field test data basis.
   1. Use a qualified testing agency for preparing and reporting proposed mix designs determined by laboratory trial batch.

B. Proportion mixes according to ACI 301 to provide normal-weight concrete suitable for piles with the following properties:
   2. Maximum Water-Cementitious Material Ratio at Point of Placement: 0.45.
   3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content of 6.0 percent, plus or minus 1.5 percent.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

F. Concrete-mix design adjustments may be considered if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant. Resubmit and obtain approval from Architect of proposed changes to concrete-mix proportions.
2.5 FABRICATION

A. Fabricate and assemble piles in shop to greatest extent possible.

B. Fabricate full-length piles by splicing pile lengths together. Maintain axial alignment of pile lengths. Maintain structural properties of pile across splice.

   1. Splice Coupling: Fit splice coupling into position and weld to adjoining steel pipe pile sections according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.

   2. Welded Splices: Accurately mill meeting ends of steel pipe piles, and bevel for welding. Continuously weld pile according to AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.

   3. Splice piles during fabrication or field installation.

C. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

2.6 SHOP COATING

A. General: Shop coat steel pile surfaces, except for surfaces to be encased in concrete, as follows:

   1. Extend painting to a depth of 35 feet below top of exposed pile.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and loose mill scale, and remove spatter, slag, or flux deposits. Prepare surfaces according to SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."

C. Painting: Immediately after surface preparation, apply coating according to manufacturer's written instructions to provide a dry film thickness of not less than 5 mils.

   1. Apply second coat to provide a dry film thickness of not less than 5 mils, resulting in a two-coat paint system thickness of not less than 10 mils.

   2. Mark pile lengths after shop painting.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94/C 94M.

   1. Do not add water to concrete mix after mixing.

   2. Maintain concrete temperature to not exceed 90 deg F.
PART 3 - EXECUTION

3.1 GENERAL

A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.

B. The work on the pedestrian bridges over and adjacent to the SFPUC’s 60-inch force main may only be done during the dry weather period, as a precaution, in case damage is done to the pipe and the force main could not be used, and the SFPUC would need to discharge to Islais Creek.

3.2 REGULATORY COMPLIANCE

A. The Contractor shall be responsible for any direct or indirect damage and the maintenance and repair of work required to repair any damage caused by the Contractor’s work to the City's existing 60 inch Southeast Plant Booster Pump Station force main system, and related facilities and improvements (collectively, "City Facilities").

B. Regulatory Compliance. Contractor acknowledges that City's operation of the City Facilities is subject, in part, to regulatory permitting requirements, including without limitation, and that upon violation of any such permits, City may be subject to significant fines and liability for unauthorized discharges. Contractor agrees to reimburse City, promptly upon request, for any regulatory fines, penalties or liability related to or in any way caused or exacerbated by the work performed by the contractors or agents under this contract.

3.3 DRIVING EQUIPMENT

A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.

B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.

C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.4 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcement cages symmetrically about axis of pile pipe in a single unit.
D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover on reinforcement.

E. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.5 CONCRETE PLACEMENT

A. Do not place concrete until other piles within a radius of 20 feet have been driven and approved.

B. Inspection: Before placing concrete, allow testing and inspecting agency to visually inspect and verify that each pile pipe is clean, watertight, plumb, and free of distortion or other defects.

C. Place concrete in a continuous operation and without segregation immediately after cleaning out pile pipe.

D. Place concrete by means of bottom discharge bucket, flexible drop chute, or steep-sided funnel hopper or tremie or pump concrete into place.

E. Place concrete in a dry pile pipe unless placement underwater is approved by Port’s Representative.
   1. Place concrete underwater by tremie method or pumping. Control placement operations to ensure tremie is embedded no less than 60 inches into concrete, and flow of tremied concrete is continuous from bottom to top of pile pipe.
   2. Other methods of depositing concrete may be used if approved by Architect.

F. Consolidate final 10 feet of concrete during placement to ensure that concrete is thoroughly worked around steel reinforcement and into corners.

G. Screed concrete level at cutoff elevation and apply a scoured, rough finish.

3.6 DRIVING PILES

A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.
   1. During initial driving and until pile tip has penetrated beyond layers of very soft soil or below bottom of pre-drilled or pre-spudded holes, use a reduced driving energy of the hammer as required.
   2. If a pile has developed the required driving resistance but has not reached the "specified tip elevation", continue driving until refusal occurs or until the "specified tip elevation" has been reached.
   3. If refusal occurs and the pile has not reached the "specified tip elevation", notify the Port Engineer. Refusal shall be defined as less than 6” of penetration in 50 blow counts.
   4. If the pile has reached the “specified tip elevation” but has not developed the required driving resistance, notify the Port Engineer.

B. Drilling Internal Soil Plug:
1. If refusal is encountered before the pile reaches design tip elevation, the internal soil plug may be removed by drilling or internal jetting. Drilling or internal jetting shall not be allowed within 10 feet above the pile tip to avoid disturbing the soils outside the pile. Prior to performing drilling or jetting, the Contractor shall notify the Port Engineer.

2. Removal, testing and disposal of soil plug material are the responsibility of the Contractor.

C. Obstructions:

1. When resistance to driving or obstruction is encountered above the desired tip elevation, the Contractor shall immediately notify the Port Engineer. Appropriate action to be taken by the Contractor based on the information available must be agreed with the Port's Representative prior to proceeding.

D. Damaged Piles:

1. Do not drive piles damaged or suspected of damage until inspected and approved by the Port Engineer. All repair costs for pile and coating including additional materials and labor required, shall be at the Contractor's expense.

E. Modifications:

1. The Port Representative reserves the right to modify the above criteria if conditions are encountered in the field which, in the Port Representative’s opinion, make it necessary to do so.

F. Pre-drilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.

1. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.

G. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.

H. Pile Splices: Splice piles during installation and align pile segments concentrically.

I. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:

1. Location: 4 inches from location indicated after initial driving, and 6 inches after pile driving is completed.
2. Plumb: Maintain 1 inch in 48 inches from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.

J. Excavation: Clean out steel pipe pile by removing soil and debris from inside pile before placing steel reinforcement or concrete.

K. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.
1. Fill holes left by withdrawn piles as directed by Port’s Representative.

L. Cut off tops of driven piles square with pile axis and at elevations indicated.

M. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:

1. Project name and number.
2. Name of Contractor.
3. Pile location in pile group and designation of pile group.
4. Sequence of driving in pile group.
5. Pile dimensions.
7. Elevation of tips after driving.
8. Final tip and cutoff elevations of piles after driving pile group.
10. Elevation of splices.
11. Type, make, model, and rated energy of hammer.
12. Weight and stroke of hammer.
13. Type of pile-driving cap used.
14. Cushion material and thickness.
15. Actual stroke and blow rate of hammer.
16. Pile-driving start and finish times, and total driving time.
17. Time, pile-tip elevation, and reason for interruptions.
18. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
19. Pile deviations from location and plumb.
20. Pre-boring, jetting, or special procedures used.
21. Unusual occurrences during pile driving.

N. Certified Piles Survey: Engage a land surveyor to prepare a piles survey showing final location of piles in relation to the property survey and existing benchmarks.

1. Notify Port’s Representative when deviations from locations exceed allowable tolerances.

3.7 FIELD QUALITY CONTROL

A. Indicator Pile Program: Indicator pile program is at Contractor’s option. If indicator piles are not used, Indicator Pile Monitoring is still required for piles noted as indicator piles (or substitute pile locations authorized by the Port).

1. Where shown, various structure piles are designated to be indicator piles. The Port will use indicator pile data to determine revised “minimum and estimated” pile tip elevations as well as driving resistance capacity criteria. Drive indicator piles to indicated tip elevations and driving resistances and as directed by the Port Engineer. Indicator piles shall be monitored with a Pile Driving Analyzer (PDA) and data analyzed in terms of bearing capacity components using a wave equation numerical simulation of the pile. Piles shall not be cut off until all indicator pile data and analyses are submitted and the piles are accepted by the Port Engineer.
Bayview Gateway and Tulare Park
Improvements Project

B. Indicator Pile Monitoring:

1. Pile Driving Analyzer: All indicator pile driving shall be monitored by the Contractor with a pile driving analyzer capable of:
   a. Measuring the transient pile response parameters such as strain and acceleration during pile driving.
   b. Estimating the actual energy delivered by the pile driving hammer systems to the head of the pile during driving.
   c. Evaluating the capacity and driving stresses of the indicator piles.
   d. Aiding in the understanding and interpretation of unusual or unanticipated pile driving characteristics.

2. The Contractor shall engage an independent qualified firm acceptable to the Port Engineer to operate the PDA, and present a written report to the Port Engineer no later than one week after the indicator pile program is completed. The report shall indicate all the above factors and final pile capacities after performing the required detailed numerical simulation analyses on at least two of the 24 inch steel pipe piles as directed by the Port Engineer.

3. Re-strike of Indicator Piles: At least two (2) of the 24 inch steel pipe indicator piles shall be re-struck or re-driven 24 hours after the initial installation to obtain change in pile capacity or driving characteristics as directed by the Port Engineer. The Contractor shall monitor the piles with the (PDA) for the re-strike/re-drive also and submit a report as specified above.

C. Production Pile Monitoring:

1. Three percent of the production piles shall be monitored by the Contractor with a pile driving analyzer meeting the requirements specified above. The specific piles to be monitored shall be as directed by the Port Engineer.

D. Damaged and Misplaced Piles:

1. Remove and replace with new piles those damaged, misplaced, driven below design cutoff, or driven out of alignment, as directed. Damaged butts of piles shall be repaired as directed by the Port Engineer. Where damage is severe, repair shall consist of cutting off damaged section and constructing new section.

3.8 TOUCHUP PAINTING

A. Clean field welds, splices, and abraded painted areas and field-apply paint according to SSPC-PA 1. Use same paint and apply same number of coats as specified for shop painting.

1. Apply touchup paint before driving piles to surfaces that are immersed or inaccessible after driving.
3.9 DISPOSAL

A. Remove withdrawn piles and cutoff sections of piles from site, and legally dispose of them off Owner's property.

3.10 LIMITATIONS

A. No pile driving shall occur during the night on weekdays (7:00 PM to 7:00 AM) and no pile driving shall occur on weekends or holidays.

END OF SECTION 31 62 16
SECTION 32 01 13.63
SLURRY SEAL

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section includes specifications for slurry sealing at the locations and to the dimensions indicated on the Plans in accordance with these Specifications and as directed by the City Representative.

B. The slurry seal shall conform to section 37-3 of the CTSS. All materials used in the work shall comply with the requirements herein specified, and the composition of the slurry shall also be in accordance with these specifications.

C. The slurry seal shall be Type I aggregate or as directed by the City Representative.

1.02 REFERENCE STANDARDS

A. State of California Department of Transportation Standard Specifications (hereinafter referred to as CTSS), dated 2010.

1.03 PERFORMANCE QUALITY CONTROL

A. Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of the work described for this Section, and who shall be present at all times during progress of the work of this Section and shall direct all work performed under this Section.

B. For actual finishing of slurry seal on asphalt concrete surfaces and operation of the required equipment, use only personnel thoroughly trained and experienced in the skills required.

C. Slurry sealing work shall only be performed when the pavement and air temperatures are at least 60 degrees F and rising. The City anticipates that the entire slurry sealing work can be completed in 3 aggregate days. In the event that the total number of days when the required temperature occurs is less than 2 days and the Work is not complete, the City, at its sole discretion, may extend the contract duration until such time as enough days when the required temperature occur to complete the total of 3 aggregate days.

1. There shall not be non-compensable time extensions in the event the work is not performed during days when the pavement and air temperatures are at least 60 degrees F and rising, and there are at least 3 days when such temperature occurs during the contract duration, and during City’s time extension, if any.

1.04 SUBMITTALS

A. Submittals shall conform to section 37-3.01C of the CTSS.

1. No slurry sealing work shall be done prior to the approval of the submittals.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials shall conform to section 37-3.02 of the CTSS.
B. Water used in making slurry shall be potable and free from harmful soluble salts.

C. Mix Design shall conform to section 37-3.01D(4)b of the CTSS. The table is provided below for reference:

**Slurry Seal Mix Design Requirements**

<table>
<thead>
<tr>
<th>Properties</th>
<th>International Slurry Surfacing Association Test Method</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistency, mm, max</td>
<td>Technical Bulletin 106</td>
<td>30</td>
</tr>
<tr>
<td>Wet stripping</td>
<td>Technical Bulletin 114</td>
<td>Pass</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Technical Bulletin 115</td>
<td>Pass</td>
</tr>
<tr>
<td>Cohesion test(^a), kg-mm within 1 hour, min</td>
<td>Technical Bulletin 139</td>
<td>200</td>
</tr>
<tr>
<td>Wet track abrasion, g/m², max</td>
<td>Technical Bulletin 100</td>
<td>800</td>
</tr>
</tbody>
</table>

\(^a\) Mixing test must pass at the maximum expected air temperature at the job site during placement.

\(^b\) Using project source aggregate, asphaltic emulsion, and set-control agents, if any.

D. Aggregate shall conform to section 37-3.02A of the CTSS. Aggregate must have the following gradation as determined under California Test 202. The table is provided below for reference:

**Aggregate Grading**

<table>
<thead>
<tr>
<th>Sieve sizes</th>
<th>Percentage Passing by Aggregate Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>--</td>
</tr>
<tr>
<td>No. 4</td>
<td>100</td>
</tr>
<tr>
<td>No. 8</td>
<td>90–100</td>
</tr>
<tr>
<td>No. 16</td>
<td>60–90</td>
</tr>
<tr>
<td>No. 30</td>
<td>40–65</td>
</tr>
<tr>
<td>No. 200</td>
<td>10–20</td>
</tr>
</tbody>
</table>

E. Aggregate quality shall conform to section 37-3.02B(2) of the CTSS. The table is provided below for reference:

**Aggregate Quality**

<table>
<thead>
<tr>
<th>Quality Characteristic</th>
<th>Test Method</th>
<th>Specification By Aggregate Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Sand equivalent, min</td>
<td>California Test 217</td>
<td>45</td>
</tr>
<tr>
<td>Durability index, min</td>
<td>California Test 229</td>
<td>55</td>
</tr>
</tbody>
</table>

F. Mix design results shall include any proposed additives. No change in the proportions of the approved mix design will be permitted without the City Representative’s approval. If the source of supply for either the aggregate or the emulsion is changed, the mix design approval and the quality control procedures specified herein shall be repeated. Mixes used shall not deviate more than ± 1% from the approved proportion of emulsion.

G. The completed slurry shall have a minimum skid resistance of forty (40) when tested per California Test No. 342.

2.03 SLURRY MIXING AND SPREADING EQUIPMENT

A. Mixing and Spreading shall conform to section 37-3.03C of the CTSS.

PART 3 – EXECUTION
3.01 SURFACE PREPARATION

A. Prior to slurry sealing each roadway or area, each roadway or area to be slurry sealed shall be “approved for sealing” by the City Representative. In order for a roadway or area to be approved for sealing, the following requirements shall be performed to the City Representative’s satisfaction.

1. All existing painted or thermoplastic traffic stripes and pavement markings within the roadway or area to receive the slurry seal shall be removed prior to sealing operations unless indicated otherwise on the Plans or as directed by the City Representative. Removal shall be to the satisfaction of the City Representative.

2. Any pavement damaged during marker removal shall be repaired to the satisfaction of the City Representative prior to the slurry sealing of the roadway or area. All repair work shall be considered Incidental Work.

3. All pavement markings and damaged pavement removed shall be disposed of outside the roadway or area in accordance with Section 16-1.01 of the CTSS.

4. Immediately following the removal of existing pavement striping/markings and pavement markers, clean and sweep the roadway or area to eliminate all materials attributed to or involved with removal operations. All materials shall be removed from the roadway or area prior to the end of each working day or as directed by the City Representative. Water shall not be used to flush down roadways or areas in place of sweeping.

5. Portions of roadways or areas that have been previously open to public traffic shall be subject to the following additional requirements:
   a. Stop bars and legends, excluding those at intersections may be removed up to seven (7) calendar days prior to placement of the slurry seal. All other stripes and markings, including crosswalks and stop bars at intersections requiring removal shall be removed the same day the slurry is to be placed.
   b. If pavement markers, paint or thermoplastics delineation, stop bars, or legends are removed in advance of the day of the slurry seal application, temporary pavement delineation shall be installed.

B. All vegetation has been removed in accordance with the following requirements:

1. All vegetation has been removed from all cracks in the existing roadway or area and along the edge of pavement or gutter prior to placing the slurry seal.

2. In the event mature trees are encountered adjacent to the roadway or area requiring the slurry seal, operations around the trees shall be such that the desired slurry sealing result is accomplished without damage to the trees. No trimming of trees shall be allowed without specific written permission of the City Representative.

3. Vegetation and tree limbs removed shall be disposed of outside the roadway or area in accordance with section 16-1.01 of the CTSS.

4. Tree roots under pavement areas that are causing an uneven surface shall be removed with a sharp edge instrument to a depth of eight (8) inches below finished grade as Incidental Work. Feeder roots greater than two (2) inches in diameter shall be checked by the Bureau of Urban Forestry. Call the Customer Service number 311 prior to removal.

C. All manhole covers, valve boxes, miscellaneous utility lids and catch basins have been protected in accordance with the following requirements:

1. The surface of all manhole covers, valve boxes, miscellaneous utility lids and catch basins within the limits of work shall be protected from the slurry seal.

2. All materials used to protect manhole covers, valve boxes, miscellaneous utility lids and catch basins shall be removed and disposed of properly after the slurry sealing operations.
3. All manhole covers, valve boxes, miscellaneous utility lids and catch basins shall have a clean surface after the slurry sealing.

D. Architectural items in the roadway have been protected in accordance with the following requirements:
   1. The surface of all architectural items including the edges shall be protected from the slurry seal.
   2. All materials used to protect architectural items shall be removed and disposed of properly after the slurry sealing operations.
   3. All architectural items shall have a clean surface after the slurry sealing.
   4. The City Representative may require architectural items to be temporarily moved out of the roadway, then replaced after the slurry seal has cured. This work shall be considered as Incidental Work.

E. Crack Sealing has been applied in accordance with section 37-5 of the CTSS and the following requirements:
   1. Crack sealing shall be applied to locations of existing cracks within the slurry sealing limits of work. The crack sealant shall be Type II or as directed by the City Representative and in accordance with 37-5.02 of the CTSS. The table is provided below for reference:

<table>
<thead>
<tr>
<th>Crack Treatment Material</th>
<th>Quality Characteristic</th>
<th>ASTM Test Method</th>
<th>Type I Material</th>
<th>Type II Material</th>
<th>Type III Material</th>
<th>Type IV Material</th>
<th>Type V Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softening point (min.)</td>
<td>D 36</td>
<td>102 °C</td>
<td>96 °C</td>
<td>90 °C</td>
<td>84 °C</td>
<td>84 °C</td>
<td></td>
</tr>
<tr>
<td>Cone penetration at 77° F (max.)</td>
<td>D 5329</td>
<td>35</td>
<td>40</td>
<td>50</td>
<td>70</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Resilience at 77° F, unaged, %</td>
<td>D 5329</td>
<td>20-60</td>
<td>25-65</td>
<td>30-70</td>
<td>35-75</td>
<td>40-80</td>
<td></td>
</tr>
<tr>
<td>Flexibility b</td>
<td>D 3111</td>
<td>0 °C</td>
<td>0 °C</td>
<td>0 °C</td>
<td>-11 °C</td>
<td>-28 °C</td>
<td></td>
</tr>
<tr>
<td>Tensile adhesion, %, (min.)</td>
<td>D 5329</td>
<td>300</td>
<td>400</td>
<td>400</td>
<td>500</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Specific gravity (max.)</td>
<td>D 70</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Asphalt compatibility</td>
<td>D 5329</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td>Sieve test (percent passing)</td>
<td>See note d</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

a Except for viscosity, cure each specimen at a temperature of 23 °C ± 2 °C and relative humidity of 50 ± 10 percent for 24 ± 2 hours before testing.

b For flexibility test, the specimen size must be 6.4 ± 0.2 mm thick x 25 ± 0.2 mm wide x 150 ± 0.5 mm long. Test mandrel diameter must be 6.4 ± 0.2 mm. Bend arc must be 180 degrees. Bend rate must be 2 ± 1 seconds. At least 4 of 5 test specimens must pass at the specified test temperature without fracture, crazing, or cracking.

2. Where cracks of varying widths are to be filled, it may be necessary to use more than one crack sealant formulation on the project.

3. Sand applied to tacky crack treatment shall be in accordance with 37-5.02 of the CTSS. The table is provided below for reference:

<table>
<thead>
<tr>
<th>Sand Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
</tr>
<tr>
<td>No. 4</td>
</tr>
<tr>
<td>No. 50</td>
</tr>
<tr>
<td>No. 200</td>
</tr>
</tbody>
</table>
4. Refer to the manufacturer’s product information sheet or application specifications for application methods, handling requirements, and other information.

5. No sealant shall be placed in cracks until cracks are free of deleterious materials, including old sealant, organic materials, sand, dust and clay and are dry.

6. Cracks shall be filled flush with the surface and any overfill shall be squeegeed so that the overband cap does not exceed 1/16 inch above the surface and the width does not exceed two (2) inches beyond the crack edges.

7. Ensure protection of newly placed materials from damage by traffic, weather, or other forces until fully cured. All crack sealed areas damaged by any force prior to acceptance of the work shall be corrected.

8. Work shall be scheduled such that crack sealing operations in a given area are performed at least seven (7) calendar days prior to application of the slurry seal.

9. All work associated to crack sealing shall be considered as Incidental Work.

F. Cracks larger than one (1) inch shall be filled or sealed flush with the surface with hot asphalt concrete as directed by the City Representative.

G. The surface of each roadway or area to be slurry sealed shall be adequately cleaned a maximum of forty-eight (48) hours prior to application of the slurry seal by sweeping as necessary to remove all loose particles of paving, dirt, vegetation, oil, and gasoline drippings; and all other extraneous materials.

3.02 INSTALLATION

A. Installation and placement shall conform to Section 37-3.03D of CTSS.

B. Exception: The slurry shall not be installed unless the pavement and air temperatures are at least 60 degrees F and rising.

C. Exception: Paint binder or tack coats are not to be applied prior to application of the slurry seal.

D. At limits of the slurry seal (start or finish), a straight line cut-off shall be obtained. All work associated with the straight line cut-off shall be considered as Incidental Work.

E. Edge limits of the slurry on both sides of the roadway or area shall be maintained in a neat, straight and uniform line. In the event that the slurry extends onto the gutter, parking strip, face of curb, top of curb or sidewalk or the slurry is not in a neat, straight, uniform line, all excess slurry from the gutters, parking strips, face of curbs, top of curbs or sidewalks shall be removed using an appropriate method. Any runs or drips that spill on to any concrete surface shall be removed the same day the spill occurs. At completion of removal operations, concrete surfaces shall be restored to original condition (grey/white concrete finish). All work associated with the removal of the slurry from surfaces shall be considered as Incidental Work.

F. Rolling of the slurry shall be on an as needed basis as required by the City Representative and shall be considered as Incidental Work. Rolling of the slurry sealed roadways or areas shall commence once the slurry has cured enough so that it will not pick upon the tires of the roller. A self-propelled 10-ton pneumatic roller with a tire pressure of fifty (50) PSI (3.4 ATMS) equipped with a water spray system shall be used. The roller shall operate at a maximum speed of five (5) miles per hour. The surface to be rolled shall be subjected to a minimum of three (3) full coverage passes by the roller.
G. Roadway and/or area sweeping following the application (and rolling) of the slurry seal shall be in accordance with the following requirements:

1. Sweep each roadway and/or area slurry sealed.
2. The initial sweeping shall be performed no sooner than three (3) calendar days and no more than five (5) calendar days after the slurry has been applied to the roadway or area. There shall be enough passes to ensure the entire roadway or area slurried is swept. Additional passes may be required if the entire roadway or area slurried is not swept.
3. Sidewalk areas adjacent to the slurried areas shall be swept as directed by the City Representative.
4. The final sweeping shall be performed no sooner than fourteen (14) calendar days and no later than twenty eight (28) calendar days after the slurry has been applied to the roadway or area. There shall be enough passes to ensure the entire roadway or area slurried is swept. Additional passes may be required if the entire roadway or area slurried is not swept.
5. The sweepings removed shall be disposed in accordance with Section 16-1.01 of the CTSS.
6. All roadway and/or area sweeping shall be considered as Incidental Work.

END OF SECTION
SECTION 32 01 16.71
COLD MILLING ASPHALT PAVING

PART 1 – GENERAL

1.01 DESCRIPTION
A. This section includes specifications for planing asphalt concrete pavement at the locations and to the dimensions shown on the plans, in accordance with the Project Manual and as directed by the Engineer.

1.02 REFERENCE STANDARDS
A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), revised November, 2000.
B. San Francisco Police Code: Article 29 Regulation of Noise.

PART 2 – PRODUCTS

2.01 MATERIAL
Not Used.

2.02 EQUIPMENT
A. Cold Planer machine: In accordance with the requirements of Section 214.02 of SSDPWSF.

PART 3 – EXECUTION

3.01 PLANING EXISTING ASPHALT CONCRETE SURFACES
A. General: In accordance with the requirements of Section 214.01 of SSDPWSF.
B. Conduct of the Work: In accordance with the requirements of Section 214.03 of SSDPWSF.

3.02 PROTECTION
A. A temporary 1:18 slope of hot asphalt concrete wedge shall be constructed along any longitudinal and/or transverse drop-off exceeding 3/4-inch during the same day that the planing is accomplished.
B. Asphalt concrete for temporary asphalt concrete wedge shall be as approved by the Engineer.

3.03 SURFACE PREPARATION
A. The temporary asphalt concrete wedges shall 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 placing of asphalt concrete wearing surface shall be considered as Incidental Work to cold planing.

END OF SECTION 31 01 16.71
SECTION 32 10 10
CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 SCOPE

A. This specification section governs the furnishing, installing and removing of formwork to confine and shape concrete, including shoring and form supports, and installation of embedded items.

1.2 RELATED SECTIONS

A. Section 32 20 10 – Concrete Reinforcing

B. Section 32 33 00 – Concrete Work

1.3 REFERENCED CODES AND STANDARDS

A. San Francisco Building Code (SFBC) 2010

B. American Concrete Institute (ACI) Standards

1. 301-10 – Specifications for Structural Concrete

2. 318-07 – Building Code Requirements for Structural Concrete

3. 347-04 – Guide to Formwork for Concrete

4. SP-15 – Field Reference Manual: Specifications for Structural Concrete (ACI 301-10) with Selected ACI and ASTM References

C. The Engineered Wood Association PS-1 – Construction and Industrial Plywood.

1.4 SUBMITTALS

A. Form-Facing Materials: Submit data on form-facing materials proposed if different from that specified in Section 2.1 of this specification.

B. Construction and Contraction Joints: Submit location and detail of construction and contraction joints if different from those indicated in Contract Drawings.

C. Reshoring and Backshoring Procedure: Before using reshoring or backshoring that is required or permitted, submit procedure, including drawings signed and sealed by a professional civil or structural engineer experienced in design of this work and is licensed in the State of California. Include on shop drawings formwork removal procedure and magnitude of construction loads permitted during reshoring and backshoring.

D. Submit manufacturer’s data sheet on the following:

1. Formwork release agent

2. Form liner
3. Form ties
4. Expansion joint materials
5. Waterstop materials and splices

1.5 QUALITY ASSURANCE

A. Design formwork under direct supervision of a professional civil or structural engineer experienced in design of this work and is licensed in the State of California.

B. Allowable tolerances shall be in accordance with the requirements of ACI 347 unless otherwise noted on Contract Drawings or specified.

C. Maintain copies of all applicable Codes and Standards at the project site at all times.

D. Conform to the requirements of the Division of Industrial Safety, State of California, and all other codes and regulations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in accordance with manufacturer’s instruction.

B. Store materials in a manner that will preclude any damage or deterioration and provide easy access for inspection and identification of each item.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form-Facing Materials

1. General: Form face material in contact with concrete shall be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic, or paper that creates specified appearance and texture of concrete surface.

2. Exposed Surfaces: APA grade-stamped “B-B Plyform, Class I, Exterior” douglas fir plywood; minimum ¾ inch thick; each piece grade marked; clean, smooth, uniform in size and free of raised grain, torn surfaces, worn edges, patches or other defects; no mill oiling permitted.

3. Unexposed Surfaces: Made of wood, metal, or other acceptable material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an acceptable type for the class of work involved and of the thickness and design required for rigid construction.

4. Curved Surfaces: Form with metal, plywood, or adequately supported, surfaced and matched Douglas fir boards not more than 4-inches wide.

B. Formwork Accessories
1. Form Ties: Metal, removable to a depth of at least 1-1/2 inches below the surface of the concrete. Ties shall be of sufficient strength to prevent the spreading of the forms during concrete placement. The use of wire ties will not be permitted.

2. Form Release Agents: Use an approved non-staining coating which will permit the ready release of forms and which will not affect application of applied finishes. Form release agents containing mineral oils or petroleum solvents such as paraffin will not be permitted. Use specially formulated coatings for metal forms to prevent rust stains on concrete.

3. Chamfer Strips: Except as noted on Contract Drawings and at flush joints between concrete and other construction, provide ¾ inch triangular wood or plastic strips, place and secure in forms at external corners.

4. Expansion and Isolation Joint Material: Preformed, ½ inch thick, conforming to ASTM D994.

5. Water Stop Material: Waterstop-RX as manufactured by Cetco, a wholly owned subsidiary of AMCOL International Corp., or approved equal.

C. All other materials, not specifically described, but required for proper completion of concrete formwork, shall be as selected by Contractor and subject to the approval of the City Representative.

PART 3 – EXECUTION

3.1 PREPARATION

A. Contractor shall conform to the recommendations in ACI 318, Chapter 6.

B. Vertical and Horizontal Controls: Establish and maintain necessary benchmarks, lines, or controls throughout construction.

C. Obtain necessary information and provide for openings, sleeves, chases, pipes, recesses, nailers, anchors, ties, inserts, and similar embedded items. Coordinate with concrete and other related work for requirements governing embedment and sleeving of pipes and conduit.

D. Obtain written approval from the City Representative before framing openings not shown on Contract Drawings.

3.2 CONSTRUCTION OF FORMS

A. General:

1. Construct formwork to produce concrete surfaces conforming to tolerances in ACI 301. Construct formwork to the exact shapes, lines and dimensions of concrete members, arranged to allow erection in proper sequence and to permit removal without damage to concrete finish.

2. Unless otherwise indicated on Contract Drawings, construct formwork panels in sections as large as practicable. Construct forms of boards or plywood of same widths, shapes, and design for accurate location of form joints as indicated on the shop drawings. Fasten together with cleats; joists and studs may be used, at Contractor’s option, in lieu of cleats if required for structural integrity of formwork.
Verify clear space between forms to insure allowable coverage for reinforcing steel and allowable tolerances for construction.

B. Framing and Bracing: Framing, bracing and supporting members shall be of ample size and strength to safely carry, without excessive deflection (exceeding allowable tolerances), all dead and live loads to which formwork may be subjected, and shall be placed sufficiently close to prevent any apparent bulging or sagging of forms.

C. Exposed Concrete Surfaces:
   1. Make plywood panel patterns regular and symmetrical, joints plumb and level, horizontal joints continuous. Control reuse of forms for exposed surfaces to provide surface of uniform color and texture without sharp demarkation between adjacent surfaces.
   2. Form ties for exposed concrete surfaces shall be arranged symmetrically and shall be aligned both vertically and horizontally (do not stagger).
   3. In general, provide ¼-inch chamfer at corners for exposed concrete unless otherwise noted. At chamfers, the concrete cover for reinforcement is critical and the minimum specified thickness shall strictly apply.
   4. Edges of all form panels in contact with concrete shall be flush within 1/32-inch and form for plane surfaces shall be such that the concrete will be plane within 1/16-inch in 4 ft. Form joints shall be tight to prevent the passage of mortar, water and grout.

D. Embedded Items: Contractor shall secure all inserts, bolts, plates, and other embedded items. Use templates for equipment anchor bolts and other embedded items where final alignment is critical. Fill voids with readily removable material to prevent entry of concrete.

E. Waterproofing Conditions: Concrete surfaces to receive waterproofing and damp-proofing materials shall be formed to provide a relatively smooth surface free of sharp corners, projections, and offsets at form joints. Form ties shall not penetrate or damage applied waterproofing and damp-proofing.

F. Camber forms for slabs and beams as required for compensating deflection of form members. Positive means of adjustment (wedges or jacks) of shores and struts shall be provided to permit realignment or readjustment.

G. Forms for walls of considerable height shall be arranged with tremies and hoppers for placing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcements above the fresh concrete.

H. Provide temporary openings at bottom of forms where necessary to facilitate cleaning and inspection before concrete placement. Provide blockouts for mechanical and electrical work wherever necessary.

I. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.

J. Construction joints and expansion joints shall be provided where indicated on the Drawings. Otherwise, Contractor shall provide the layout for review and approval.

3.3 APPLICATION OF FORM COATINGS
A. Thoroughly clean forms and coat with approved form–coating material prior to initial use and before each reuse. Excess form coating material shall not stand in puddles in the forms nor shall such coating come in contact with hardened concrete against which fresh concrete is to be placed.

B. Apply form–coating material before reinforcing steel, anchoring devices and embedded items are placed and in strict accordance with manufacturer’s directions.

3.4 FALSEWORK

A. Contractor shall be fully responsible for the proper strength, safety of the falsework, supports and bearing surfaces which are used in connection with the work. Falsework shall be designed to support imposed loads without deformation, deflection or settlement.

B. Wedges in pairs or jacks shall be used where required to maintain and/or adjust forms and formwork for beams, slabs and other parts of the structure at exact elevations. To ensure uniform bearing, single wedges are not permitted. Comply with requirements of ACI 347.

C. Vertical and lateral loads shall be carried to ground by falsework framing, or by the completed structure after it has attained the requisite strength. Falsework supports, when placed on ground, shall be protected against undermining or settlement.

3.5 REMOVAL OF FORMS AND FALSEWORK

A. Responsibility: The sole responsibility for removal of forms/falsework and for any resulting structural or finish damage rests with the Contractor. If forms are to remain, The Contractor shall adhere to all governing requirements and/or recommendations.

B. The removal of forms and falsework shall be carried out in such manner as to ensure the complete safety of the structure. Supports shall not be removed until members have sufficient strength to safely support their own weight and all superimposed loadings with proper factor of safety.

C. Unless otherwise specified in the Drawings, the minimum time for forms to remain in place shall be:

1. Side forms for footings, foundations, slabs on grade, or other components that do not resist bending shall not be removed in less than 48 hours after concrete placement. At times of low temperature or other adverse weather conditions, the Engineer may increase the required time to five days.

2. The falsework and forms supporting concrete girders, beams, joists, slabs, walls, or other members subject to bending stress, shall not be removed or released in less than 14 days after the concrete has been placed. In any case, the falsework and forms supporting the members shall not be removed until the concrete has attained a compressive strength of at least 80% of the design strength based on test results of field cured cylinders. Furthermore, such members shall not be loaded until the concrete has attained its 28-day compressive strength.

D. All forms, supports, and falsework shall be arranged so that they may be readily removed without hammering or prying against the concrete.

E. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be
filled, and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

3.6 REUSE OF FORMS

A. Reuse of forms will be accepted, providing they are in good condition and have been cleaned, repaired, and resealed as required to achieve concrete of the specified quality and texture. Do not reuse form facing more than four times.

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


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:

<table>
<thead>
<tr>
<th>Irregularity Range Per Lane Mile</th>
<th>Maximum Allowable Irregularities Per Lane Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16 inch to less than 1/4 inch</td>
<td>200 irregularities</td>
</tr>
<tr>
<td>1/4 inch to less than 5/16 inch</td>
<td>100 irregularities</td>
</tr>
<tr>
<td>5/16 inch or greater</td>
<td>0 irregularities</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Irregularity Range</th>
<th>Payment Reduction Per Each Excess Irregularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16 inch to less than 1/4 inch</td>
<td>$20.00</td>
</tr>
<tr>
<td>1/4 inch to less than 5/16 inch</td>
<td>$100.00</td>
</tr>
<tr>
<td>5/16 inch or greater</td>
<td>$200.00</td>
</tr>
</tbody>
</table>

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.

B. Asphalt: In accordance with the requirements of Section 39–2.01 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 39–2.02 of the Caltrans Standard Specifications, except that aggregate grading will be as follows:

<table>
<thead>
<tr>
<th>Sieve Sizes</th>
<th>Limits of Proposed</th>
<th>Operating Range</th>
<th>Contract Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>–</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>–</td>
<td>95–100</td>
<td>89–100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>–</td>
<td>80–95</td>
<td>75–100</td>
</tr>
<tr>
<td>No. 4</td>
<td>59–66</td>
<td>X±5</td>
<td>X±8</td>
</tr>
<tr>
<td>No. 8</td>
<td>43–49</td>
<td>X±5</td>
<td>X±8</td>
</tr>
<tr>
<td>No. 30</td>
<td>22–27</td>
<td>X±5</td>
<td>X±8</td>
</tr>
<tr>
<td>No. 200</td>
<td>–</td>
<td>3–8</td>
<td>0–11</td>
</tr>
</tbody>
</table>
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.

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

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 875 Stevenson Street, 4th 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 12 16

LANDSCAPE ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES BUT IS NOT LIMITED TO:

A. Grading and compaction of subgrade.
B. Park Pathways: new and existing

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading of Soil

1.03 REFERENCES

A. Standard Specifications, Section 205, 212.
B. CTSS, Section 39

1.04 SUBMITTALS

A. Submittals: In accordance with Section 205.03, Samples and Testing, of the Standard Specifications.

B. Submit asphalt concrete mix design including the amount of asphalt binder to be mixed with the dry aggregate to the Engineer for approval. There will be no resurfacing work to be done prior to the approval of the mix design. Asphalt concrete mix design shall conform to Section 39 of CTSS. Submit sample of aggregate base for review.

C. In accordance with the Section 01300 “Submittals”, submit a sample of the subject filler and/or sealer material to the Engineer for approval at least five (5) calendar days in advance of performing the filling and/or sealing work.

D. Steel Edging

1.05 QUALITY ASSURANCE

A. Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with design and application of the work described in this Section, and who shall be present at all times during progress of the work of this Section and shall direct all work performed under this Section

B. For actual finishing of asphaltic concrete surfaces and operation of the required equipment, use only personnel thoroughly trained and experienced in the skills required.

C. Compaction: In accordance with the requirements of Section 212.09 of the Standard Specifications.

D. Regulatory Requirements: Comply with Title 24, Part 2, California Building Code Site Accessibility Requirements.

1.06 PROJECT/SITE CONDITIONS

2/12/2014  32 12 16 - 1  Asphalt Paving
A. Verify location and coordinate installation of utility poles and other structures to include but not limited to: existing planting and pathways, signs, utility boxes, manholes, and equipment block-outs and pads, prior to commencement of work in this Section.

B. Existing pathway subgrade condition unknown. If no aggregate base exists – only fill uneven sections with aggregate base to provide smooth grade conditions and compact according to execution instructions.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Aggregate Base: All aggregate shall be in accordance with Section 205.02 of the Standard Specifications. The particle size distribution with the grading specified for 3/8 inch maximum size aggregate.

B. Asphalt: In accordance with the requirements of Section 39-2.01 of CTSS, except that asphalt shall be AR-4000.

C. Aggregate: In accordance with the requirements of Section 39-2.02 of CTSS for paving type A, except that aggregate grading shall be in accordance with one of the grading requirements as follows:

<table>
<thead>
<tr>
<th>Sieve Sizes</th>
<th>3/8” Max.</th>
<th>1/2” Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4”</td>
<td>-----</td>
<td>100</td>
</tr>
<tr>
<td>1/2”</td>
<td>100</td>
<td>95-100</td>
</tr>
<tr>
<td>3/8”</td>
<td>95-100</td>
<td>75-90</td>
</tr>
<tr>
<td>No. 4</td>
<td>73-77</td>
<td>55-61</td>
</tr>
<tr>
<td>No. 8</td>
<td>58-63</td>
<td>40-45</td>
</tr>
<tr>
<td>No. 30</td>
<td>29-34</td>
<td>20-25</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-10</td>
<td>3-7</td>
</tr>
</tbody>
</table>

D. Paint Binder: In accordance with the requirements of Section 39-4.02 of CTSS.

E. Spreading Equipment: In accordance with Section 205.04 and 212.07 of the Standard Specifications.

F. Compacting Equipment: In accordance with Section 205.05, and 212.09 of Standard Specifications.

G. Steel Edging: Reyerson Steel restraint 3/16” x 4”, with Black finish or approved equal.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Obtain City Representative’s approval of pathway layout prior to installation of asphalt paving.
3.02 INSTALLATION

A. Spread and compact aggregate base in accordance with Section 205 of the Standard Specifications.

B. Spread and compact asphalt concrete in accordance with Section 212 of the Standard Specifications.

C. Paint Binder: In accordance with the requirements of Section 39-4.02 and Section 94-1.06 of CTSS.

D. Minimum Durability Index: When tested in accordance with Caltrans Test Method 229, shall be 50.

END OF SECTION
SECTION 32 12 85
STABILIZED DECOMPOSED GRANITE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Decomposed granite paving stabilized with GraniteCrete admixture as specified herein.

1.02 RELATED WORK

A. Section 31 22 13 - Rough Grading
B. Section 32 91 19 – Planting Preparation
C. Section 32 33 00 – Landscape Concrete

1.03 REFERENCES

A. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

1.04 QUALITY ASSURANCE

A. Installer qualifications: installer to provide evidence to indicate successful experience in providing decomposed granite surfacing containing GraniteCrete admixture and/or ability to follow installation instructions. Installer must have at least 3 years experience in similar work.

B. Materials shall comply with manufactures specifications.

C. Decomposed granite paving shall meet US Department of Transportation/Federal Highway Administration Standard rating for surface firmness of 0.3 inches or less and surface stability of 0.5 inches or less as measured by a rotational penetrometer.

D. Stipulations:

1. At no point shall surface fail to drain.

2. Finish shall be smooth, continuous, firm and stable in accordance to the Americans with Disabilities Act.

E. Copolymer treated decomposed granite can permanently stain concrete and other masonry surfaces. Protect adjacent pavement, curbs, etc. from contact with decomposed granite. Cover interface edge of decomposed granite and concrete with plastic sheeting during placement. Remove any spillover immediately.

F. Do not install decomposed granted blended with GraniteCrete admixture surfacing when sub-base is wet at saturated field capacity.

G. Do not install GraniteCrete blended with decomposed granite during rainy conditions or below 40 degrees Fahrenheit and falling.
1.05 SUBMITTALS

A. Manufacturer’s product data sheet and installation instructions indicating that product complies with specifications for:
   1. Decomposed granite blended with GraniteCrete admixture surfacing.
   2. Redwood header

B. Submit one-quart cubic foot quarry samples of decomposed granite with admixture in colors specified for approval by City Representative prior to delivery to site.

C. Redwood header: Submit evidence of chain-of-custody in accordance with Forest Stewardship Council.

1.06 MOCK-UP

A. Notify City Representative 7 days in advance of mockup construction.

B. Construct mockup of 20 Square feet minimum of decomposed granite blended with GraniteCrete admixture surfacing, including base course and Redwood header, at location approved by City Representative. Build mockup a minimum of 7 working days prior to installation. Intent of the mockup is to demonstrate surface finish, texture, color and standard of workmanship.

C. Allow City Representative to view and obtain approval of mock-up before proceeding with rest of decomposed granite blended with GraniteCrete admixture surfacing.

D. Remove mock-up after acceptance of work specified in this Section.

1.07 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all admixture materials in original, unopened packaging. Protect materials / aggregate from contamination with foreign matter. Store under waterproof cover and protect from dampness.

3.08 FIELD CONDITIONS

A. Do not install decomposed granite blended with admixture surfacing when sub-base is wet at saturated field capacity.

B. Do not install materials during rainy conditions or below 40 degrees Fahrenheit and falling.

PART 2 – MATERIALS

2.01 BASE

A. Aggregate Base: Caltrans Class II, 95% compacted 4” thick on pedestrian paths and 6” thick on vehicular paths covered with spun bonded landscape fabric by Fabricscape, Inc., Chicago, IL, (800)991-0550 or approved equal.
2.02 DECOMPOSED GRANITE

A. Decomposed granite shall be:
   1. A crushed natural granite stone
   2. Color: TAN
   3. Free of shale, clay, friable materials and debris
   4. Having a 3/8” maximum gradation; Gradation in accordance with ASTM C136:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8”</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>85-100</td>
</tr>
<tr>
<td>#8</td>
<td>70-80</td>
</tr>
<tr>
<td>#16</td>
<td>50-65</td>
</tr>
<tr>
<td>#30</td>
<td>40-50</td>
</tr>
<tr>
<td>#50</td>
<td>25-50</td>
</tr>
<tr>
<td>#100</td>
<td>15-25</td>
</tr>
<tr>
<td>#200</td>
<td>10-15</td>
</tr>
</tbody>
</table>

5. Distributed by Lyngso Garden Materials, 19 Seaport Blvd. Redwood City, CA, 94063. (650) 364-1730, or approved equal.


2.03 REDWOOD HEADER

A. RIS Merchantable Heart Grade from sustainable managed forests as certified by the Forest Stewardship Council.

B. Dimensions: Nominal 2x4” with 45 degree mitered joints or 1x4” built up to match 2x4” thickness.

C. Stakes: 2”x2”x1’-6” Redwood tapering to a point spaced at 4’-0” on center

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify 80 percent relative compacted subgrade is dry and ready to receive work of this Section.

B. Verify gradients and elevations of base are correct.

PREPARATION

A. Excavate to 7” depth as required so edges of decomposed granite blended with admixture surfacing will match adjacent grades.

B. Sub-grade Preparation: Comply with Greenbook Section 301-1 – “Sub-grade Preparation.”

C. Base Course Installation: Comply with Greenbook Section 301-2 – “Untreated Base.”
D. Redwood header: install flush with crushed aggregate blended admixture. Provide sufficient stakes to secure in place.

E. Install four inches of Class II base rock and compact to 95% compaction.

3.03 INSTALLATION

A. Prior to installation, dampen surface on which installation is to occur.

B. Mix stabilizing admixture and decomposed granite per manufacturer's instructions at an off-site location, to provide a uniform even mix. Use of an off-site cement mixer per City Representative's approval.

C. Install three and three quarter inches of decomposed granite with admixture and compact using hand tamper, vibre roller, or vibre plate. The three quarter additional inch allows for a finish compaction of three inches of decomposed granite with admixture.

D. Compact with a vibratory plate to 95 percent optimum moisture content in accordance with ASTM D1557.

E. Decomposed granite and stabilizing admixture blend must remain damp throughout installation. Material may be misted with a showerhead type hose nozzle or covered with a tarp to maintain dampness during installation. Do not allow material to dry out during installation.

F. Level surfaces to elevation and gradients as indicated.

G. Compaction: After optimum moisture content is achieved for compaction, thus achieving an 88% to 92% compaction. Hand-tamp around benches, sign posts, corners, boulders, etc. Initially use a vibratory plate or a 1-3 ton smooth double drum roller in static position. Follow with final compaction using a heavy lawn roller to obtain the final desired dense, smooth, uniform finish. Take care while compacting to avoid damage to planting and irrigation systems.

H. Compacted Thickness: 3”

I. Once material tamping is complete, sweep entire surface with a medium bristle broom.

J. Compact swept material surface with a water filled lawn roller.

K. Surface shall follow contours indicated in grading plan. Flat areas shall be sloped or crowned for drainage as indicated in grading plan. Slope 2.0% maximum to drain away from structures.

L. Completed, finished surface shall be of consistent quality and free of deleterious materials such as organic materials, nails, stones, and loose material. Surface shall not have depressions or humps greater than 1/4” in ten feet.

M. Following compaction, mist the entire surface with a showerhead type hose nozzle. Mist the entire surface everyday for 5 days following installation.

N. There shall be no pedestrian or vehicular traffic on the finished surface for 5 days following installation or until surface has fully cured.
3.04 TESTING AND PROTECTION

A. Test installed decomposed granite paving with a rotational penetrometer to meet required USDOT/FWHA standards. Installations failing test shall be replaced and reinstalled until satisfying standard.

B. Protect installed site furniture, if required, during the construction period to prevent damage and wear.

END OF SECTION 32 12 85
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, 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


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 875 Stevenson Street, 4th 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. As an alternative, after achieving the concrete base depth as shown on the plans or stated in the specifications, the Contractor may add additional concrete to make flush with the existing surface. Concrete that is flush to the surface shall be milled before placing the final asphalt concrete wearing surface.
   3. The final asphalt concrete wearing surface and restored base depths shall be as shown on the cross sections in the plans.
   4. Installing and removing the temporary asphalt concrete surface on the concrete base areas or milling of excess concrete base before placing the final asphalt concrete wearing surface will be considered as Incidental Work to the Concrete Base bid item.

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. 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 back lot of the Griffith Pump
      Station at 1105 Thomas Street, San Francisco, or where directed by the City
      Representative within the City. Contact Chris McDaniels of the Bureau of Street
      and Sewer Repair at (415) 695-2090, 48 hours prior to delivery.
   2. The Contractor shall clean the granite curb of dirt, 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.

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. The cobblestones
      will be neatly and securely placed on pallets so they can be moved about safely
      after delivery. The cobblestones will be delivered, including off loading, to the
      lower lot of the City Yard at 2323 Cesar Chavez Street, San Francisco, or where
      directed by the City Representative within the City. Contact Liz Lerma of the
      Bureau of Street and Sewer Repair at (415) 641-2627, 48 hours prior to delivery.
   2. The Contractor shall clean the cobblestones of dirt, 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.

1.4 SUBMITTALS

A. The Contractor shall submit eight (8) copies of 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.
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 cementitious 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 may 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: It 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.

2.2 MIXES

A. Concrete Base: Concrete for concrete base will be Class 6–3000–3/4 and contain the admixture 2 pounds calcium chloride per sack of cement (800.08 and 800.11) to accelerate the setting of the concrete in accordance with the requirements of Section 800 of the DPW Standard Specifications.

B. Concrete Pavement, Concrete Parking Strip and Concrete Bus Pad: 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.

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 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.

B. Concrete Pavement, Concrete Parking Strip and Concrete Bus Pad
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. Concrete Bus Pad: In accordance with the requirements of Section 210 of the DPW Standard Specifications, except that the thickness for concrete bus pad will be 10 inches.
3. Placing Concrete: In accordance with the requirements of Section 210.05 of the DPW Standard Specifications.
4. Construction Joints: In accordance with the requirements of Section 210.07 of the DPW Standard Specifications.
5. Dummy Joints: In accordance with the requirements of Section 210.08 of the DPW Standard Specifications.
6. Protection and Curing: In accordance with the requirements of Section 210.09 of the DPW Standard Specifications.

C. 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.

D. 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.

E. 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.
4. Finishing: In accordance with the requirements of Section 204.06 of the DPW Standard Specifications.
5. Protection and Curing: In accordance with the requirements of Section 204.09 of the DPW Standard Specifications.
6. Sidewalk will not be constructed monolithic with curb.
7. Street Names: In accordance with the requirements of Section 204.08 of the DPW Standard Specifications.

F. 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

A. 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.

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 curb and gutter work, including curb and gutter at constructed curb ramps.

END OF SECTION
SECTION 32 17 33
CAST-IN-PLACE DETECTABLE SURFACE TILES

PART 1   GENERAL

1.1 DESCRIPTION
A. This section includes specifications for furnishing and installing cast-in-place detectable surface tiles embedded in all curb ramps at the locations and to the dimensions shown on the plans, in accordance with the Project Manual and as directed by the Engineer.

1.2 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, apply to this Section.
B. Americans with Disabilities Act (ADA) Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces
C. California Code of Regulations (CCR) Title 24 Part 1, Articles 2, 3 and 4; and Part 2, Section 205 definition of “Detectable Warning”, Section 1127B.5 for “Curb Ramps”; and Section 1133B.8.5 for “Detectable Warnings at Hazardous Vehicle Area's”.
E. CCSF DPW Order NO. 175, 387 Adopting Revised Curb Ramp Standards Plans.

1.3 SUBMITTALS
A. Product Data: Submit manufacturer’s literature describing products, installation procedures and maintenance instructions.
B. Samples for Verification Purposes: Submit two (2) tile samples minimum 24" x 48" of the kind proposed for use. Samples shall be properly labeled and shall contain the following information: Name of Project; Submitted by; Date of Submittal; Manufacture’s Name; Catalog No.; and Date of Fabrication.
C. Shop drawings: Submit shop drawings showing plans of tile placement including joints, ribs, sound-amplifying panels, all materials to be used, and an outline of installation procedures.
D. Material Test Reports: Submit current test reports from a qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. Tests listed in Section 1.04 shall be performed by a certified and qualified independent testing laboratory on a cast in place tactile system. All test reports submitted shall show compliance with the most current reference standards and current product and material to be provided at time of the submittal.
1.4 QUALITY CONTROL

A. Provide cast-in-place detectable surface tiles and accessories as produced by a single manufacturer.

B. Installer’s Qualifications: Engage an experienced Installer certified in writing by tile manufacturer, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

C. Tiles shall meet or exceed the following test criteria using the most current test methods:

1. Water Absorption: Not to exceed 0.05% when tested in accordance with ASTM-D570-98.

2. Slip Resistance: 0.80 minimum wet and dry static coefficient of friction on top of domes and field area, when tested in accordance with ASTM C1028-96.

3. Compressive Strength: 28,000 psi minimum, when tested in accordance with ASTM D695-02a.

4. Tensile Strength: 19,000 psi minimum, when tested in accordance with ASTM D638-03.

5. Flexural Strength: 25,000 psi minimum, when tested in accordance with ASTM D790-03.

6. Chemical Stain Resistance of Tile when tested by ASTM D 543-95 (re approved 2001) to withstand without discoloration or staining - 10% hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10% ammonium hydroxide, 1% soap solution, turpentine, Urea 5%, diesel fuel and motor oil.

7. Wear Depth: Not less than 500, when tested in accordance with ASTM C501-84 (reapproved 2002).

8. Flame Spread: Less than 15, when tested in accordance with ASTM E84-05.

9. Gardner Impact: Not less than 550 lbf/in when tested in accordance with Geometry “GE” of ASTM D5420-04. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.

10. Accelerated Weathering of Tile when tested by ASTM G155-05a shall exhibit the following result-ΔE<4.5 as well as no deterioration, fading or chalking of surface of tile color No.33538 when exposed to 3000 hours minimum exposure.

11. Wheel Loading: The cast in place tile shall be mounted on a concrete platform with a ½” airspace at the underside of the tile top plate then subjected to the specified maximum load of 10,400 lbs., corresponding to an 8,000 lb individual wheel load and a 30% impact factor. The tile shall exhibit no visible damage at the maximum load of 10,400 lbs using AASHTO-HB17 single wheel HS20-44 loading “Standard Spcifications for Highways and Bridges.”
12. Accelerated Aging and Freeze Thaw Test of Tile when tested to ASTM D1037-99 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other defects.

13. Salt and Spray Performance of Tile and Adhesive System when tested to ASTM-B117-03 not to show any deterioration or other defects after 200 hours of exposure.

14. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM D 2486-00 with reciprocating linear motion of 37± cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block is to be 3.2 lb. Average wear depth shall not exceed 0.060 after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.

15. Embedment flange spacing shall be no greater than 3.1" center to center spacing as illustrated on the product Cast In Place drawing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings.

1.6 GUARANTEE

A. Cast-in-place tactile tiles shall be guaranteed in writing for a period of five (5) years from date of project's final completion. The guarantee includes defective work, breakage, deformation, and loosening of tiles and failure of adhesives, fasteners and sealants.

PART 2 PRODUCTS

2.1 MATERIALS

A. Detectable surface tiles shall be made of a homogeneous glass and carbon, reinforced composite material, vitrified polymer composite, or cementitious material with an ultraviolet stabilized coating to minimize color wear, and shall be compliant with SFDPW curb ramp standards; DPW Order No.175, 387.

B. Color: Yellow conforming to Federal Standard 595B Table IV, Color No. 33538. Color shall be homogeneous throughout the tile.

C. Domes: Square grid pattern of raised truncated domes of 0.2 inches nominal height, base diameter of 0.9 inches, and top diameter of 0.45. Domes shall have a center-to-center spacing of 1.67 inches, and a base to base spacing of 0.77 inches, measured between the most adjacent domes on square grid.

D. Tile shall have perimeter beveled edges of 1:2 maximum slope. Tile field surface shall not exceed 1/8" maximum when measured from the curb ramp surface to the top of the field. Tile shall have a sound amplifying plastic back plate for sound on cane differential.
E. Cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.

F. The specifications of the concrete, sealants and related materials shall be in accordance with the contract documents and the guidelines set by their respective manufacturers.

2.2 MANUFACTURERS

A. Available Manufacturers subject to compliance with these specifications include, but are not limited to, the following:

1. Cementitous Cast-In-Place TekWay Dome-Tiles or approved equal.

2.3 EQUIPMENT

A. Contractor shall provide all tools, equipment and services required for satisfactory installation per manufacturers instruction as incidental work. Equipment which may be required include typical mason’s tools, a 4’ long level with electronic slope readout, 25 lb. weights, vibrator and small sledge hammer with 2" x 6" x 20” wood tamping plate, and a device for cutting the tiles.

PART 3 EXECUTION

3.1 PREPARATION

A. During all concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Tile System. An overly wet mix will cause the Cast-In-Place System to float, therefore under these conditions suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.

C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to tile placement.

3.2 INSTALLATION

A. Contractor will not be allowed to install curb ramps until all submittals have been reviewed and approved by the Engineer. Tile shall be installed per manufacturer’s instructions.

B. The tile shall be oriented such that the rows of detectable surface domes are parallel with the direction of the ramp. When multiple tiles regardless of size are used, the domes shall be aligned between the tiles and throughout the entire detectable surface installation. Tile shall be placed to the back of curb in accordance with the contract drawings. Cutting the tiles may be required. Multiple tiles are to be joined through adjacent flanges with stainless steel fasteners.

C. The Cast-In-Place Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets and the field level of tile is flush to the adjacent concrete.
surface or as the contract drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

D. Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

3.3 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer’s specification.

B. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile to rock the tile, causing a void between the underside of tile and concrete.

C. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

D. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

E. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.

END OF SECTION
SECTION 32 20 10
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SCOPE

A. This specification section governs materials, fabrication, placement, and inspection of steel reinforcement and reinforcement supports.

1.2 RELATED SECTIONS

A. Section 32 10 00 – Concrete Forming and Accessories
B. Section 32 33 00 – Landscape Concrete

1.3 REFERENCED CODES AND STANDARDS

A. San Francisco Building Code (SFBC) 2010
B. American Concrete Institute (ACI) Standards
   1. 117-10 – Specifications for Tolerances for Concrete Construction and Materials
   2. 301-10 – Specifications for Structural Concrete
   3. 318-08 – Building Code Requirements for Structural Concrete
C. AWS - American Welding Society
D. American Society for Testing and Materials (ASTM) Standards
   1. A82/A82M – 07 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
   2. A185/A185M-07 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
   3. A496/A496M-07 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
   5. A615/A615M-09b – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   6. A706/A706M-09b – Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
E. Concrete Reinforcing Steel Institute (CRSI)

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01300.

B. Shop Drawings:

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, bending, placement details, and splicing and lapping.

2. Contractor shall coordinate with architectural, structural, mechanical, and electrical Contract Drawings for the location of anchors, bolts, inserts, conduits, sleeves, and any other embedded items, which are required to be cast in concrete. Contractor shall make all necessary provisions as required for the reinforcing steel that will not interfere with the placement of the embedded items.

3. 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.

4. Shop drawings shall not be reproductions of the Contract Documents, nor shall they use or incorporate reproductions of parts of the Contract Documents.

C. Mill Test Reports: 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. Where reinforcing is required to be welded, mill test reports shall verify the weldability of the steel or the use of weldable steel (ASTM A706).

1.5 QUALITY ASSURANCE

A. Concrete reinforcement work shall be in accordance with CRSI Manual of Standard Practice and conform to ACI SP-66. Also see paragraph 3.4 for reinforcing steel special inspection requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. 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.

B. 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 MATERIAL

A. Reinforcing bars: Reinforcing bars shall be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.

1. Reinforcing bars shall conform to ASTM A615, Grade 60, unless otherwise indicated.

2. Reinforcing bars shall be ASTM A706, Grade 60 at concrete shear walls and concrete moment frames as noted on the Contract Drawings and where welding is required.

B. Wire: Use plain or deformed wire as indicated in the Contract Drawings. Plain wire may be used for spirals.

1. Plain wire shall conform to ASTM A82.

2. Deformed wire size D4 and larger shall conform to ASTM A496.

C. Welded Wire Reinforcement: Use welded wire reinforcement as indicated in the Contract Drawings.

1. Plain welded wire reinforcement shall conform to ASTM A185, with welded intersections spaced no greater than 12 inches apart in direction of principal reinforcement.

2. Deformed welded wire reinforcement shall conform to ASTM A497, with welded intersections spaced no greater than 16 inches apart in direction of principal reinforcement.

D. Mechanical Couplers: Mechanical couplers shall be Type 2 and shall be capable of developing 125% of the specified yield strength and the ultimate tensile strength of the reinforcing bar.

2.2 ACCESSORIES

A. Tie wire: Minimum 16 gage black annealed wire.

B. Supports and spacers: Provide spacers, chairs, bolsters, and other devices to support and secure the reinforcement in place. Use plastic tip chairs for exposed finished concrete surfaces. 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.

2.3 FABRICATION

A. All reinforcing bars shall be shop fabricated to conform to the required shapes and dimensions, in accordance with CRSI standards.

B. All reinforcement shall be bent cold.

C. Reinforcement partially embedded in concrete shall not be field bent, except as shown on the Contract Drawings or permitted by the City Representative.
D. Inside diameter of bend, other than for stirrups and ties in sizes No. 3 through No. 5, shall not be less than the following:

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Minimum Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 3 through No. 8</td>
<td>6 bar diameter</td>
</tr>
<tr>
<td>No. 9, No. 10, and No. 11</td>
<td>8 bar diameter</td>
</tr>
<tr>
<td>No. 15 and No. 18</td>
<td>10 bar diameter</td>
</tr>
</tbody>
</table>

E. Inside diameter of bend for stirrups and ties shall not be less than 4 bar diameter for No. 5 and smaller.

F. Standard hooks shall mean one of the following:

1. 180-degree bend plus 4 bar diameter extension, but not less than 2 ½ inches at free end of reinforcing bar.

2. 90-degree bend plus 12 bar diameter extension at free end of reinforcing bar.

3. Stirrups and Tie Hooks:
   a. No. 5 bar and smaller, 90-degree bend plus 6 bar diameter extension at free end of reinforcing bar
   b. No. 6, No. 7, and No. 8 bar, 90-degree bend plus 12 bar diameter extension at free end of reinforcing bar
   c. No. 8 bar and smaller, 135-degree bend plus 6 bar diameter extension at free end of bar

G. Reinforcing bars that are to be butt spliced, placed through limited diameter holes in metal or have a threaded end shall have the applicable end saw-cut.

H. Reinforcing bars shall not be damaged in bending or straightening, and reinforcing bars with kinks or improper bends shall not be used on the job.

I. Welding of reinforcing bars shall conform to AWS D1.4. Type and location of welded splices and other required welding of reinforcing bars shall be indicated on the Contract Drawings.

PART 3 - EXECUTION

3.1 PLACEMENT

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 than 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.

3.2 SPLICING

A. Lap Splices:

1. Reinforcing bars shall be lap spliced as indicated on the Contract Drawings. Splices at locations other than those indicated are subject to the approval of the City Representative and, if permitted, shall conform to the lap lengths specified in the Drawings, but not less than 40 bar diameters.

2. Locate splices not indicated on the Contract Drawings at points of minimum stress. Indicate splice locations on shop drawings. Splice locations shall be well staggered with no more than 50% of the bars spliced at any section, subject to review by the City Representative. Welded splices or mechanical couplers may be substituted for contact lap splices at the discretion of the Contractor, subject to approval by the City Representative.

B. Welded Splices:

1. No reinforcing bars shall be welded either during fabrication or placement unless specifically shown on the Contract Drawings, specified herein, or with prior written consent of the City Representative. All reinforcing bars that have been welded without such approval shall be rejected and immediately removed from the work site. When welding of reinforcement is approved or shown, it shall conform to AWS D1.4. All welded splices shall be subjected to Special Inspection performed by a certified Special Inspection and Testing Agency.

3.3 REINFORCEMENT AROUND OPENING

A. 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.

3.4 INSPECTION

A. Before concrete is placed, reinforcement placement shall be inspected by a certified Special Inspection Agency. Any errors or discrepancies shall be corrected before placing concrete. Re-inspection shall be paid for by the Contractor. The Special Inspection Agency shall be notified for reinforcing steel special inspection not less than 48 hours prior to concrete placement.

END OF SECTION
SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work Included: Provide all material, labor, equipment and service necessary for the furnishing and installation of chain link fencing and gates, as shown on the Drawings and as specified herein. The work includes, but is not limited to:

1. Polyolefin coated galvanized chain link fencing fabric; and galvanized steel posts, rails and accessories for 8' tall fence, fittings, and hardware.
2. Concrete footings, core drilling, post sleeves; erection and support accessories.
3. Sign attachment: fence manufacturers and installer’s name and phone number; and regulatory signs.
4. Adjustments, touch-up and final acceptance.

1.02 RELATED SECTIONS

A. Section 09 90 10 – Landscape Painting
B. Section 31 23 00 – Excavation and Fill
C. Section 32 33 00 – Landscape Concrete

1.03 REFERENCES

A. STANDARD SPECIFICATIONS of the City and County of San Francisco, Department of Public Works, Bureau of City Engineering (DPWSS), 1986, Section 803.
B. Selected ASTM Standards for Fence Materials and Products, current edition. ASTM, Philadelphia, PA
C. Chain Link Fence Manufacturers Institute (CLFMI) "Product Manual"

1.04 QUALITY ASSURANCE

A. Provide chain link fence as complete units controlled by a single source including: necessary erection accessories, fittings, and fastenings. A single installer shall perform the work of this section, and the installer shall have not less than 5 years of successful experience in the installation of chain link fences similar to those required for this project.

B. Fence shall be erected by skilled mechanics in accordance with the best practice of the trade in accordance with the recommendation of the Chain Link Fence Manufacturer's Institute.
1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material shall be delivered and unloaded at job site on pallets and bound in such a manner that no damage occurs to the product during hauling, handling, or unloading at the job site.

1.06 SUBMITTALS

A. General: Submittals to be in accordance with the requirements of Section 013300, "Submittal Procedures."

B. Submit the following to the City Representative for acceptance: Product Data for coated chain link to include: Information in the form of manufacturer's technical data, specifications, and installation instructions for fence fabric, posts, rails; swing gates, hinges, hold-back and latch assemblies, accessories; and ADA complying modifications.

C. 6" square min sample of 1" galvanized chain link fencing fabric with warm gray polyolefin coating

D. Shop Drawings: Submit fabricator’s shop drawings to City Representative for review and approval as follows:
   1. Horizontal and vertical layout of fence system and gates;
   2. Plan and section drawings to scale.
   3. Contract drawings reused by fabricator will not be accepted.
   4. Show details of each new post, post installation, post cap; gate details, hardware, hinges, latches, and ADA complying modifications.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Report and record to City Representative any discrepancies between field measurements and Drawings that affect construction. See Landscape Drawings.

PART 2 PRODUCTS

2.01 MATERIAL

A. Refer to Drawings.

B. All fencing shall have top and bottom rails and #9 tension wire at 18" and 36" between posts.

C. Fence fabric: Fence fabric shall be polyolefin thermally fused to 9 gauge core galvanized steel, 1" mesh with a minimum breaking strength of 1290 pounds. Color: Warm Grey.

D. Polyolefin coating: 10 mil (0.25mm) thickness, thermally fused to zinc-coated steel core wire Per ASTM F668 Class 2b.

E. All metal fence framing to be Polyolefin coated finish: In accordance with ASTM F 1043, apply supplemental color coating of minimum 10 mils (0.254mm) of thermally fused polyolefin in color to match fabric.
F. All metal fence fittings, accessories, and components including post caps, top and bottom rails and rail ends and sleeves, wire ties, hog ring ties, brace tension bands, tension bars, tension wire, truss rods, to be polyolefin coated 10 mil (0.25mm) thickness, thermally fused. Nuts and bolts to be galvanized steel, painted to match polyolefin color specified.

2.03 CONCRETE

A. Concrete: Provide concrete consisting of Portland cement per ASTM C 150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi. Use at least four sacks of cement per cubic yard, 1 inch maximum size aggregate, 3 inch maximum slump.

2.04 GATES

A. Assemble gate frames by welding for square tubing or corner fitted for round tubing. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories.

1. Fabric: Same as for fence. For square tubing, provide flat bars fastened with J-bolt. For round tubing, secure fabric at vertical edges with tension bars and bands and to inside of frame with fabric bolts. Remove sharp ends or edges.

2. Bracing: Install diagonal cross bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates 5 feet or wider to ensure frame rigidity without sag or twist.


1. Gate Hardware: Provide painted galvanized steel hardware and accessories for each gate:
   a. Tension bars: 4 sides.
   b. Hinges: Heavy-duty size and material to suit gate size and as indicated on the drawings, non-lift-off type, offset to permit 180-degree gate opening. Swing direction as shown on Plans. Provide 3 pairs of hinges for each leaf over 6-foot nominal height.
   c. Latch: Forked type to permit operation from both sides of gate, with padlock eye as an integral part of latch. Provide ADA complying latch as shown on details.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted. Record and report to the City Representative all discrepancies between drawings and field conditions that affect construction progress.

1. Apply fabric to outside of framework. Install fencing on boundary lines inside of property line established by survey as required by Division 1.
2. See Plans for fence heights and locations; and footing dimensions.
3. Equally space posts between terminal posts and as indicated on drawings

3.02 GATE INSTALLATION

A. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary. Install gates according to Chain Link Fence Manufacturer’s Institute instructions, plumb, level, and secure.

B. Attach accessories and manufacturer’s name and telephone number, and other signs to gates or per City Representative’s direction.

C. Clean and touch-up fencing with vinyl or exterior enamel paint at the following intervals: walk-thru for punch list and final acceptance.

3.03 ADJUSTING

A. Gates: After repeated operation of completed installation equivalent to 3 days’ use by normal traffic, readjust gates. Schedule field adjustments under the direction of the City Representative at the following minimal intervals:

1. Within 3 days of punch list walk-thru
2. Within 3 days of substantial completion
3. 3 weeks after substantial completion

3.04 WARRANTY

A. Warranty against defective materials and workmanship for a period of one year from date of substantial completion.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. This Section includes general criteria for materials, production, erection, and evaluation of metal work as indicated on the Plans. Provide labor, material, equipment, related services, and supervision required for the manufacture and installation of the following:
   1. Metal Handrails
   2. Metal Guardrails
   3. Pipe Barricade
   4. Post and Cable Barrier
   5. Metal Bollards

1.02 RELATED SECTIONS

A. Section 09 90 10 – Landscape Painting
B. Section 32 33 00 – Concrete Work

1.03 REFERENCES

A. SSDPW - Sections: 413 - Steel and Other Metal Structures, 807 - Galvanizing.
B. Structural Welding Code, AWS D1.1-90.

1.04 SUBMITTALS

A. General: Submittals to be in accordance with the requirements of Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Submit fabricator’s shop drawings to City Representative for review and approval as follows:
   a. Horizontal and vertical layout of Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards; plan and section drawings to scale.
   b. Details of guardrail at Bayview Gateway including light fixture housing assembly
   c. Layout of gate operating system to include closing and all locking hardware.
   d. Contract drawings reused by fabricator will not be accepted.

C. Submit the following to the City Representative for acceptance:
   1. Product Data and color sample for grout.

D. Mockups
   1. Sample mock-ups shall provide a full range of workmanship and texture proposed for the job to include: same type of materials, forms, and attachments as described in the contract drawings.
   2. Mock-ups shall be prepared as many times as three to obtain approval and acceptance from the City Representative. Approved mock ups shall remain on site.
until all concrete work is completed and will be used as the standard for concrete workmanship. Prepare the following items for City Representative's approval:

a. Guardrail at Bayview Gateway including typical span of two posts and rails between with light fixture housing assembly. Mock-up shall include functioning light fixture.

b. Guardrail at Bayview Gateway including 90 degree corner assembly.

c. Typical guardrail including typical span of two posts and rails between.

1.05 QUALITY ASSURANCE

A. The Contractor shall require a single installer to perform the work of this Section having no less than five years of successful experience in installation of metal handrails, guardrail, and gates similar to those required for this project.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code – Steel."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify metal work dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 WARRANTY

A. All materials and workmanship specified under this Section shall be under warranty as stated in Section 01 78 36, Warranties.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

A. Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards. Provide steel free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discoloration, or other imperfections on finished units are not acceptable. No lead or turn coating shall be used in the fabrication or installation of the fencing and gates.

B. Provide steel post, gate and guardrail materials complying with the following requirements:


2. Steel plates, shapes and bars: ASTM A36.

3. Steel Rope: 316 Stainless Steel Wire Rope, 1x7, 3/16” Dia.

4. Stainless Steel to be 316 grade Stainless Steel.

C. Paint – Refer 09 90 10 Landscape Painting for painting requirements.
D. Fasteners

1. Hardware: All bolts and nuts shall be hot-dip galvanized or stainless steel; stainless steel where indicated.
2. Stainless Steel hardware to be 316 grade Stainless Steel.

E. Grout and Anchoring Cement

2. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and is recommended by manufacturer for exterior use.

2.02 FABRICATION

A. General: Fabricate Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacing, and anchorage, but not less than that required to support structural loads.

B. Assemble Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Welded Connections: Fabricate Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. For posts set in concrete, provide preset sleeves of stainless steel not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) greater than outside dimensions of post and steel plate forming bottom closure.
E. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

F. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated.

G. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

H. Fabricate joints that will be exposed to weather in a watertight manner.

### 2.03 FINISHES

A. General: Steel elements, terminal sections, bolts, nuts, and other fittings shall be galvanized by the hot-dipped process conforming to ASTM A525-G90 unless otherwise noted, and except for stainless steel components and hardware. Minimum weight of coating for all elements and hardware shall be 2.00 oz./sq. ft. All surfaces shall be uniformly coated, and all machine work, bending, welding, drilling, and other fabricating shall be done as far as practical before the galvanizing. Galvanizing shall conform to the requirements of SSDPW Section 807. All uncoated spots or damaged coatings shall be cause for rejection.

B. Galvanizing: Hot-dip steel elements and other fittings to comply with applicable standard listed below:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.
3. Fill vent and drain holes that will be exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

D. Apply shop primer to prepared surfaces of railing components, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Primer need not be applied to surfaces to be embedded in concrete.

### 2.04 PREPARATION

A. Coordinate drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

### PART 3 EXECUTION

#### 3.01 INSTALLATION:
A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing fence and gates. Set Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards accurately in location, alignment, and elevation, measured from established lines and levels. Fit exposed connections accurately together to form tight, hairline joints.

1. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.

3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

5. Where field welds affect shop coatings/painting, clean areas affected by welds and apply coating/painting as specified in Section 09901 and SSDPW Section 807.01.

C. Fastening to In-place Construction: Use anchorage devices and fasteners where necessary for securing fence and gates and for properly transferring loads to in-place construction.

D. Railing Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.

E. For posts mounted in concrete footings, leave 1/8-inch buildup, sloped away from post.

3.02 CLEANING AND MAINTENANCE

A. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

B. For Finished Surfaces: Remove and clean splatters from other work.

3.03 PROTECTION

A. Protect finishes of metal work from damage during construction period with temporary protective coverings. Remove protective coverings at the time of substantial completion.
B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

1. Handrails, Guardrails, Pipe Barricade, Post and Cable Barrier, and Metal Bollards shall be carefully erected, true to line and grade.

2. Gates shall operate smoothly and shall be adjusted and/or repaired as necessary during warranty period to ensure smooth operation.

2. After erecting all metal work, any abrasions of the galvanizing or exposed steel shall be repaired in accordance with SSDPW Section 807.01 and as noted on the Drawings.

END OF SECTION
SECTION 32 33 00
LANDSCAPE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Forming, placement, and finishing of concrete pavement, bands, curbs, walls and footings.
B. Concrete Color

1.02 RELATED SECTIONS
A. Section 09 -90-10 – Landscape Painting
B. Section 12 93 00 – Site Furnishings
C. Section 31 22 13 - Rough Grading
D. Section 32 10 00 – Concrete Forming and Accessories
E. Section 32 20 10 – Concrete Reinforcing
F. Section 32 33 10 – Fine Grain Pervious Concrete
G. Section 32 35 00 – Concrete Finishing
H. Section 32 91 19 – Planting Preparation

1.03 REFERENCES

1.04 QUALITY ASSURANCE
A. Allowable Tolerance: All work shall be of the exact size, dimensions locations and lines shown on the plans unless otherwise specified herein. Permissible deviations shall be those shown in ACI 347.
   1. Maximum variation above or below a true plane shall be ¼” in 10 feet for all finishes: as determined by a 10 foot straightedge placed anywhere on the plane surface, in any direction:
   2. All concrete and pavements shall be free of depressions; puddling will not be allowed to occur.
B. Installers Qualifications: Qualified and competent workmen with a minimum five years work experience of same paving type installation, and placement of concrete shall work on the job.
C. Mock-Ups: Provide mock-ups of concrete work per Specification section 32 35 00 Concrete Finishing.
1.05 REFERENCES

Comply with the applicable provisions of the following:

A. American Concrete Institute, (ACI)
   1. ACI 347 - “Recommended Practice for Concrete Formwork”
   2. ACI 305R - “Hot Weather” and ACI 306R - “Cold Weather”

B. Portland Cement Association (PCA)
   2. American Society of Testing Materials (ASTM)
   3. ASTM C156 - “Standard Test Method for Water Retention by Concrete Curing Materials”
   4. ASTM C494 - “Specifications for Chemical Admixtures for Concrete”

1.06 SUBMITTALS

A. General: Submit per Section 013300 and Standard Specifications.

B. Product Data: Submit six (6) copies of manufacturer’s literature, specifications, applications, and installation instructions for:
   1. Joint materials and systems
   2. Curing compounds
   3. Inserts and other materials integral to the final installation of exposed concrete work.
   4. Color samples (color chart not accepted)

C. Mock-Ups: Per 1.04 Quality Assurance, above.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Concrete Materials: Six (6) sacks cement minimum, 3,000 psi at 28 days, ¾” maximum aggregate with 4-inch slump.

B. Integral Color and Compound:

   1. Furnish proprietary materials in unopened manufacturer’s standard containers with original labels showing: quantity, analysis where applicable, and name of manufacturer. Color admixture shall comply with the requirements of ASTM C-979-82. Calcium chloride shall not be permitted in the mix.

   2. Integral color shall be pure, concentrated color pigments containing no fillers, adulterants or admixtures.

      a. Concrete paving type 1: CCSF Standard concrete paving in accordance with SSDPWSF - SECTION 204.01. General sidewalk, pathway, curbs and curb walls only.
b. Concrete paving type 2: Integrally colored/exposed aggregate concrete paving. Color as manufactured by Davis Color (800)356-4848 or equal: Cobblestone 860. Aggregate shall be ¼” quartz pebble as provided by Lyngso Garden Materials, 19 Seaport Blvd. Redwood City, CA 94063. (650) 364-1730, or approved equal.

c. Concrete paving type 3: Fine Grained Pervious concrete paving color as manufactured by Davis Color (800)356-4848 or approved equal: Cobblestone 860.

d. Concrete site walls - typical: Color as manufactured by Davis Color (800)356-4848 or approved equal: Pebble 641.

e. Concrete site walls – featured: Color as manufactured by Davis Color (800)356-4848 or approved equal: Palomino 5447.

3. Curing compound shall be Color Seal II as manufactured by Davis Color (800)356-4848 or approved equal.

2.02 ACCESSORIES

A. Formwork and Reinforcing Steel: In accordance with DPW Standard Specifications, Section 411.

B. Expansion Joints: In accordance with DPW Standard Specifications, Section 411.

C. Urethane Sealant: Sikaflex-1a elastomeric sealant or approved equal (Sika Corporation-415 487-2294 or 201-933-8800.)

D. Grout: Non-shrink, non-metallic, of workability to ensure a minimum of 45 minutes placement time before initial set of metal item. It shall have a minimum 28 day compressive strength of 9,000 psi, 5,000 psi in dry pack applications and conform to ASTM C-827m C-191, C-109. Color when fully cured shall match adjacent concrete.

2.03 ANTI GRAFFITI COATING

A. See Painting Section 09 90 10

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify gradients and elevations of base are correct.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify City Representative minimum 24 hours prior to commencement of concrete operations.
3.03 FORMWORK AND REINFORCEMENT STEEL

A. Construct formwork and place reinforcement steel in accordance with Section 411.04 and 411.05.

3.04 PLACING OF CONCRETE

A. Field Quality Control: City Representative to approve layout of concrete work prior to installation.

B. Place concrete in accordance with Section 204.05 and 800.14 of the Standard Specifications.

C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

D. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

E. Before pouring concrete, Contractor to confirm that the layout of walls, curbs and play equipment accurately reflect what’s indicated on the drawings.

F. Slope. All exposed surfaces shall be sloped for drainage.

3.05 FINISHING

See Section 03 35 00 Concrete Finishing

3.06 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury and graffiti marking of surface finish. Replace all defective work as required by the City Representative at no additional cost to the City.

END OF SECTION 32 33 00
SECTION 32 33 10

FINE GRAIN PERVIOUS CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The work specified in this section is the provision of all material, labor, equipment, and services necessary for furnishing and installing fine grain pervious concrete paving by licensed installer, as shown on the Drawings and specified herein.

B. All references to Evolution in regards to manufacturers, products and or method of installation shall be construed to include the words “Or Equal”. All references to Fine-Grain Pervious Consultant or Certificate shall be construed to include the words “Or Equal.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading

B. Section 32 10 00 – Concrete Forming and Accessories

C. Section 32 20 10 – Concrete Reinforcing

D. Section 32 33 00 – Landscape Concrete

E. Section 32 35 00 – Concrete Finishing

1.03 REFERENCES

A. ASTM C 29 “Test for Unit Weight and Voids in Aggregate.”

B. ASTM C 150 “Specifications for Portland Cement” (Types I or II only).

C. ASTM C 172 “Sampling fresh concrete”

D. ASTM C 494 “Specification for Chemical Admixtures for Concrete.”

E. ASTM C 595 “Specifications for Blended Hydraulic Cements” (Types IP or IS only).

F. ASTM C 1688 “Standard Test for Density and Voids Content of Freshly Mixed Pervious Concrete.”

G. ASTM C 1701 “Standard Test Method for Infiltration Rate of In Place Pervious Concrete”.

H. ASTM C 1028 - 07 “Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method”.

I. ASTM C 1692 “Clean Potable Water”.

J. ACI 306R “Cold Weather Concreting”.

K. ACI 305 “Hot Weather Concreting”.

L. C 125 Terminology relating to Concrete and Concrete Aggregates

M. C 470/C 470 M Specifications for Molds for Forming Concrete Test Cylinders Vertically

N. C 511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the testing of Hydraulic Cements and Concretes.

O. C 617 Practice for Capping Cylindrical Concrete Specimens

P. C 1064/C 1064M Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
Q. C 1688 Standard Test Method for Density and Voids content of Freshly Mixed Pervious Concrete

1.04 QUALITY ASSURANCE

A. Workmanship and materials: All workmanship and materials within this Section shall conform strictly to the manufacturer's specifications installation instructions and guarantees.

B. Quality control to be maintained by licensed installer of fine grain pervious concrete paving throughout duration project.

1.05 SUBMITTALS

A. Submit per Section 01 33 00 and Standard Specifications.

B. Manufacturer's literature, specifications, installation instructions product data and warranties

C. An owner's manual for cleaning, repair, and maintenance for installed pervious pavement.

D. Two-Year Limited Warranty for installed pervious pavement.

1.06 FIELD CONSTRUCTED MOCK-UP SAMPLES

A. Prior to the installation of any Fine Grain Pervious Concrete, Contractor shall erect mock-up samples for each color of concrete work required for approval.

B. Notify the City Representative a minimum of one-week prior to mock up construction. Coordinate location of mock up with Engineer.

C. Demonstrate quality and range workmanship that will be produced in final installation of work.

D. City Representative may require up to three (3) mock ups of the same unit of work to reach approved standard for workmanship and finish quality, without additional cost to the City.

E. Retain and maintain approved mock-up samples during construction in an undisturbed condition as a standard for judging completed portions of the final installations.

F. Approved mock-ups may be located and remain as final installations of the work at the discretion of the City Representative.

G. Fine Grain Pervious Concrete Paving Samples: Minimum one - 3’x3’ panel of Fine Grain Pervious Concrete Paving. See Section 323500 for color and finish information.

H. Field Quality Control Testing: The City Representative shall approve a site cast sample of the specified pavement before paving begins. The following criteria for the sample shall be used:
1. The surface appearance of the sample must be approved for texture, finish and should have minimal surface tearing or raveling. The finished product must match the approved sample.

2. Accepted sample panels, in like new condition, may be used in the contract work.

3. Permeability shall be tested using ASTM C 1701 or approved equal.
   i. Permeability shall be at least 100 inches per hour immediately after curing plastic is removed.
   ii. If less than six inches of specified base rock is installed the ASTM C 1701 permeability test shall not be criteria for acceptance.
   iii. Thickness. No measured sample may be less than 3/8” of specified thickness.

4. Compressive Strength in 28 days as tested using Compressive Strength Test as sampled by EPR Standard for Making and Curing Pervious Concrete Test Specimens in the Field [BETA].v1 shall typically be 1600 to 2000 psi are for comparison use only- not for acceptance or rejection of the mix.

5. Finished voids shall be 20% +/- 4% as long as the product reaches 1600 psi compressive strength or greater unless otherwise authorized by the City Representative.

6. At a location as approved by the contracting agency, the proposed contract shall construct a sample test panel on-site, using the same design requirements required for the substantial portion of the project. The sample test panel should be installed using the same required tools and qualified personnel required for project installation as found in Section 1.3. The fresh concrete used in the test panel shall be tested for voids and unit weight as per ASTM C 1688.

7. Sample test panel must be approved by the City Representative and must meet the Quality Assurance requirements.

1.07 QUALIFICATIONS: CONSULTANTS, INSTALLERS, PRODUCT SUPPLIERS

A. Authorized APC Pervious Concrete (Placing) Contractor Requirements:

1. Engage experienced subcontractors for fine grain pervious concrete paving installation. Approved subcontractors must have a proven record of installing specialty paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance for a minimum of 7 years.

2. Current NRMCA Pervious Concrete “Installer” or “Craftsman” Certificate. This approval shall be based upon consultation with Evolution Paving Resources and submission of records and references reflecting completion of 20 successful pervious concrete jobs, with a demonstrated ability to recognize and correct out-of-specification conditions on any completed pervious concrete projects.

3. Concrete Contractor must hold two (2) Certifications. A. Evolution Architectural Pervious Concrete Certificate of Endorsement and (B). Either a NRMCA “Craftsman” or “Installer” Certificate.
A. Sub-contractors that do not hold an Evolution Architectural Pervious Concrete Certificate shall conform to the following criteria for this work.

i. The subcontractor shall receive full time consultation during installation from Fine-Grain Pervious Consultant/Quality Assurance Specialist, or equal at no additional expense to the City during installation as follows:

ii. Fine-Grain Pervious Consultants/Quality Assurance Specialists include Scott Erickson of Evolution Paving Resources (EPR), PO Box 20610, Salem or 97307 Telephone: 503-393-5050; Website: www.evolutionpaving.com or equal.

iii. Non Endorsed Installers shall be allowed to install Ultimate Series mixes when the Fine-Grain Pervious Consultant/Quality Assurance Specialist is present during construction meeting and installation.

iv. The subcontractor shall follow quality controls as established by the Fine Grain Pervious Consultant/Quality Assurance Specialist which includes stopping the pour to correct deficiencies.”

4. Prior to award of the contract, the placing contractor shall furnish the City Representative a statement attesting to qualifications of the crew in placing, finishing and curing pervious concrete. This statement must include training and project experience.

C. Pervious Concrete Delivery Company

1. Volumetric (Truck Mounted) Site Mixed Mobile Mixers per pervious concrete system manufacturer’s directions.

a. The volumetric mobile mixer must be calibrated using the aggregate specifically manufactured for this project. This must be done before each job starts and whenever the stockpile is restocked.

b. The mobile mix supplier shall show proof that the volumetric mixer used to produce APC has undergone the Volumetric Mixer Manufacturer Bureau (VMMB) certification process, meets VMMB 100-01 Volumetric Mixer Standards and carries the associated VMMB rating plate, or equal.

c. Volumetric mixer bulk material quality control.

1. Aggregate stockpile bins shall be provided in a centralized off-site location for each aggregate type and located on a paved surface to prevent contamination from deleterious materials, trash, dirt and debris.

2. Aggregate bins shall be arranged to assure that each aggregate is distinctly separated and not intermingled with others, contains no oversize material, and is free from material segregation.

3. Aggregate bins shall be labeled, identifying material type to ensure that correct aggregate is fed to the appropriate mixer material compartment.

4. Separate weatherproof storage shall be provided for each type of cementitious material (portland cement, fly ash, and slag).
5. Admixtures and additives shall be stored in individual containers and protected from damage by equipment, vehicles and weather. Admixtures identified as unstable or prone to separation/settlement, shall be provided with agitation of the ingredients to ensure consistency.

D. Weather Limitations:

1. Do not place pervious concrete pavement when the ambient temperature is below 40°F or above 80°F, unless otherwise permitted in writing by the city representative.
2. Do not place pervious concrete pavement when the wind, heat or humidity does not allow enough time to place, properly joint, compact, edge, finish and cure before the surface dries and is no longer workable without damaging the surface.

1.08 SUBSTITUTIONS, ADDITIONS AND DELETIONS

A. General: Submit proposals for substitutions in accordance with the DPW Standard Specifications. Acceptance by the Engineer is required prior to proceeding with the work under this section.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS:

A. Portland Cement:
   1. Type I-P(25)(MS), low alkali blended cement conforming to ASTM C595 where available locally.
   2. Portland Cement Type I or II conforming to ASTM C 150 with approval from EPR.

B. Fly Ash: Type C or Type F Fly Ash may be used as a cement replacement up to 25% maximum.

A. MaxCem type IS30 Blended Portland Cement (30% Slag Blended Cement is also approved for use in listed mixes).

E. Aggregates:

   1. The aggregate must be crushed and it must be manufactured using “cone and rolls” type crushers unless otherwise approved by the engineer of record and EPR.
   2. The proprietary aggregate size and shape must be approved by Evolution Paving Resources to meet appearance and performance standards.
   3. The aggregate must be washed, (less than 4.0% passing 200 sieve) and free of other contaminants, unless otherwise approved by the City Representative.
   4. The aggregate must contain a minimum void content of 41% as determined by ASTM C 29 unless the fresh finished voids in the mix as tested using ASTM C 1688 result in 20% +/- 4% voids.
5. The aggregate must allow finished mix to meet or exceed criteria established in the sample panel referenced in 1.5 above.

2. 2 ADMIXTURES

A. Evolution ULTAD 600 & 700 Type S admixtures are allowed for use in EPR Ultimate Series fine grain as directed in the mix design presented by EPR.

B. Evolution ULTAD admixtures must be added as specified in the approved mix design.

C. Hydration stabilizers are authorized for use in the mix if used as directed in the mix design.

D. Other admixtures must comply with ASTM C 494 and approved by the City Representative.

E. All admixtures shall be used per manufacturer’s recommendations.

F. Water: Clean potable water shall be used per ASTM C 1692.

F. Proportions:

1. Total cementitious material shall not be less than 564 lbs. per CY unless approved by the City Representative.

2. The volume of aggregate, cement, water, and admixture per cubic yard calculated as a function of the unit weight as determined by ASTM C1688 Standard Test for Density and Voids Content of Freshly Mixed Pervious Concrete and must result in a yield of 27 cubic feet per cubic yard.

3. The unit weight per CY of the concrete shall be +/- 5 lbs of the design unit weight

2.3 CURING MATERIALS

A. Moisture-Retaining Cover: A thin (1) or (2)-Mil Polyethylene film ASTM C 171 shall be used to cover the fresh Fine-Grain pervious concrete. A six mil Polyethylene film shall also be used on top of the thin Polyethylene cover to anchor it unless otherwise authorized by the engineer.

B. Evaporation Control: Only those materials approved by Evolution Paving Resources, LLC.

2. 4 RELATED MATERIALS

A. Patching Compound: By approval of Engineer & Evolution Paving Resources.

2. 5 FINE GRAIN CONCRETE MIX

A. Approved Manufacturers:

1. Ultimate Series Fine Grain Pervious Concrete: Evolution Paving Resources, PO Box 20610, Salem OR 97307 Telephone: 503-393-5050; Email: scott@evolutionpaving.com; Web: www.evolutionpaving.com.
B. Mix design alternates or approved equals must be submitted for approval by City Representative or record a minimum of seven (7) days prior to bid opening in accordance with these specifications. A hardened sample, void content of finished mix, and at least three job references of the proposed pervious concrete shall accompany the alternate or approved equal request.

B. Contractor shall furnish to the City Representative a mix design for approval prior to the sample pour being placed. The mix design shall include:

1. Mix identification name or number.
2. Cementitious materials by amount and type.
4. Aggregate amounts.
5. Aggregate void content as determined by ASTM C 29 altered to allow compaction of the sample to be completed using a Standard Proctor Hammer twenty blows per lift instead of using a rod.
6. Quantity of admixtures used in ounces per cubic yard (CY).
7. Unit weight of the fresh (plastic) mix as determined in accordance with ASTM C 1688.
8. Target finished voids (by percent) of the pervious mix as determined by ASTM C 1688.
9. Integral color, if used, shall include brand, color and dosage rate in pounds per hundred-weight of cementitious materials per cubic yard.

D. The water/cement ratio shall be such that the cement paste displays a wet metallic sheen when floated with a magnesium hand float without causing the paste to flow from the aggregate or seal the pavement.

PART 3 EXECUTION

3.1 GENERAL

A. Fine-Grain Pervious Concrete is ready for compaction, jointing, edging and finishing immediately after strike off. Unlike standard concrete, there is no delay between placement and completion of all finishing processes.

B. Do not place more material on the ground than the crew can finish & cure in 10 minutes or 20 feet of spacing behind discharge of the mix onto the ground.

C. Notification Requirements:
1. The SFDPW design professional of record and the City Representative shall be notified forty-eight (48) business hours in advance of subgrade preparation, recharge bed installation, and all pervious concrete pours (allowing reasonable time for professional to reach the site) to inspect or send a representative to inspect sub-grade preparation, recharge bed installation, and all pervious concrete pours.

2. A pre-paving conference shall be scheduled with at two weeks’ notice and be held prior to installation of the sample panel. Shorter notice allowed if approved by the SFDPW design professional of record and the City Representative. The following individuals are required to attend:
   A. Concrete Supplier (either of the following):
      1. Mobile Mix (site mixed) manager and truck operator(s).
      2. Ready mix plant (if used): QC representative & dispatcher
      3. Pervious concrete contractor.
      4. Site work contractor.
      5. Project Foreman.
      6. Approved pervious concrete consultant per Section 1.07.
      7. SFDPW Design Professional of Record.
      8. City Representative.

3.2 BASE PREPARATION

   A. Pervious Base Aggregate: Specification, Installation and Review of Installed Base

   1. Base Aggregate Specifications:
      When base material shall be composed of a minimum of 6” of a uniform sized aggregate with a minimum size clean crushed stone, ASTM No. 57 (1”-1/2” to 3/4) or approved equal. The aggregate should have at least 40% voids unless otherwise specified by civil or geotechnical contract documents. Note: alternate open graded crushed rock sizes may be approved. The size is not as important as meeting the minimum requirement of 40% voids.

   2. Before placement of the pervious concrete begins, the pervious concrete contractor and the SFDPW Design Professional of Record and the City Representative shall inspect the in-place open graded base aggregate for compliance to the plans and specifications:
      a. Verify the rock is open-graded. If not, do not proceed.
      b. Filter fabric (if required) shall be “PERC” Infiltration Fabric or approved equal and must be properly secured at least sixteen (16) inches outside of bed, or per the design documents, whichever is greater unless otherwise specified by the design professional.
c. When the pervious concrete abuts a building face or interfaces with asphalitic concrete pavement, an impervious barrier shall be installed to prevent water from seeping from the recharge bed into adjacent base materials or structures. Approved barriers may include;

   1. An impermeable pond liner properly installed to prevent flow from the aggregate base.

   2. Flush curbs placed onto impermeable soil or used in conjunction with a waterproof liner.

   3. Any barrier chosen by the design professional of record to isolate the adjacent structure.

d. The base must be compacted to an acceptable level as approved by the design professional of record.

   1. Moisten, spread and compact the open-graded base in maximum 4 in. (100 mm) lifts with a vibratory plate compactor until there is no visible movement of the aggregate. Do not crush aggregate with the compactor.

   2. The surface tolerance the compacted open-graded base should not deviate more than \( \pm \frac{3}{8} \) in. \( (\pm 25 \text{ mm}) \) over a 10 ft (3 m) straightedge.

   3. Do not subject base material to any vehicular traffic before APC installation begins.

e. Test the base aggregate for permeability after compaction. Perform test using the “fire hose” method or equivalent (using potable water) for assessment of infiltration capacity.

f. Base rock temperature and moisture control. Two hours prior to placing concrete, and immediately prior to the pour, the recharge bed shall be soaked with water to minimize effect of dry or hot aggregate from drawing moisture out of the plastic concrete. The design professional of record may waive this requirement in wet conditions.

g. Placement of all other elements of the design (i.e. conduits, drainage pipe(s), utilities, irrigation sleeves, etc.) are to be reviewed by the contractor prior to placing concrete.

### 3.3 FORMS

A. Compaction is required so the top of forms should be set to final grade and a removable riser strip should be added on top of those forms or added to the screed to compensate for elevation loss during compaction.

B. Thickness of the riser strip is typically ¼” for Fine-Grain mixes however it is the responsibility of the installer to use a riser strip of adequate thickness to provide the specified finished grade after compaction.
C. All joints are to be clearly marked prior to placement.

3.4 PLACING

A. Do not place pervious concrete around manholes, utility vaults or other access plates.

B. Pervious concrete shall be placed on the ground as close as possible to its final location. Avoid piling and dragging into place when possible.

C. Edge compaction required immediately in front of the screed.

1. Workers shall compact the material from the form into the pour four (4) inches by stepping on the mix parallel to the form and applying their body weight. There is no need to jump or stomp to provide adequate compaction.

2. Avoid contaminating the surface with dirty or dripping wet boots.

3. If dirt or excess water is transferred to the compacted edge, remove and replace the contaminated mix from the grade before continuing the pour.

4. Edge compaction must be done in two lifts:
   1. First when the mix is placed next to the form
   2. Again after refilling the compacted area to a level above finished grade so the compacted mix will be cut to grade during screeding.

3.5 SCREEDING

A. Screeding by hand rod is typically most affective with Fine-Grain mixes. The Contractor may choose to use other screeding tools but must discontinue using any tool that results in surface tearing, sealing or raveling.

B. High and low spots in the screeded surface must be seeded with fresh material immediately and then re-screeded.

C. Fill open or torn areas of the surface with fresh mix immediately and compact the new mix with the compaction roller.

3.6 SURFACE COMPACTION AND FINISHING

A. Do not pour on hot sub-base in excess of 100 degrees F. Cool base with water at least two hours before placement and again immediately ahead of placement. Moisten sub-base to provide a uniform dampened condition at the time concrete is placed.

B. Pervious Concrete Placing Equipment and tools:

1. A hand operated straight edge may be used to place the Fine-Grain Pervious Concrete. A riser strip of 1/4” to 3/8” may be required during hand screeding to allow for compaction to final grade of the forms after placement. Vibrating or spinning “Roller” screeds shall not be used.
2. Immediately after screeding remove the riser strips and compact the surface using an approved compaction tool like a Lura or Bunyan (or approved equal) Pervious Cross Roller weighing (approximately) 75 pounds.
   
a. Use of lighter cross rollers is not allowed.
   
b. Heavier cross rollers may be used if the installer can demonstrate the tool has not reduced permeability below 250 inches per hour as tested by ASTM C1701 or approved equal.
   
c. Cross rolling is used to add compaction not to finish the surface. Once compaction to grade is achieved, stop rolling.

3. A weighted steel “Fresno” or Magnesium float may be used in conjunction with other hand tools to remove roller marks caused by the cross roller to improve the appearance of the pavement surface, provided it does not seal the surface or reduce permeability below acceptable rates of infiltration.

C. Do not add material after the “sheen” is gone from:
   
1. The seeding mix with, or
   
2. The sheen has left the surface of the pour.
   
3. Working with partially-set paste on either surface will weaken the bond and dramatically increase the chance of raveling.

D. Final surface finish will be achieved with a wood float or other approved finishing tool that provides an ADA approved surface.
   
1. Hand floats and other tools typical to concrete finishing may be used but only if they do not seal the surface, reduce permeability below acceptable infiltration rates or result in a slippery surface texture.

E. Touch up with hand float or steel trowel is allowed as needed but you must immediately stop these processes if the surface seals.
   
1. Hand floats and other tools typical to concrete finishing may be used but only if they do not seal the surface, reduce permeability below acceptable infiltration rates or result in a slippery surface texture.

3.7 JOINTING AND EDGING

A. All wet cut edges and cold joint edges must be edged with an approved 1/2” or 5/8” radius edger unless otherwise specified. A radius edge is also required next to curbs and next to sawn joints.

B. Contractor must follow the “jointing plan” as per the plans unless approved in writing by the City Representative. Joints should not exceed ten (10) feet in either direction.
with the larger dimension of a panel not exceeding 125% of the smaller panel.

C. Wet cut contraction joints into the pavement immediately behind the compaction roller. The sooner these deep grooves are cut the easier it is to achieve a clean joint with a tight radius.

D. Never leave torn or open radius tooled edges or joints. Add fresh material and re-tool to leave a tight radius edge that is not torn or ragged.

E. Plan ahead and avoid cold joints:
   1. If a delay occurs that lasts long enough the concrete is no longer workable (metallic sheen lost), install a transverse construction joint, compact the edge of the new joint.
   2. Or remove the placed mix back to a scheduled joint. Use a straight edge and edging tool to make the new joint.
   3. During short delays cover the pavement, including the face of the new edge, with plastic until fresh concrete arrives.
   4. Use of a surface stabilizing agent like “BASF Confilm™ or approved equal, is encouraged during delays. Stabilizers may be reapplied as long as the paste is not damaged.

F. Unless otherwise instructed by the City Representative, isolation or expansion joints will not be used except to isolate from structures or when pavement is abutting concrete slabs and the joints cannot be matched.

G. Sawed joints: (If used):
   1. If approved by City Representative, saw cutting should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking. A delay in saw cutting fresh pervious may be allowed up to seven days if the pavement is placed or wet cut in sections 20 feet by 40 feet on center or smaller.
   2. If plastic is removed for saw cutting in less than seven days the entire surface of the pavement must be saturated before replacing the plastic to rehydrate for curing.
   3. Dust created by dry cut pavements must be removed immediately after cutting by using vacuum or leaf blower that is only inches away from the blade. Do not allow the dust to accumulate on the surface for more than a few seconds.
   4. Slurry created by wet cutting must be thoroughly flushed or vacuumed from the surface before the water in the slurry starts to dry. Contractor must thoroughly flush the fines through the pavement as the blade cuts the mix. No draining of the slurry should be allowed at any time during the cutting process.

3.8 CURING MATERIALS AND PROCEDURES

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Curing Materials and Procedures:

1. Proper curing procedures require that FINE-GRAIN should be covered in twenty-five (25) feet or less after the pavement is placed.

2. Curing procedures must always be completed in less than twenty (20) minutes after placement.

3. In dry or windy conditions, curing must be started sooner and placing should be suspended if the wet metallic sheen cannot be maintained long enough to complete finishing operations.

C. Cover Materials. The pavement surface must be covered with one- or two-Mil polyethylene plastic sheeting. Six (6)-Mil or thicker polyethylene plastic to hold down the one- or two-Mil plastic is also required unless otherwise approved by the City Representative.

1. To reduce discoloration caused by uneven curing (often due to uneven plastic contact to the surface), remove the plastic after 24 hours and thoroughly flush the surface with clean water. Replace and carefully re-secure the plastic.

2. Repeat this procedure on the third day after placement.

3. To reduce air spaces under the plastic a concrete finishing broom may be used to lightly remove air voids from the one- or two-mil sheeting if no surface damage results from the broom and plastic.

4. Unless otherwise noted on the mix design and approved by Evolution Paving Resources even mixes using internal or external chemicals proven to provide curing protection are still required to cover the surface with plastic sheeting although the duration the cover must remain may be shortened if so noted on the mix design.

5. Black or white sheeting is suggested. Clear is not recommended because it may increase the chances of “tiger” stripe discoloration.

6. The sheeting shall overlap all exposed edges at least fifteen inches and shall be secured by anchoring the plastic for all weather conditions; without using dirt or stones smaller than half inch.

7. Sheetimg with unrepaired holes or rips will not be allowed.

D. Weather Considerations related to curing plastic.

1. In windy conditions it may be necessary to cast aggregate (the base rock may be used if the smallest size of the rock is larger than the aggregate used in the pervious mix) to anchor the plastic. Evenly spread rock across the surface as needed to remove all “ballooning” plastic. Use caution when casting the aggregate on freshly placed mix.

E. Surface Stabilizers:
1. A fog or light mist may be sprayed using a low or medium solid hydration-stabilizing agent CONFILMTM or approved equivalent.

2. Apply with a pressure sprayer above the surface as needed during high temperature, high wind, and low humidity.

3. Coat the surface adequately to provide protection without diluting the cement paste on the surface.

4. IMPORTANT NOTE: Use of CONFILMTM or approved equal surface stabilizers is approved for mixes that have not been treated with internal curing admixtures. Confirm what surface stabilizing sprays are allowed on your job by talking with Evolution Paving Resources before the sample panel is installed and again before installation begins.

F. Liquid curing compounds are not allowed as a replacement of curing plastic unless approved in writing by Evolution Paving Resources and the City Representative. Surface treatments for curing or other approved purposes are allowed in conjunction with curing plastic unless otherwise approved by the City Representative.

G. Curing duration:

5. If the temperature is 55 degrees F or higher the curing time required is typically;
   a. 24 hours for pedestrian traffic
   b. 7 days for car traffic
   c. 14 days for truck traffic.

6. Some mix designs now may include internal curing admixtures that can reduce the number of days the plastic sheeting is required to remain in place. Consult the mix design to determine which mix is specified.

3.9 TESTING

A. Void testing to be completed using ASTM C 1688 Standard Method of Testing Voids in Fresh Pervious Concrete. Do not use ASTM C 140, the test for voids in hardened concrete.

B. Permeability shall be tested using ASTM C 1701 or approved equal.
   1. ASTM C 1701 must be tested on clean, level pervious pavement upon removal of the curing plastic and accepted before opening the pavement to traffic.
   2. Permeability shall be at least 100 inches per hour immediately after curing plastic is removed. The design professional of record is authorized to determine permeability on slopes.

3.10 REPAIRS AND PROTECTION

A. Pavement Protection: During Construction/Before Acceptance
1. The general contractor must inform all trades; especially landscapers, not to dump fine materials such as dirt or bark on the pervious concrete, and:

   a. The general contractor must protect the pavement from other trades who use the pavement for staging, storage or other reasons.

   b. Protect the pavement surface from abrasion, discoloration, or sediments by covering with a geotechnical fabric. This fabric must be properly anchored and maintained in place starting when the curing plastic is removed (if used) and shall remain until completion of any construction or landscaping activity or other work on site that may expose the pavement to damage or contamination.

   c. It is the general contractor’s responsibility to remove and pay for replacement costs of surface damage for causes out of the control of the installer.

3.11 REPAIRS AND REPLACEMENT

   A. Remove and replace pavement sections that fail to meet standards established and approved by the owner. Unless otherwise authorized by City Representative, remove the entire section at no expense to the owner at the nearest joint.

   B. Patching small areas may be allowed if the installer uses the exact mix design with the same ingredients and cement supplier and can demonstrate the patch will match the appearance and performance of the existing pavement after the replacement pavement has cured. Minor color differences are to be expected and are not a basis for rejecting patching.

   C. If the pavement has been clogged with construction debris or other sediment, clean the pavement as shown in section and retest. If the pavement is slow draining because of improper mix design or installation techniques, remove and replace the section of pavement that is not compliant with the specifications to the nearest joint.

   D. Milling and replacing the surface of clogged or raveling surfaces as per Evolution Paving Resources “Overlay Specifications” is allowed instead of full depth removal and replacement if approved by the owner.

3.12 CLEANING AT THE COMPLETION OF THE JOB

   A. Removal of loose construction “crumbs” or other installation debris left on the surface of the pavement is the responsibility of the pervious installer within five days after curing period unless otherwise agreed in writing with the general contractor. This does not relieve the general contractor from cleaning the pavement at the completion of the project.

   B. A water truck to flush the loose material, using low pressure water is the preferred way to clean the pavement. High pressure- pressure cleaners are approved for use after 28 days.

   C. It is especially necessary to remove all loose material before painting lines or other symbols on the pavement.

   D. The general contractor shall be responsible to clean, repair and touch-up, or replace when directed, pavement which has been soiled, discolored, or damaged by other trades outside the installer’s control prior to substantial completion.
3.13 MAINTENANCE AFTER CONSTRUCTION & PRIOR TO ACCEPTANCE OF WORK.

A. The contractor is responsible for all Maintenance after construction during the 365-day maintenance period and until final acceptance.

B. Observation for Maintenance Period Commencement: Request observation by City Representative after all APC material is installed and after all other work of this Section is completed. Maintenance Period shall begin upon observation and review by the City Representative and shall continue for a minimum of 365-calendar days until Final Acceptance.

3.14 PROGRESS MAINTENANCE OBSERVATION

A. General: Notify the City Representative 30 days after commencement of maintenance period for a Progress Maintenance Observation. All items determined to be deficient during the previous observation shall be completed prior to the meeting. Failure to do so may result in an extension of the maintenance period. In addition, prior to first Progress Maintenance observation, furnish the City Representative with the following information:

1. Void and strength testing results.

2. Maintenance schedule for sweeping and pressure washing APC surfaces.

B. Failure to provide the above submittals may result in the re-scheduling of the Progress Maintenance Observations and to extend the 365-Day Maintenance Period.

C. Final Maintenance Observation: Notify the City Representative 365-days after commencement of the maintenance period for Final Maintenance Observation. Prior to this observation, all items determined to be deficient during the Progress Maintenance Observations shall be completed and signed off by the City Representative.

3.17 FINAL ACCEPTANCE

A. General: Work under this Section will be accepted by the City Representative upon satisfactory completion of all work of this Section, Section 32 33 10 Fine Grain Pervious Concrete, including 365-Day Maintenance Period, exclusive of replacement of APC material under the terms of the Warranty.

B. Termination of Observation: During the Final Acceptance Observation, any APC item previously identified as deficient in the Progress Maintenance Observations and determined by the City Representative to be still deficient, shall automatically terminate the Final Observation and result in the extension of the Maintenance Period an additional 30 days. Additional costs associated with subsequent Observations that are required as a result of the Contractors failure to correct deficient items shall be paid by the Contractor. There shall be no conditional final acceptance agreement for any work.

END OF SECTION
SECTION 32 35 00
CONCRETE FINISHING

PART 1    GENERAL

1.01    SECTION INCLUDES

A. The work in this Section shall be performed in accordance with the Drawings and the
Provisions of Bid and Contract Documents, and with the applicable provisions of SSDPWSF,
Section 800 - Portland Cement Concrete and Related Materials and Work and Section 411 –
Concrete Structures.

1.02    DESCRIPTION

A. Work Included: Provide all material, labor, equipment and services necessary for the
finishing of concrete work, as shown on the Drawings and as specified herein. The work
includes but is not limited to:
1. Placement and finishing of concrete.
2. Concrete curing.
3. Patching and repair.
4. Integral color and color cure.
5. Form finish for curb walls.
7. Anti-graffiti coating.

1.03    RELATED SECTIONS

A. Section 32 10 00 – Concrete Forming and Accessories
B. Section 32 20 00 – Concrete Reinforcing
C. Section 32 33 00 – Landscape Concrete
D. Section 32 33 10 – Fine Grain Pervious Concrete

1.04    QUALITY ASSURANCE

A. Allowable Tolerance: All work shall be of the exact size, dimensions locations and lines
shown on the plans unless otherwise specified herein. Permissible deviations shall be
those shown in ACI 347.
1. Maximum variation above or below a true plane shall be ¼” in 10 feet for all
finishes: as determined by a 10 foot straightedge placed anywhere on the plane
surface, in any direction:
2. All concrete and pavements shall be free of depressions; puddling will not be
allowed to occur.

B. Installers Qualifications: Qualified and competent workers with a minimum five years
work experience of same paving type installation, and placement of concrete shall work
on the job.

1.05    SUBMITTALS

A. General: Submittals to be in accordance with the requirements of Section 01 33 00,
Submittal Procedures, and SSDPWSF.
B. Mock-Ups: Sample mock-ups shall provide a full range of workmanship and texture proposed for the job to include: same type of materials, retardants, curing compounds, and other curing/finishing methods. Sample panels shall be prepared as many times as three to obtain approval and acceptance from the City Representative. Approved mock ups shall remain on site until all concrete work is completed and will be used as the standard for concrete workmanship. Prepare the following items for City Representative’s approval:

1. Prepare on site two concrete panels of each color and finish type for concrete paving as specified. Each panel shall be 36" square, minimum.
   a. Concrete type 1 - CCSF standard – broom finish
   b. Concrete type 2 – Integrally colored concrete with pressurized water blast finish
   c. Concrete type 2 – Integrally colored concrete with exposed aggregate finish
   d. Concrete type 3 – Integrally colored fine grained pervious concrete

2. Prepare on site two concrete wall mock-ups of each color and finish type for site walls as specified. Each mockup shall be 36" long, minimum, and include full depth and height, radiused edges, reveal at paving surface, and all other typical elements described in the drawings.
   a. Site wall, typical - pressurized water blast finish
   b. Site wall, featured – pressurized water blast finish

3. Concrete interpretive elements: Full-size mock up of one concrete sculptural element with metal edging, including specified integral color. Mock up shall be of any element that includes radius curves. Up to three (3) mock-ups to be provided if necessary, to achieve quality of finish element, per approval of the City Representative.

C. Product Data: Submit six copies of manufacturer’s literature, specifications, applications, and installation instructions for:
   1. Joint materials and systems.
   2. Curing compounds
   3. Aggregate for exposed concrete work.
   4. Other materials integral to the final texture and finish of concrete work.

1.06 MAINTENANCE

A. Contractor is to provide the following:
   1. Concrete design mix indicating proportions of aggregate, sand, water, and reinforcing.
   2. Product number and manufacturer's address and phone number for all concrete admixtures.

1.07 JOB CONDITIONS

A. Hot weather: Comply with the recommended practice of ACI 305R and the requirements specified herein.

B. Cold Weather: Comply with the recommended practice of ACI 306R and the requirements specified herein.
PART 2 PRODUCTS

A. Integral Color and Curing Compounds:
   1. Furnish proprietary materials in unopened manufacturer’s standard containers with original labels showing: quantity, analysis where applicable, and name of manufacturer. Color admixture shall comply with the requirements of ASTM C-979-82. Calcium chloride shall not be permitted in the mix.
   2. Integral color shall be pure, concentrated color pigments containing no fillers, adulterants or admixtures. Color as manufactured by Davis Colors, www.daviscolors.com, or approved equal. See Section 32 33 00 for colors.
   3. Curing compound for the integral color shall be as manufactured by Davis Colors or approved equal.
      a. Curing compounds shall be clear water based resin type, free of wax, grease or other substances deleterious to materials applied to concrete in accordance with ASTM C309.
      b. Curing compound shall not discolor concrete or affect bonding or other finishes applied thereof.
      c. Curing compound shall restrict loss of water to not more than 0.500 grams per sq. cm. of surface when tested per ASTM C156.

B. Expansion Joint Filler:
   1. Pre-molded bituminous material, non-extruding, conforming to ASTM D2475: thickness as shown on the Drawings.
   2. Color and type as selected and approved by City Representative.
   3. As manufactured by Celotex Corporation; or equal.

C. Backer Rod
   1. Extruded closed cell polyethylene foam rod.
   2. ICEL backer rod as manufactured by Dow Chemical Co. or equal.

D. Elastomeric Joint Sealant:
   1. Non-sag 1 part polyurethane
   2. Color of sealant to match color of the joint mortar.
   3. Lithoseal Trafficalk 3G as manufactured by L.M. Scolfield, (415) 255-2728 or Sikaflex 1a as manufactured by Sika Chemical Co. Lyndhurst, NJ or equal.

E. Anti-Graffiti Coating and Pre-Sealant:
   2. Apply to all finished concrete curbs, curbwalls, exposed fence/post footings, and other exposed vertical concrete and painted surfaces as directed by the City Representative.
PART 3 EXECUTION

3.01 CONCRETE MIX
A. General: In accordance with Sections 411 and 800 of SSDPWSF.

3.02 FINISHING CONCRETE
A. All exposed concrete surfaces shall have Class 1 Surface Finish in accordance with SSDPWSF SECTION 210.06, 204.06, 411.10, and 411.11 similar with exceptions as noted herein:
   1. Slope. All exposed surfaces shall be sloped for drainage.

3.03 FINISHES
A. General: Contractor is to produce finishes in accordance with Drawings, and as specified herein.
B. Form Finish: in accordance with SSDPWSF – SECTIONS 411.09; 411.10 and 411.11 Class 1 Surface Finish.
D. Integrally colored concrete paving: Pressurized Water Blast Finish:
   1. Concrete shall be finished to a smooth steel trowel finish. The finish shall be brought to a smooth surface, free from defects and blemishes.
   2. The surface is then sprayed with top surface retarder, ‘Grace Top-Cast #05 Sandblast’ at the rate of 175–300 ft2/gal (4.3–7.4 m2/L) and allowed to cure at least 12 hours.
   3. Blast with pressurized water to expose aggregate uniformly to as approved by the city representative.
   4. Water blast perpendicular to surfaces. Abrasively blast corners and edge patterns using back-up boards to maintain uniform edges.
   5. Type of nozzle, pressure and water blasting techniques used shall be in accordance with approved mock-up and samples.
   6. Perform water blast finishing in a continuous operation, utilizing the same work crew to maintain continuity of finish on each surface area of work.
   7. After water blasting to required depth is completed, and the approval of the City Representative has been obtained in writing, apply a weak acid wash to clean abrasive surfaces to match approved sample.
   8. Thoroughly neutralize and flush retarder from surfaces.
   9. Protect adjacent materials and finishes from the acid wash.
E. Integrally colored concrete paving: Exposed Aggregate Concrete
   1. Medium Sandblast Finish for Exposed Aggregate Concrete:
      a. Blast with Number 1 Fine Sand to expose aggregate uniformly to a minimum depth of 1/16th of an inch, as approved by the City Representative.
      b. Direct sandblast perpendicular to surfaces. Abrasively blast corners and edge of patterns using back-up boards, to maintain uniform corner or edge line.
c. The type of nozzle, pressure and blasting techniques used shall be same in accordance with approved mock-up and samples.
d. Perform abrasive blast finishing in a continuous operation, utilizing the same work crew to maintain continuity of finish on each surface area of work.
e. After abrasive blasting to required depth is completed, and the approval of the City Representative has been obtained in writing, apply a weak acid wash to clean abrasive blasted surfaces to match the approved sample.
f. Thoroughly neutralize and flush acid from surfaces with a pressurized water blast.
g. Protect adjacent materials and finishes from the acid wash

F. Integrally Colored Fine Grain Pervious Concrete Finish: See Specification Section 32 33 10.

3.04 JOINTS AND EDGES

A. General:
   1. Construct joints in accordance with Drawings and approved shop drawings. See SSDPWSF SECTION 210.07, for reference only. Joint character shall match that of approved Mock-up.
   2. Joints shall be made complete as shown; crossing joints shall physically intersect, and joints extending to vertical surfaces shall be fully made. If portions of joints cannot be completely executed with use of customary tools, set strips of metal or sealed wood into plastic concrete, and carefully remove after concrete has hardened. Align manually made joints carefully with those portions made by inserts.

B. Expansion Joints and Edging: Provide expansion joints at the location and intervals as shown on the approved shop Drawings, and at all locations where paving abuts any vertical surface such as: buildings, walls, and other structures.
   1. Place approved joint material with top edge 1/4 inch below the paved surface, and secure in place to prevent movement.
   2. Form joint and other edges in the fresh concrete using an edging tool to provide a smooth uniform impression.
   3. Strike all edges before and after finishing.
   4. After the curing period, clean expansion joints carefully and fill with approved joint compound, flush with the paved surface in such a manner as to avoid spilling onto paved surfaces.

C. Control Joints and Score Lines:
   1. Construct for paved surfaces as shown on drawings and as herein specified.
   2. Tooled Joints: Form joints in fresh concrete by grooving top portion with recommended cutting tool and finishing edges with a jointer.

3.05 CURING AND PROTECTION

A. In accordance with SSDPWSF SECTION 800.16 - PROTECTING AND CURING CONCRETE with exceptions noted herein. See product section - curing compound. Also see Section 03 30 00-Cast - in-place Concrete.

3.06 DEFECTIVE CONCRETE AND REPAIRS
A. General: In accordance with SSDPWSF SECTION 800.18 - REPAIRING IMPERFECT CONCRETE and Section 03 30 00 – Cast-in-place Concrete. Concrete shall be considered defective for the following reasons:
1. Failure of finished concrete profiles, and dimensional tolerances, to conform to the requirements and the allowable tolerances in this Section.
2. Concrete showing cracks, rock pockets, voids, spalls, or other visual defects.
3. Failure of concrete finishes to match approved samples, as determined by the City Representative.

B. All defective concrete shall be subject to removal and replacement by the Contractor, at his expense, unless it is determined by the City Representative that it can be patched as specified below or that the location of this defective concrete is not detrimental to the function and the appearance of the project.

C. Repairing and Patching: Immediately after removing forms, inspect all concrete surfaces and patch any pour joints, voids, rock pockets, toe holes, and other imperfections at once, but not until surfaces have first been examined by the City Representative. Chip away defective areas to a depth of about one inch with the edges perpendicular to the surface. Use binding agent as required to ensure that patch will bond completely and permanently to concrete surface.

D. Repair exterior exposed-formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Repaired surfaces must match adjacent concrete in form, texture, and color. Prepare test samples prior to repairing concrete for City Representative's approval. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the City Representative. Surface defects, as such include: color and texture irregularities, cracks, spalls, air bubbles, honey comb, rock pockets and holes left by tie rods and bolts, fins and other discoloration's that cannot be removed by cleaning.

3.07 CLEANUP

Clean up shall be performed as each portion of the work progresses. Refuse, excess dirt and sand shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired and returned to its original new condition.

END OF SECTION
PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions Specification Sections, apply to the work specified in this Section. **The landscape irrigation work is design build.**

1.02 DESCRIPTION

A. Work shall include the following: Provide irrigation design and layout plan, materials, labor, equipment, and services necessary for the furnishing and the installation of a complete irrigation and quick coupler system as shown on the Drawings and as specified herein. The work includes, but is not limited to:

1. Design to comply with SFPUC Water Efficient Ordinance for Tier 2.
2. Apply for new Water Meter and service connection from SFPUC New Service Applications, 525 Golden Gate Ave, 2nd Floor, SF, CA.
3. Making connections to water, electrical supplies.
4. Trenching and stockpiling excavation materials and backfilling trenches.
5. Providing a complete system including piping, valves, fittings, sprinkler heads, automatic controls and final adjustment of heads to insure complete coverage.
6. Replacement of unsatisfactory materials.
7. Clean-up, inspection and acceptance.

1.03 RELATED WORK

A. Section 31 10 00 Site Clearing
B. Section 31 23 33 Trenching and Backfilling
C. Section 32 91 19 Planting Preparation
D. Section 32 90 00 Planting

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. All work and materials shall be in conformance with the latest rules and regulations of the National Electric Code; The Uniform Plumbing Code, published by the Western Plumbing Officials Association, and The San Francisco Plumbing Code.

2. New irrigation system will require new water service connection and water meter. Contractor to file application with all required supporting documentation at SFPUC New Service Applications, 525 Golden Gate Ave. New service application will require submittal of Water Efficient Irrigation Ordinance documents per sub-paragraph 3 below.

3. SFPUC Water Efficient Irrigation Ordinance for Tier 2 Landscapes. www.sfwater.org/landscape. Contractor shall submit approved irrigation design and other necessary materials to the SFPUC as required in conformance with the Water Efficient Ordinance for Tier 2 Landscapes.

1.05 SUBMITTALS

A. Material List: Submit six (6) copies of complete material list for review for compliance with the Contract Documents. Material list shall include the manufacturer, model number, and description of all materials and equipment to be used. Include all sealants, cements, and other proprietary items.

B. Shop Drawings for Irrigation Design: The contractor shall submit a detailed irrigation layout on scaled drawing indicating locations of irrigation heads, new irrigation lines, remote control valves, quick couplers, main and lateral line pipes and sizes, controller location and connections to the service main line. Contractor to test the pressure at the point of connection to verify design parameters.

C. Detail Drawings: Submit detail drawings for all assemblies not detailed on the Drawings.

D. Record Documents: Submit 'Record Drawing' prior to the Maintenance Period to include:

1. Changes from the contract drawings and specifications material locations, sizes, and kinds of equipment. Drawings shall be to scale on half-sized laminated sheets, see below.

2. Dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
   a. Connection to existing water lines.

D. Operation and Maintenance Manuals: Prepare and deliver, at least ten calendar days prior to completion of construction, two hard cover, three-ring binders containing the following information:

1. Index sheet stating Contractor's address and telephone number and list of equipment with name and addresses of local manufacturer's representatives.

2. Catalog and parts sheets on all material and equipment installed under this Section.
3. Complete operating and maintenance instructions for all major equipment.
4. Complete and dated warranties for all materials used.
5. (6) Sets of scaled drawings of the as-built irrigation system, identifying all irrigation equipment. Each valve station shall be color coded with a unique. The 11 x 17 drawing shall be laminated.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Coordinate on-site storage of materials with other trades. Protect products from weather or other conditions, which would damage or impair their effectiveness. Store products on-site in such a manner that they may be readily inspected.

B. Exercise care in handling, loading, unloading and storing of PVC pipe and fittings. Transport all PVC pipe in a vehicle, which allows the length of pipe to lie flat so not to subject it to undue bending or concentrated external load at any point. Discard any section of pipe that has been dented or damaged and, if installed, replace with new piping.

1.07 JOB CONDITIONS

A. General: Areas to receive work are to be received by the Contractor free of debris, concrete, base rock, asphalt, trash, and litter down to the existing site soil and or concrete sub slab at commencement of work, except where noted on the Drawings.

B. Protection: Become acquainted with all site conditions. Take necessary precautions to protect site condition and improvements to remain. Damage incurred by this Contractor shall be repaired to its original condition, or equal replacement shall be provided at no additional cost to the Engineer. Repair and replacement shall be done to the satisfaction of the Engineer. Should utilities or other conditions not shown on the Drawings be found during the course of the work, report to the Engineer in writing and obtain the Engineer’s instructions prior to proceeding with the work affected.

C. Verification: Field verify all dimensions, grades, and coordinates. Report all discrepancies to the Engineer in writing, and obtain the Engineer’s instructions, prior to proceeding with the work affected.

1.08 SUBSTITUTIONS

A. General: Submit proposals for substitutions per Section 01 33 00– Submittal Procedures and Section 01 25 13 – Product Substitution Procedures, prior to proceeding with the work of this Section.

1.09 WARRANTY

A. All materials and workmanship shall be as specified and shall be under warranty, for a minimum period of one year from the date of Final Acceptance. During and at the end of this period, all required repairs and adjustments, including adjustment to grade, shall be made including all repairs to other work made necessary thereby, without additional expense to the City.
B. Repair of Damage: All damage to paving, planting, structures, and other improvements due to settlement of improperly compacted trench backfill shall be promptly repaired to the satisfaction of the Engineer and without additional cost to the City. The Contractor is also responsible for damage caused by leaks in the piping systems being installed or having been installed.

C. Present to the City Representative at time of Final Acceptance, warranties for all materials used.

D. The City reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the City Representative shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.

PART 2 PRODUCTS

2.01 GENERAL

A. Use only new materials of brands and types specified herein.

2.02 PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) Pipe: Pipe shall be made from NSF approved, Type 1, Grade 1 PVC compound conforming to ASTM resin specification D1784. All pipes must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.

B. All PVC pipe must bear the following markings:
   1. Manufacturer's name
   2. Nominal pipe size
   3. Schedule of class
   4. Pressure rating in P.S.I.
   5. NSF (National Sanitation Foundation) approved
   6. Date of extrusion

C. Pressure Pipe:
   1. Pressure Main Line Piping: All irrigation piping under constant pressure shall be schedule 40 galvanized steel. Steel pipe and couplings shall conform to the Specifications of ASTM Designation: A 120, standard weight, galvanized. Fittings, except for couplings shall be galvanized malleable iron, banded and threaded, conforming to ANSI standard: B16.3, 150-pound class. Buried 18” minimum depth
   2. Domestic Potable Water Line: Copper type K, hard drawn, conforming to ASTM B88. A six inch long harass nipple with a restrained compression joint coupling shall be used wherever connecting copper pipe to dissimilar metals. The coupling shall be Dresser, Rockwell, or equal.

D. Non-pressure Lateral Line Piping: PVC Schedule 40 plastic pipe.
E. Fittings:
   1. Fittings for solvent weld PVC plastic pipe shall be Schedule 40, Type 1, Grade 1, NSF approved conforming to ASTM D 2466.
      a. All PVC fittings shall bear the manufacturer's name or trademark, material designation, size applicable I.P.S. schedule and NSF seal of approval.

F. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be to type and installation methods prescribed by the manufacturer.

G. Connections between main line and control valve and quick coupling valve shall be PVC Schedule 80, Type 1, Grade 1, threaded nipples and elbows.

H. Sleeves: All piping which runs under pavement shall be installed in class 315 PVC sleeves two sizes larger than irrigation pipe to allow for easy removal and insertion. Length of sleeve shall provide for a minimum of 5 feet over hang on each side of the pavement.

I. Control Wire Conduit: Where control wires pass under paving, they shall be enclosed in Schedule 40 PVC conduit.

2.03 IRRIGATION CONTROLLERS AND ENCLOSURES


2.04 IRRIGATION CONTROL WIRING

A. All irrigation control wiring to be placed in PVC Schedule 40 conduits.

2.05 VALVES

A. Solenoid Valve: Superior Model 950-DWPRS (Dirty Water Pressure Reducing) or approved equal.

B. Gate Valve: Nibco or approved equal

2.06 QUICK COUPLING VALVES

A. Quick Coupler: Buckner: QB44LRCAR10 with spring loaded lockable cap and concrete collar or approved equal. Spaced every 50’ o.c.

2.07 VALVE BOXES

A. The housings for valves shall be manufactured from high-density reinforced concrete or calcium carbonate and polyester resins interlaced with fiberglass and ultraviolet inhibitors including locking cast iron lids, and all required extensions, where and as shown on the Plans. The lids shall be cast with lock/key
mechanism and shall have cast letter 1" - inch high with the word IRRIGATION. Manufacturer shall be Christy, Brooks Products, or equal. Provide four keys.

2.08 SPRINKLERS

A. Heads range per design criteria. Allowable materials: Hunter I-20, Rotors, Rotators MP 1,000-3,000 series and Sprays.

B. Tree Bubblers and Root Watering System
   1. Manufacturer shall be Rainbird RWS-B-C-G-1402, with RWS sock, RWS grate.

2.09 REDUCED PRESSURE BACKFLOW DEVICE

A. Manufacturer shall be Febco, 825Y; or equal. No known equal.

B. Backflow device shall be housed with an expanded galvanized, powder coated, metal grate enclosure on a concrete pad. The enclosure shall be 9-gauge with a mesh size of ¾", powdercoat Forest Green, with "Lock Shield Bracket" to allow padlock locking to concrete base pad; install galvanized steel eye bolt in concrete base pad to allow padlock locking with bracket. Manufacturer: BPDI, Phoenix, Arizona, PH (800) 266-5411, or (602) 788-5411; BPDI Guard Shack, GS-3 or GS-4 to fit, or equal.

2.10 SPECIAL TOOLS/SPARE PARTS

A. Equipment to be furnished: Supply as a part of this Contract the following tools:

B. Two sets of special tools required for removing disassembling and adjusting each type of sprinkler and valve supplied.

1. One quick coupler key and matching hose swivel for every five or fraction thereof of each type of quick coupling valve installed.

2. Three spare keys to operate the Controller.

2.11 BACKFILL SOIL

A. All backfill for irrigation system trenching shall be free of rocks and clods over ½-inch in diameter. Backfill shall be free from refuse, plants or roots, clods, weeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or extraneous material. Backfill shall be free of soil-borne diseases, and shall be capable of sustaining healthy plant life.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor is responsible for providing a pressure supply line with quick coupler valves, and making connection to the existing water supply line. Report to the City Representative all conditions preventing compliance with this requirement, and obtain the City Representative’s instructions prior to proceeding with the work affected. Failure to report to the City Representative constitutes acceptance of this requirement by the Contractor.
3.02 FIELD QUALITY CONTROL

A. The Contractor shall be responsible for notifying the City Representative in advance for the following observation meetings, according to the time indicated:

1. Field Layout - 48 hours.
2. Pressure supply line installation and testing - 48 hours.
3. Automatic controller installation - 48 hours.
4. Control wire installation - 48 hours.
5. Lateral line and sprinkler installation - 48 hours.
6. Coverage test - 48 hours.
7. Maintenance Period Observations - Seven (7) calendar days.
8. Final Observation - Seven (7) calendar days.

3.03 SITE CONDITIONS

A. Inspect and be familiar with all existing site utilities. Exercise extreme care in excavation and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations.

3.04 COORDINATION

A. The Contractor shall schedule and coordinate work with other trades and shall verify the connection with water supply prior to commencing work.

B. Install pipe and sleeves under pedestrian paving and through walls and footings.

C. Do not install piping or sprinkler head until walls, footing, curbs and other related structures are in place.

D. Do not install pipe until planting areas have been prepared as indicated under the Planting Plan.

3.05 LAYOUT

A. Arrange work to obtain coordinated installation with proper clearance, running straight and direct as possible, and forming right angles and parallel lines with adjacent structures and systems.

B. Prior to installation, stake out all pressure supply lines routing and location of quick coupler valves.

C. Coordinate installation of entire irrigation system including pipe, so there shall be no interference with utilities or other construction or proposed locations of trees and shrubs.

D. Line Clearance: Underground lines shall have a minimum horizontal clearance of 2-inches from each other, 6-inches between main line and lateral line. All lines shall have a minimum horizontal clearance of 12-inches from the lines of other trades. This requirement does not apply to any lines crossing at angles from 45 to 90 degrees.

E. No line shall be installed parallel to and directly over another line.

F. Restore surfaces, existing underground installation, etc. damaged or cut as result of excavations, to original conditions. Where irrigation lines, irrigation trenching
and pipe work interfere with other utilities, report to the City Representative in writing and obtain the City Representative’s instructions prior to proceeding with the work affected.

3.06 TRENCHING AND BACKFILLING

A. Trenching: Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall be to the following depths:

1. Provide for a minimum of 24 inches cover for all pressure supply (main) lines.
2. Provide a minimum of 18 inches cover for all non-pressure (lateral) lines.
3. Provide for a minimum cover of 18 inches for all control wiring.

B. Backfilling: The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the specified backfill. If settlement occurs and subsequent adjustments in pipe, valves, emitters, bubblers, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the City.

1. In planting areas: Backfill shall be manually or mechanically compacted to a dry density of 85 percent. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
2. Under Paving: All pipe located under paving shall be sleeved. Trenches located under areas where paving will be installed shall be backfilled with specified backfill (a layer 6-inches below the pipe and 3-inches above the pipe) and compacted to 95 percent compaction, using manual or mechanical tamping devices. All backfilled trenches shall be left flush with the adjoining grade. Set in place, cap and pressure test all piping under paving prior to the paving work.

3.07 INSTALLATION OF PIPING

A. Install lines (and various assemblies) in accordance with the manufacturer’s instructions.

B. Do not install multiple assemblies in plastic lines. Provide each solenoid valve and quick coupler valve with its own outlet off the main line.

C. Install all assemblies specified in accordance with details shown on the Drawings.

D. Coordinate work to minimize amount of sleeving required under existing pavement. Piping under existing pavement may be installed by jacking or boring. The Contractor shall obtain the City Representative’s approval for all cutting or breaking of pavement prior to starting the work. Repair to the original condition at no additional cost to the City.

3.08 SYSTEM INSTALLATION

A. Solenoid Valves:
1. Allow at least 12 inches between valve boxes, and allow 12-inches clearance between valve boxes and walk or curb.

2. Install each solenoid valve in a separate valve box. No soil is permitted in valve box or around valve.

**B. Flushing of System:**

1. After all new sprinkler risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the solenoid valves shall be opened and full head of water used to flush out the system.

2. Lines shall be free of dirt, debris and all other deleterious material that could clod the system. Sprinklers shall be installed only after flushing of the system has been accomplished.

**C. Sprinkler Heads:**

1. Install the sprinkler heads as designated on the details.

**3.09 TESTING PIPES**

**A.** Pipe shall be center-loaded with sufficient backfill in accordance with the paragraph on backfilling to anchor pipe before testing. No fittings shall be covered.

**B.** Prior to testing, install solenoid valves; and bleed air out of all lines at line pressure. Provide vertical pipe at all high points during installation to aid in bleeding air.

**C.** Notify the City Representative at least 48 hours in advance of testing. Tests will be observed and accepted by the City Representative.

**D.** Perform testing and furnish all equipment for testing as work of this section.

**E.** Apply the following test after solvent weld plastic pipe joints have cured at least 24 hours.

1. Test live (constant pressure) and PCV lines hydrostatically at 125 psi minimum; maintain test pressure for six (6) hours. Contractor shall make tests and repairs as necessary until test conditions are met.

2. Test lateral lines with water at line pressure; inspect visually for leaks. Retest after correcting defects.

**3.10 SYSTEM ADJUSTMENT**

**A.** Flush and adjust all sprinkler heads for optimum performance. Adjust sprinkler heads to prevent over spray onto walks, roadways and buildings.

**B.** Upon completion of each phase of work, the entire system shall be tested and adjusted to meet site requirements and the Specifications.

**3.11 SYSTEM TESTING**
A. Request the presence of the City Representative in writing at least 48 hours in advance of testing.

B. When the irrigation system is completed, perform a test in the presence of the City Representative, to determine if the water supplied to planting area is complete and adequate. The Contractor shall correct any inadequacies of coverage.

3.12 MAINTENANCE

A. General: Maintain automatic irrigation system in its entirety in an acceptable working order from time of initial installation through the 360-day Maintenance Period or until Final Acceptance, whichever is longer.

A. Maintenance Procedures: Maintenance of irrigation system consists of but is not limited to: Furnishing and replacement of broken, lost or stolen irrigation materials; flushing of irrigation system; adjustment of sprinkler heads to provide optimum amounts of water.

END OF SECTION
SECTION 32 90 00

PLANTING

PART 1 GENERAL

1.01 SECTION INCLUDES

Provide all labor, material, equipment, and services for the furnishing and installing of listed work. The work includes but is not limited to:

A. Preparation of planting areas and tree pits.
B. Placement of amended backfill, soil mix and fertilizers.
C. Preparation of new sod areas
D. Submittals
E. Protecting, Pruning & Maintaining Existing Trees
F. Drainage test in tree pits.
G. Tree planting and staking.
H. Pre-Maintenance Inspection
I. Pre-emergent herbicide.
J. Final inspection and acceptance.
K. Acceptance & Approval for 365-Day Plant Establishment Period
L. Warranty replacement.
M. Record drawings.

1.02 RELATED SECTIONS

A. Section 01 56 39 - Temporary Tree and Plant Protection
B. Section 02 99 00 – Landscape Maintenance
C. Section 32 80 00 – Landscape Irrigation Design Build
D. Section 32 91 19 - Planting Preparation

1.03 REFERENCES

A. FS 0-F-241 - Fertilizers, Mixed, Commercial.
B. ANSI Z60.1 - Nursery Stock.
C. STANDARD SPECIFICATIONS (DPWSS), City and County of San Francisco, Department of Public Works, 1986. Section 1007-Planting, 1008-Maintenance and Plant Establishment, Section 1009-Restoration of Existing Lawn and Other Planting


1.04 QUALITY ASSURANCE

A. General: Provide inspection for verifying species or variety and acceptability of plants for robustness, and branching structure

B. Testing Laboratory: Recognized local laboratory for soil and plant disease analysis of ornamental horticulture, approved by the City Representative. Testing laboratory is to perform all work in accordance with the current methods of the Association of Agricultural Chemists. See also spec section 32 91 19 Planting Preparation.

C. Nurseries: Companies specializing in growing and cultivating, harvesting and transporting plants with five years minimum documented experience, comparable to:

1. Pacific Nursery: Colma, CA 650-755-2330
2. Boething Treeland, Portola Valley, CA 650-851-4770
3. Suncrest Nursery, Watsonville, CA 831-728-2595
5. Urban Tree Farm Nursery, Fulton, CA 707-544-4446

D. Selected nurseries shall be from coastal areas between and including San Diego County and the State of Oregon where possible to minimize complications of acclimatization.

E. All nursery stock shall be available for inspection at a nursery located within fifty (50) road miles from San Francisco’s City Hall. If not available within this area, all additional expenses for transportation, board, and lodging resulting from City Representative’s inspection shall be borne by the Contractor.

F. All plant material shall comply with federal and state laws requiring inspection for plant diseases and pest infestations. Inspection certificate required by law shall accompany each shipment of plants. Clearance from the county agricultural commissioner, as required by law, shall be obtained before planting trees and shrubs delivered from outside the county in which they are to be planted.

G. Before delivery contact City Representative three days minimum in advance of plant delivery to site.

H. Any trees delivered to the jobsite which are found damaged by wind, sun and ill-handling, or unsuitable in growth or conditions, shall be removed from the site and replaced with approved trees at the Contractor’s sole expense.

I. The Contractor shall employ an arborist, certified in the State of California, and with five years proven professional experience, for consultation to be known in these documents as the Arborist. The Arborist shall provide in writing to the City Representative, any judgments that may be encountered in the field. See also section 01 56 39 Temporary Tree and Plant Protection.
1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer, fungicide, insecticide, and herbicide composition.

B. Plant Materials: Certified by State Department of Agriculture (described by ASTM Z60.1); free of disease or hazardous insects

1.06 SUBMITTALS

A. General: Submittals to be in accordance with the requirements of Section 013300.

B. Samples: Submit the following:
   1. Decorative bark mulch – one half cubic foot sample.
   2. Tree support and ties – 1 pair.

1.07 QUALIFICATIONS

A. Installer: Company specializing in installing and pruning plants with five years documented experience.

B. Maintenance Services: Performed by installer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prior to plant delivery, coordinate with City Representative any necessary staging areas or plant acclimatization holding areas.

B. Deliver fertilizer and herbicide in waterproof bags showing weight, chemical analysis and name of manufacturer.

C. Protect plants until planted.

D. Deliver plant materials immediately, 3 days maximum, prior to placement. Keep plants moist and heeled in.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not install plants when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Do not install plants when wind velocity exceeds 30 mph.

C. Provide drainage test in each tree pit and elsewhere as directed by City Representative prior to backfilling.

1. Fill pit with 152 mm (6 inches) water. Record drainage rate after one hour and 4 hours. Water remaining after 4 hours, indicates drainage deficiencies necessitating remedial measures.

2. Provide remedial measures to correct deficiencies by constructing in each area six 4-inch diameter by 12 inch drain holes, using perforated PVC pipe, filled with coarse sand and wrapped with filter fabric. Retest for drainage rate under the direction of the City Representative.
3. Report in writing to the City Representative all areas not passing these tests, and all soil conditions the Contractor considers detrimental to growth of plant material. State condition, and proposal and cost estimate for correcting the condition beyond remedial measure. Obtain the City Representative’s instructions prior to proceeding with the work affected.

4. Failure to perform drainage tests and to notify the City Representative in writing of the conditions specified above renders the Contractor responsible for all plant failure that occurs as a result of inadequate drainage or detrimental soil conditions, as determined by the City Representative.

1.10 COORDINATION

A. Coordinate with irrigation system installation.

1.11 WARRANTY

A. General: Become familiar with the anticipated growing conditions prior to commencement of work. Notify the City Representative immediately in writing of any conditions which will prevent the proper execution of the warranty responsibilities specified. Failure to notify the City Representative constitutes acceptance of the growing conditions. Any removal, repair or replacement of plant material required for unsuitable conditions found after work has begun shall be done at no additional cost to the City.

B. Requirements:

1. Plant Material: Warrant that all plant material under this Contract will be vigorous, healthy, free of dead or dying branches and branch tips, bearing foliage of normal density and color, and will otherwise comply with the Specifications.

2. Warranty Period: Warrant all plant material for a period of 180 days from date of Final Completion of Plant Establishment Period defined in specification 02 99 00 Landscape Maintenance. Any delay in completion of planting operations which extends the planting into more than one growing season shall extend the warranty period correspondingly.

3. Replacements: Without cost to the City, in a timely manner and as directed by the City Representative, replace all plants not meeting the requirements herein during and at the end of the Warranty Period. Replacements shall closely match the size of adjacent specimens of the same species in size and shall comply with all requirements of this Specification.

PART 2 PRODUCTS

2.01 PLANTS

A. General: Plants shall be nursery and/or field grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least eighteen months per contract growing agreement.

1. Acclimatization: Plant material shall be properly acclimated and conditioned, in accordance with good horticultural practices, for the exposure, wind and humidity
levels, soil and other conditions, occurring at the project site and in the proposed plant locations.

2. Coordination: The Contractor shall coordinate his acclimatization schedule with the City Representative to allow an adequate conditioning period for the plant material prior to the approved date of plant installation. Notify the City Representative in writing prior to proceeding with any acclimatization work if approved work schedule allows insufficient time to acclimate the material.

3. Proper Identification: All plants shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by species and cultivar (as appropriate).

4. Compliance: All plants shall comply with federal and state laws and regulations requiring inspection for plant disease, pests, and weeds. Inspection certificates required by law shall accompany each shipment of plants. Clearance from the local county agricultural commissioner, if required, shall be obtained before planting trees originating outside the county in which they are to be planted. Even though plants may conform to county, state, and federal laws, the City may impose additional requirements.

5. Quality: Plants shall be superior in form, compactness and symmetry, sound, healthy vigorous, well branched and densely foliated when in leaf; free of disease, insect pests, eggs or larvae, and free from physical damage or adverse conditions that would prevent thriving growth.

6. All plants shall be true to type or name as shown on the Drawings and shall be individually tagged as specified herein.

7. All plants shall be healthy, have a form typical for the species or cultivar, be well-rooted, and properly trained.

8. Inspection: The City reserves the right to reject plants that do not meet specifications as set forth in these guidelines or as adopted by the City. If a particular defect or substandard element can be corrected easily, appropriate remedies shall be applied at no cost to the City.

B. Nursery Tree Quality. These specifications apply to deciduous, broadleaf evergreen and coniferous species. They do not apply to palms. Note that leaf characteristics will not be evident on deciduous trees during the dormant season.

1. Tree Health

   a. Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar. Changes in form caused by wind, pruning practices, pests, or other factors shall not substantially alter the form for the species or cultivar.

   b. Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress as indicated by wilted, shriveled, or dead leaves.

   c. Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar.
Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.

d. Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds (except properly made pruning cuts), sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).

e. Roots: The root system shall be substantially free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Root distribution shall be uniform throughout the container substrate, and growth shall be appropriate for the species or cultivar. At time of inspection and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

2. Tree Crown. Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.

a. Trees shall have a single, relatively straight central leader. They shall be free of co-dominant stems and vigorous, upright branches that compete with the central leader. If the original leader has been headed, a new leader at least one-half of the diameter of the original leader shall be present.

b. Main branches shall be well distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.

c. Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch.

d. The attachment of the largest branches (scaffold branches) shall be free of included bark.

e. Temporary branches, unless otherwise specified, should be present along the lower trunk below the lowest main (scaffold) branch, particularly for trees less than 1 inch in caliper. These branches should be no greater than 3/8 inch diameter. Clear trunk should be no more than 40% of the total height of the tree.

3. Tree Trunk

a. The trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.

b. Trunk caliper and taper shall be sufficient so that the tree will remain vertical without a stake. Trunk caliper at 6 inches above the soil media (substrate) surface shall be within the diameter range shown for each container size below:
Container Size ---- Trunk Diameter

# 5.........................0.5" to 0.75"
# 15..........................0.75" to 1.5"
24-inch box.............1.5" to 2.5"
48" box..................3.5" to 5.0"

4. Roots
   a. The uppermost roots or root collar (root crown) shall be within the upper 2 inches of the soil media (substrate).
   b. The root collar and the inside portion of the root ball shall be free of defects, including circling, kinked, and stem girdling roots. Soil removal near the root collar may be necessary to inspect the aforementioned root defects.
   c. The tree shall be well rooted in the soil media (substrate). Root distribution shall be uniform throughout the container media. Structure and growth shall be appropriate for the species/cultivar.
   d. When the container is removed, the root ball shall remain intact. When the trunk is lifted both the trunk and root system shall move as one.
   e. At the time of inspection and delivery, the root ball shall be moist throughout. The crown shall show no signs of moisture stress as indicated by wilted, shriveled, or dead leaves or branch dieback.
   f. The roots shall show no signs of excess soil moisture as indicated by poor root growth, root discoloration, distortion, death, or foul odor.

C. Native No Mow Sod: one year old dense growth with grass having mowed at one inch height before lifting from field. Grown on fumigated soil. Sod is to be in vigorous condition, dark green in color, free of disease, weed and harmful insects
   1. “Native Mow Free”, mix of Festuca occidentalis, Festuca idahoensis, and Festuca rubra; available through Delta Bluegrass Company, or approved equal. Stockton, CA; (800) 637-8873.

2.02 PLANTING AND TREE PIT BACKFILL
   A. General: See Section 32 91 19 Planting Preparation for imported topsoil and amendments used for amended backfill.

2.03 SOIL ADDITIVES
   A. General: See Section 32 91 19 Planting Preparation and DPWSS, Section 1007.04 Soil Amendment.

2.04 FERTILIZERS AND AMENDMENTS
   A. General: See Section 32 91 19 Planting Preparation for amended backfill fertilizers, special soil mix, and mulch.
2.05 MATERIALS

A. General: All materials supplied shall be free of deleterious and extraneous substances, including contaminants detrimental to plant growth, such as excess salts, boron, solvents, etc.

B. Staking Materials:

   Site Trees:
   1. Ties: Corded rubber type, with a broad smooth surface in contact with the tree.
   2. Stakes: 2-inch diameter by 12-feet long, pointed at one end, copper naphthenate–treated wood–painted black. Provide three (3) minimum per tree. Do not penetrate root ball.

C. Mulch:


D. Water: Clean, potable and free of deleterious matter. Source, in accordance with regulations and codes governing water conservation measures for the City and County of San Francisco.

E. Pre-emergent Herbicide: Per San Francisco’s Integrated Pest Management Program accepted products, and as approved by the Port of San Francisco.

F. Anti-Desiccant: Type as approved by the City Representative. Use for preventing excessive loss of plant moisture and inhibiting wilt; sprayable, water insoluble vinyl-vinyledine complex which will produce a moisture retarding barrier. Film formed shall have a mvt (moisture vapor transmission rate) of not more than 10 grams per 24 hours at 70 percent humidity. Contractor to furnish information with submittal that the material can be used safely on plant materials specified and obtain approval prior to use.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Verify that prepared subsoil is ready to receive work.

B. Verify that irrigation work is complete.

C. Installation Observations: Specifically request the following observations.

   1. Plant material at place of growth.
   2. Plant delivery at project site.
   3. Plant pits and drainage test.
   4. Planting area backfill and finish grading prior to planting.
   5. Plant material delivery to site.
   6. Layout and placement of plant material at time of planting.
   7. Staking procedures.
   8. Pruning, trimming and maintenance procedures.
3.02 ORDERING REVIEW AND ACCEPTANCE OF PLANT MATERIAL

A. Ordering:
1. Within 30 days after award of Contract, submit written certification to the City Representative of the quantity and species of plant material ordered, and the nurseries supplying the material.
2. The Contractor is responsible for providing all plant material in the quantities and sizes specified on the Drawings, and for making all arrangements in advance per terms of the contract.

B. Review and Rejection of Plant Material: Submit written request for review of plant material at least 10 days prior to commencement of planting operations. Review by the City Representative does not waive the City Representative's right of rejection during planting or any time thereafter.

C. Pre-selected Material: All plant material shall be tagged at the place of growth by the City Representative. All such material shall be governed by the requirements set forth herein and such pre-selection does not constitute waiver of these requirements.

D. Rejection of Material: The City Representative reserves the right to review and reject plant material at any time, and at the place of growth, for non-conformance to the Drawings and Specifications. Do not install plant material which has not been reviewed at the Contract site by the City Representative.

3.03 HANDLING OF PLANT MATERIAL

A. General: Do not bind or handle any plant in such a way that would result in damage to the plant material. Lift and handle plants only from bottom of root ball.

B. Access: The Contractor shall be responsible for accessing and installing all plant material at the job site. The Contractor shall inspect the job site and become familiar with all requirements and restrictions. Plant material shall be carefully bound with saran, burlap or other lightweight fabric as required allowing access. Care should be exercised to prevent damage or breakage to limbs; and ropes or other lines should not be allowed to damage bark. At the time of submitting bid, the Contractor shall notify the City Representative in writing, of any conditions that would prevent the accessing and installation of the specified plant material.

C. Plants: Maintain all plant material in a healthy growing condition prior to and during planting operations. Protect plants at all times from sun and drying winds. Plants are to be planted within two days of delivery to site unless staging and acclimatization areas are pre-approved by City Representative. Plants that cannot be installed on this work schedule shall be returned to the grower until installation requirements can be met.

3.04 LAYOUT OF PLANT MATERIAL

A. General: Tree locations in the Contract Documents are schematic. The City Representative will review for conformance to the design intent of the Contract Documents, the locations of all plants in the field prior to planting. Notify the City Representative and schedule layout review sufficiently in advance of planting to allow for review and adjustment without disrupting construction schedule.

B. Plants: The City Representative will review locations of plants in the field, after plants are delivered to the site, but before placement and positioning. After placement of trees in approved locations, but before final planting, notify City Representative to review final positioning of plants.
D. Adjustments: The City Representative reserves the right to make minor adjustments in the layout of all plant material.

3.05 EXCAVATION OF PLANTING PITS

A. Prior to planting and back fill, scarify the sides and bottom of the pit as required to eliminate any glazed surfaces. Excavate plant pit as shown on the Drawings.

B. Obstructions: If rocks, underground construction work, tree roots or other unknown obstructions are encountered in the excavation of plant holes the Contractor shall report all such conditions in writing to the City Representative. Where locations cannot be changed, submit a written proposal and cost estimate for removing the obstructions to a depth of not less than 6 inches below the required hole depth. Obtain the City Representative’s instructions prior to proceeding.

C. The Contractor is to become familiar with all scheduling requirements concerning: plant pit excavation and plant material delivery.

D. Test drainage as specified in 1.09 C.

3.06 PLANTING

A. General: Do not plant under unfavorable weather conditions.

B. Place plants for best appearance for review and final orientation by City Representative.

C. Set plants vertically.

D. Boxed Plant Material: After removing plants from their containers, disentangle any small roots that encircle the container. Do not cut or otherwise disturb the root ball. Inspect all plants for root bound condition; do not install root bound plants, or plants found to have cracked or broken root balls when taken from the container. All root-balls of plant material shall be inspected and approved by the City Representative prior to installation.

E. Backfill for boxed plant material:

1. Scarify the bottom and sides of the tree pit. Place back fill amended or otherwise to an elevation as shown on the Drawings to support the root-ball and then flood the pit with water to settle the soil. Set the tree in the pit on firm and compacted soil.

2. After setting the tree, place back fill soil, tamping and settling one foot lifts. Do not use muddy soil for back-filling.

3. Place fertilizer packs evenly distributed in plant pit when back fill operation is 2/3 full per manufacturer’s recommendation. See spec section 32 91 19 Planting Preparation.

4. The crowns of plants shall be set at a minimum height of 1 1/2 inch as required to account for any settling. The crown of tree shall remain above finish grade after any adjustments have been made.

5. The trees shall be staked in accordance with details at time of planting.

6. Watering: Thoroughly water all plants immediately after planting, taking care to avoid erosion.

F. Mulch all planting areas as noted on the drawings.

G. Thoroughly water all plants immediately after planting, taking care to avoid erosion.
H. Securely stake all trees planted on the site immediately after planting. The Contractor shall modify staking procedures as required by the City Representative to accommodate field conditions, at no additional cost to the City.

3.07 PREPARATION OF SUBSOIL and BACKFILL

A. Remove foreign materials, weeds and undesirable plants and their roots in excess of 1 inch diameter; concrete, construction debris, and litter. Remove contaminated subsoil. Contractor may provide approved topsoil in lieu of cleaning existing site soil.

B. Scarify subsoil to a depth of 3 inches on walls of plant pits. No auger slick or smooth sides and bottom, which inhibit drainage, shall be acceptable.

C. Rake and pull out weeds and objects over 1 inch in diameter.

3.08 PRUNING

A. Boxed plant material:
   1. Prune plants only at the direction of the City Representative AND the Arborist and according to reference standards to preserve the natural character of the plant.
   2. Remove all dead wood, suckers and broken or badly bruised branches.
   3. Remove sucker basal and lateral growth to prevent re-sprouting; retain normal side branching.
   4. Use only disinfected, sharp tools.
   5. Improperly pruned trees will be subject to rejection by the City Representative.
   6. Apply tree seal to cuts over 1 inch diameter in accordance with manufacturer's instructions.

3.09 PREPARATION OF SOD BEDS

A. Sod laid near existing trees and shrubs
   1. All work shall be done by hand to incorporate nutrients and mulches. Scarify soil to a depth no greater than 3’ in each direction. Avoid any damage to root structure below. Follow manufacturer’s instructions for laying sod.

B. New sod beds
   1. Follow manufacturer’s instructions for laying sod.

3.10 PLANT ESTABLISHMENT AND MAINTENANCE

A. See Specification section 02 99 00 Landscape Maintenance

END OF SECTION
SECTION 32 91 19

Planting Preparation

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide all labor, material, equipment, and services necessary for the furnishing and installing of amended backfill and performing finished grading, as shown on the Plans and as specified herein. The work includes but is not limited to:
   1. Submittals
   2. Soil testing.
   3. Finished grading of landscaped areas.
   4. Soil amendments, fertilizers and mulch.
   5. Removing excess soil materials.
   6. Clean-up.

1.02 RELATED SECTIONS

A. Section 31 22 13 – Rough Grading
B. Section 32 80 00 – Landscape Irrigation Design Build
C. Section 32 90 00 – Planting

1.03 DEFINITIONS

A. Site Soil: All existing topsoil.
B. Import Topsoil: Any topsoil, approved by the City Representative, brought to the immediate planting area from another source including remote area of the project site.
C. Amended Backfill: Homogeneous mixture of site soil or imported topsoil combined with amendments for use as a planting medium.

1.04 QUALITY ASSURANCE

A. Testing Laboratory: Recognized laboratory for soil and plant disease analysis for ornamental horticulture, approved by the City Representative. Testing laboratory is to perform all work in accordance with the current methods of the Association of Official Agricultural Chemists at the Contractor’s cost.

1.05 REFERENCE STANDARDS

A. Comply with the applicable provisions of the following:
   1. Agricultural Experimental Station Extension Service, University of California, 1979, Publication No. 4091.

B. STANDARD SPECIFICATIONS (DPWSS) City and County of San Francisco, Department of Public Works, 1986. Section 1001 - Site Preparation, Section 1002 - Earthwork and Section 1007 - Planting.
1.06 TESTING LABORATORY

A. Recognized local laboratory for soil and plant disease analysis of ornamental horticulture, approved by the City Representative. Testing laboratory is to perform all work in accordance with the current methods of the Association of Agricultural Chemists.

B. All testing to be done by Soil and Plant Laboratory, San Jose, (408) 727-0330, soilandplantlaboratory.com., or approved equal.

1.07 SUBMITTALS

A. General: Submittals shall be in accordance with the requirements of Section 013300 - Submittals.

B. Product Data and Samples: Furnish copies of manufacturer's literature and laboratory analytical data for review of the following items.

1. Greenwaste compost one-half gallon bag, label source & content from reputable source.
2. Shredded Redwood Bark Mulch: 1 quart
3. Commercial Fertilizers as specified
4. Import Topsoil: one-half gallon bag, label source and content.

C. Test Reports: Submit the results of the following tests to the City Representative:

1. Existing Site Soil: Provide test A05 for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment and fertilization.
2. Existing Site Soil, Provide a mycorrhizal soil analysis.
3. Imported Soil: Provide test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment and fertilization. Submit test reports of representative sample(s) for approval prior to delivery and for every 100 yards delivered to the site.
4. Greenwaste Compost: Provide test A09, organic amendment evaluation or equivalent from US Composting Council seal of testing assurance.
5. Submit this specification section including section 2.03 Fertilizers and Amendments to soil laboratory for amendment consideration.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Fertilizers and Amendments: Store fertilizers and amendments, bark mulch, soil mix, and other materials which could stain concrete and similar surfaces in such a manner that staining does not occur.

B. Deliver, store, protect and handle products to site under Section 1007 Planting, SSDPWSF.

C. Deliver fertilizer and other bulk products in waterproof bags showing date, weight, chemical analysis and name of manufacturer.
PART 2 PRODUCTS

2.01 SOILS

A. General: All soils and recommended amendments for planting areas shall be free of rocks over 1/2-inch in diameter and free of foreign debris. Soils shall be free from subsoil, refuse, plants or roots, clods, weeds, viable weed seeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or extraneous material. Soils, sand and soil mix shall be free of soil-borne diseases and capable of sustaining healthy plant life.

B. Imported Topsoil:
1. Topsoil shall be fertile, friable soil of loamy character, containing an amount of organic matter normal to the region. All imported topsoil used on the job shall be from the same source. Import topsoil shall have:
   a. pH factor between 6.0 and 7.2 (reaction of paste during soils testing).
   b. Salinity of less than 2.0 (Electrical conductivity in mmho/cm).
   c. Sodium absorption ration (SAR) of less than 6.0
   d. Sodium: Less than 5.0 mill equivalents per liter or 150 ppm.
   e. Chloride: Less than 5.0 mill equivalents per liter or 150 ppm.
   f. Boron content less than one part per million.
   g. Organic matter content less than 5%.

2. Make all arrangements for obtaining and testing imported topsoil. Submit test results of a representative sample of the proposed supply for approval by the City Representative well in advance of its scheduled delivery to the site. The approved sample will establish the standards to which all imported topsoil used on the job must conform.

3. Do all work necessary to bring imported topsoil to standards specified above.

4. Transport imported topsoil directly from source to final position. If stockpiling is required, locations and amounts of stockpiles will be designated by the City Representative.

5. The City Representative reserves the right to take additional samples of imported topsoil at the site. If subsequent testing proves material to be at variance with the approved sample, remove rejected soil from the site and replace immediately, at no additional cost to the City.

2.02 SOIL ADDITIVES

A. General: Refer to DPWSS, Section 1007.04 - Soil Amendment.

B. All soil amendments and mulches shall be organic, OMRI (Organic Materials Review Institute) Certified.

2.03 FERTILIZERS AND AMENDMENTS

A. Utilize in each planting pit, Mycorrhizal fertilizer packs in quantity appropriate and recommended by manufacturer for plant size and type. Available as: Green Diamond biological feeder packs 4-2-2 and Green Diamond Tree pack 10-2-4, or approved equal. Available from: Marin Soil Solutions, San Rafael, CA. Ph: 415-456-3300.

C. Fertilizer:
   1. Fertilizer: Granular slow release all natural organic fertilizer with no chemical content, NPK 7-2-1, 96% fungal and bacterial biomass, 4% water, sterile and free of weed seeds. Fungal biomass to be obtained by fermentation on raw materials such as cottonseed meal, soybean meal, sucrose, lactose, trace elements, and vitamins, under constant sterile conditions. Fertilizer nutrients shall not be derived from any animal waste, animal by-products, or sewage material. Guaranteed sterilized and free of weed seeds. **Biosol Forte** fertilizer, by Rocky Mountain Bio Products, Denver, Co., Ph: (888) 696-8960; or equal, no known equal.

   Available through:
   b. S&S Seeds, Inc., Carpinteria, CA. (805) 684-0436

   2. Nutrient Constituents: Organic Matter: >85%; Carbon/Nitrogen ratio: 5:1; Nitrogen (total) >7%. Nitrogen (water-soluble) <0.5%; Phosphorous (P205) 2-4%; Potassium (K20) 1%; pH level range: 6.5-7.5

   3. Application: 1,300 lbs/acre, and per manufacturer’s recommendations and site soil test and soil laboratory recommendations in accordance with Section 32-91-19.

D. Ammonium Sulfate: 21-0-0, Caution: Ammonium sulfate fertilizer will burn leaves if applied to wet foliage. Immediately following the application, water in material thoroughly.

E. Iron Sulfate: Ferric sulfate, containing minimum 18-20 percent iron expressed as an elemental. Caution: Iron sulfate will stain concrete, stucco and tile surfaces. Avoid contact with these surfaces. After iron sulfate application, clean all such surfaces before any water application, including rains.

F. Calcium Carbonate Lime: Ground oyster shell type.

G. Cottonseed meal

H. Bone meal

I. Peat Moss

J. Perlite

K. Endo-Mycorrhizal Innoculant: Granular Endo Mycorrhizae blend consisting of four species of Mycorrhizae (Glomus intraradices, G. mosseae, G. aggregatum, and G. etunicatum), with 60,000 spores per pound. Manufacturer: Mycorrhizal Applications, Inc., by Rocky Mountain Bio Products, Denver, Co., Ph: (888) 696-8960; or equal, no known equal. Available through:

PART 3 EXECUTION

3.01 FINISH GRADING

A. General: All areas to be planted shall be free of rocks over one-half inch in diameter and free of foreign debris, subsoil, refuse, plants or roots, clods, weeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or extraneous material.

Areas to be planted shall be free of soil-borne diseases and capable of sustaining healthy plant life. Do all work necessary to bring site soil, imported soil and planter backfill to compliance with these requirements.

1. Verify with the City Representative that all filter fabric covering Subsoil drains are securely in place. Do not proceed with backfilling until said conditions are completed and approved.

2. Verify positive drainage rate in tree pits, planting areas and elsewhere as directed by City Representative. See Section 329000 Planting.

B. Surface Drainage: Contractor is responsible for proper surface drainage of planted areas. Report in writing to the City Representative any discrepancies in the Contract Documents, obstructions on the site, or any other conditions, which prevents establishing proper drainage. Contractor shall proceed with the work under the direction of the City Representative.

C. Final Contouring:

1. Handle and place the soil and amended backfill to required depths as shown on Drawings.
   a. Deposit amended backfill in horizontal lifts not exceeding 12 inches. Moisten to settle. Compact or roll each lift to 85 percent relative compaction.

2. Work soil and amended backfill sufficiently so that after rolling, and after full settlement has occurred, the site will be graded to within +0.10 of a foot from the lines, grades, and elevations shown, and as may be directed by the City Representative. Finished surface shall be smooth and uniform, and shall be free of depressions that retain standing water, or any surface irregularities that would impede proper drainage.

   Unless otherwise noted, finish grade for all planting areas and tree pits shall allow for a two inch mulch layer, set 1/2 inch below top of adjacent walks, pavement, curbs, and walls.

3.02 PREPARATION OF PLANTING HOLES

A. Dig pits as indicated on drawings.

B. Scarify bottom of planting pit to a depth of 3 inches. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

C. Test drainage as specified in 1.09 C.
3.03 **SOIL AMENDMENT**

A. **General:** After finish grading operations in planting areas are completed, rototill in at least 2 perpendicular directions and with soil at the proper moisture content, so that all clods greater than 3/4" diameter will be broken up resulting in a homogenenous blend of amended soil.

B. The following recommendations are to be used for bidding purposes only; final amendment procedures shall be in accordance with recommendations based on soil testing.

**Planting Area & Tree Pit Backfill:** Provide 18 inches amended backfill for planting areas and full depth of container plus 8 inches in tree pits. Amended backfill mix per 1000 cubic yards:

<table>
<thead>
<tr>
<th>Amount</th>
<th>Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 cubic yards</td>
<td>Imported topsoil</td>
</tr>
<tr>
<td>1 cubic yard</td>
<td>Greenwast Compost</td>
</tr>
<tr>
<td>500 pounds</td>
<td>Organic Fertilizer</td>
</tr>
<tr>
<td>1 pound</td>
<td>Iron sulfate (20% Fe)</td>
</tr>
<tr>
<td>1 pound</td>
<td>Soil sulfur</td>
</tr>
<tr>
<td>2 pounds each</td>
<td>Cottonseed meal and Bone meal</td>
</tr>
<tr>
<td>1/2 cubic yard</td>
<td>Peat moss</td>
</tr>
<tr>
<td>1/2 cubic yard</td>
<td>Perlite</td>
</tr>
<tr>
<td>10 pounds</td>
<td>Ammonium Sulfate</td>
</tr>
<tr>
<td>20 pounds</td>
<td>Endo mycorrhizal inoculant</td>
</tr>
</tbody>
</table>

C. **Additional Amendments:** Soil amendment recommendations may vary for planting areas. Provide additional amendments as required by soil testing and as directed by the City Representative at no extra cost to the City.

D. **Apply fertilizer in amounts appropriate to growing season as directed by manufacturer, unless otherwise directed by the City Representative.**

E. **Replenish amended soil throughout the Contract as soil settles from erosion, compaction and watering.**

F. **Apply a minimum two-inch bark mulch layer, approximately two weeks following planting when amended backfill has settled as noted on drawings.**

3.03 **PLACEMENT OF PLANTING BACKFILL**

A. **General:** Place planting backfill mix to the depths specified to obtain finish grades shown on the Drawings. Soil mix shall be handled in a manner so as to prevent segregation of ingredients.

B. **Thoroughly water planting backfill mix after placement to compact and settle mix.**

C. **Place planting backfill in one foot lifts and jet wash in between lifts to specified compaction rate.**

**END OF SECTION**
SECTION 33 46 43
LANDSCAPE SUBSOIL DRAINAGE

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this Section consists of furnishing and installing a subsoil drain system using filter fabric, non-perforated PVC pipe, perforated PVC, and PVC fittings.

1.02 RELATED WORK

A. Section 31 23 35 – Landscape Utility Trenching and Backfilling
B. Section 32 91 19 – Planting Preparation
C. Section 33 49 26 – Landscape Drainage Structures

1.03 REFERENCES

A. DPW Standard Specifications - 1986, Section 810.03.

1.04 SUBMITTALS

A. General: Submit each item in the Article according to the Conditions of the Contract and Section 01 33 00, Submittal Procedures.
B. Product data for the following:
   1. Non-perforated PVC pipe and fittings.
   2. Perforated pipe.
   4. Cleanouts
   5. Sleeves

1.05 QUALITY ASSURANCE

A. Engage an experienced Installer who has completed subsoil drainage systems similar in material design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Installer Qualifications: Engage an experienced Installer who has completed subsoil drainage systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
PART 2 PRODUCTS

2.01 USE OF TRADE NAMES
   A. The use of trade names on the Drawings or finish schedule is to establish the file pattern to be used. It is not intended to exclude other manufacturer’s whose patterns, in the judgment of the contracting Officer, are equivalent to those named.

2.02 AVAILABLE MANUFACTURERS
   A. Subject to compliance with requirements, manufacturer’s offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. Filter fabric:
         a. Mirafi 140 N, Mirafi, Inc. (415) 331-6434, or equal.

2.03 PIPE AND FITTINGS
   A. General: Include pipes, fittings and couplings; size noted on Drawings.
   B. Non-perforated: Polyvinyl Chloride (PVC), ASTM D1784 and D1785, high impact, Schedule 80.
   C. Perforated: PVC pipe, ASTM D3034 and D2412, high impact, SDR 35.
   D. Fittings: PVC, solvent weld, socket type, of same materials as pipe.
   E. Cement: ASTM D2564 for solvent weld joints, as recommended by the manufacturer.

2.04 DRAIN CLEAN OUTS
   A. Clean-outs shall be in accordance with the Drawings.

2.05 SLEEVES
   A. Schedule 40 PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40.

2.06 BACKFILL MATERIAL
   A. Impervious backfill: ¾" minus crushed rock per SSDPWSF 712 – Crushed Rock Layer.
   B. Porous backfill: ¾" diameter drain rock.

PART 3 EXECUTION

3.01 GRADE TOLERANCE
   A. The final invert grade of the pipe taken at any point along the line shall not vary more than plus or minus 1/2 inch from the established grade.
3.02 FILTER MATERIAL INSTALLATION

A. Install filter fabric in trench to receive perforated pipe as following:
   1. Beginning at the outflow drain, install filter fabrics neatly and in accordance with manufacturer's specifications.
   2. Lap joints in filter fabric a minimum of 6". Repair and replace all torn or defective filter fabric, ensure a continuous envelope is provided along the trench.

B. Place supporting layer of porous backfill material over compacted subgrade and the layer of filter fabric where perforated pipe is to be laid, to a minimum depth of two (2) inches.

C. Bed perforated pipe with full bearing, solidly in filtering material.

3.03 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings as indicated and according to the following:
   1. Join non-perforated pipe and fittings with couplings for soil tight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; and manufacturer's written instructions.
   2. Join perforated pipe and fittings with couplings for soil tight joints according to AASHTO "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or ASTM D 2321; and manufacturer's written instructions.
   3. Install according to ASTM D 2321 and manufacturer's written instructions.
   4. Install perforated pipe with perforations down.

B. Close upgrade end of drainpipe with suitable plug.

C. Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.04 INSTALLATION OF SLEEVES

A. All subsoil drainage pipes passing through concrete headers shall be installed in Schedule 40 PVC sleeves of sufficient size to allow for easy insertion and removal.

3.05 BACKFILL INSTALLATION

A. General: Backfill subsoil drainage trenches according to SSDPWSF 703 – Trench Backfill

B. Non-perforated pipe:
   1. After satisfactory testing, place and compact impervious fill material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to subgrade elevations as indicated on drawings to receive surface material.

C. Perforated pipe:
   1. Place porous backfill over piping after satisfactory testing. Cover piping to width of at least 6 inches on each side and above top of pipe to within 4 inches of finish grade. Place porous backfill in layers not exceeding 3 inches in loose depth, and compact each layer placed.
   2. Wrap filter fabric over porous backfill. Overlap edges a minimum of 6 inches.
3. Fill trench to grade indicated on Drawings with amended soil as specified in Section 02923 – Landscape Grading.

3.06. FIELD QUALITY CONTROL

   A. Hydro-flush all lines, including the connection to the sewer, prior to testing drainage system. Dispose of fluidized wastewater as directed by the City Representative.

   B. Testing: Test drain piping with water or visually check piping to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

   END OF SECTION
SECTION 33 49 26
LANDSCAPE DRAINAGE STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION
   A. The work of this section consists of constructing or furnishing and installing pre-cast catch basins.

1.02 SUBMITTALS
   A. In accordance with Section 01 33 00, Submittal Procedures, submit manufacturer's brochures and testing results for materials and strength parameters.

PART 2 PRODUCTS

2.01 GRATE
   A. Grates for catch basins shall be cast iron, ADA compliant (if at grade), and heel proof in pedestrian areas (if at grade). Grates shall be easily removable for basin cleaning and shall have locking devices for positively securing grates.

2.02 CATCH BASIN
   A. Acceptable products are manufactured by U.S. Concrete Cast Products (925) 960-8740 or equal. Catch basins and extensions shall be pre-cast concrete, with bolt down, cast iron grate, 2'-9" inside clear diameter.

2.03 DRAIN INLET
   A. Acceptable products are manufactured by U.S. Concrete Cast Products (925) 960-8740 or equal. Drain inlets shall be cast concrete, 18" sq. Grates shall be cast iron, heel proof, and vandal resistant. See Drawings for size and shape.

2.04 TRENCH DRAIN
   A. Pre-engineered, pre-manufactured trench drain system, "Mini Channel Drain" with brass grate. Manufacturer: NDS, Phone: (800) 726-1994, www.NDSPRO.com, or equal; no known equal. Secure brass grate with brass or stainless steel vandal resistant screws.

2.05 ATRIUM GRATE
   A. Atrium Grate with corrugated elbow, size to fit, by NDS, Phone: (800) 726-1994, www.NDSPRO.com, or equal; no known equal. Material: Black structural polyolefin.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Place pipe sections flush on the inside of the structure wall, projecting outside sufficiently for proper connection with the next pipe section.
B. Set catch basins at the grade and location shown on the drawings. Install grates and secure in place with removable attachments. Install in strict accordance with manufacturer’s details.

3.02 CONNECTION TO EXISTING DRAIN LINE

A. The Contractor shall make connection to the existing drain line where and as shown on the Plans and as specified herein and in accordance with Section 317 of the Standard Specifications.

3.03 FINAL PIPE CLEANING

A. Before testing drainage system, clean all lines by flushing including connection to sewer. Dispose of fluidized wastewater as directed by the City Representative.

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.

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 30 00 Submittals except as modified or added to in this Section. See Section 01 30 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, 1680 Mission Street, 4th 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 901 Rankin Street, San Francisco, CA 94124 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 11 53 Request for Qualifications for more information.
PART 2 – PRODUCTS

2.1 VEHICLE SIGNAL HEADS

A. Vehicle signal faces shall be in accordance with the 2010 CTSS, Section 86-4.01, "VEHICLE SIGNAL FACES," through Section 86-4.02, "Programmed Visibility Vehicle Signal Faces," inclusive, except as amended as follows:

1. Programmed visibility signals shall be delivered with no dimmer modules installed. Units shall be delivered with dimmer module receptacle sealed (water tight) or without receptacle.

2. Signal section housing shall be dye cast aluminum, equipped with stainless steel hardware and neoprene door gasket. The signal shall have tunnel visors, glass lens, and alsak reflectors with cast aluminum reflector rings. Sockets are to be held by a bail, have four (4) position adjustments, and leads shall be wired directly to the terminal block with one (1) stakon or quick disconnect. No quick disconnect shall be directly on the socket. Signal shall have matching green, amber and red sockets. Terminal block shall be mounted in yellow section only.

3. The signal door lip, where it closes against the housing, shall be a minimum 7/16-inch thick for 8-inch signals and ½ inch for 12-inch signals.

4. The shape of each signal face section housing or housing door without back plate shall be square when viewed from the front.

5. Signal doors shall open 180 degrees. The 12-inch shall have only two (2) latches.

6. 12" vehicle signal LED’s shall comply with current Type 1 LED signal modules specifications from the Institute of Transportation Engineers (http://www.ite.org/standards/VTCSH_LED_Circular_Signal_Final.pdf) and Caltrans (http://www.dot.ca.gov/hq/esc/ttsb/electrical/pdf/traffic_signal.pdf) with the following provisions:
   a. The manufacturer shall submit reports from Intertek ETL that certify full compliance of LED signal modules to the referenced ITE specifications across the temperature range of -40 degrees centigrade to +74 degrees centigrade for all colors. Evidence of full compliance to all required testing methods, procedures, and sections as outlined in the above ITE document Figure 2, design Qualification Testing Flow Chart must be included without any exceptions, changes, or omissions. The manufacturer must also submit a data sheet showing the exact catalog number of the items submitted on the bid and the Independent Lab report must show the full qualification of this catalog number.
   b. All modules are to be water tight and resist wicking water into the housing where wires or terminals penetrate the housing. Each unit shall be sealed by use of an O-ring gasket compressed radially or have a lens permanently sealed in production. Screwed on front lenses are not allowed.
   c. All modules shall have a visual appearance similar to an incandescent lamp. They shall have a smooth, uniform, non-pixilated appearance. The LED module shall use Hi Flux LED’s as a centralized light source. No 5mm LED’s shall be used.
   d. All modules shall be warranted for 5 years. The warranty must include workmanship, materials, and the modules must maintain minimum luminance intensity as per the ITE VTCSH-LED Circular Signal Supplement 4.1.1 for all colors throughout the warranty period.
   e. LED modules must be GE GT1(-17A) or Dialight X/XL series part numbers or other equal.
   f. All modules on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition, high-energy transients as stated in NEMA Standard TS-2-2003 section 2.1.8. In
addition the module shall comply with the following standards: 1) IEC 1000-4-5, ANSI/IEEE C62.41.2-2002 at 3KV with a 2 ohm source impedance, and 2) IEC 1000-4-12 & ANSI/IEEE C62.41.2-2002 at 6KV, 30 Ohms, 200A, and 100 kHz ring wave.

g. For uniformity of appearance the unlit lens shall be the color of the LED output and the manufacturer and must comply to the specifications for all three colors in both 8” and 12” sizes.

h. To insure reliable signal operation over the warranty period and that the device is not overdriving an insufficient number of LED’s each module shall have the following minimum number of LED’s by size & color: 12” Red -8 LED’s, 12” Yellow -21 LED’s, 12” Green -8 LED’s, 8” Red –4 LED’s, 8” Yellow –14 LED’s, and 8” Green –4 LED’s. This is in addition to photometric requirements in the ITE VTCSH-LED Circular Signal Supplement 4.1.1

7. 12” vehicle signal arrow LED’s shall comply with current Type 1 LED vehicle signal arrows modules specifications from the Institute of Transportation Engineers: (http://www.ite.org/standards/_vti_cnf/VTCSH%20LED%20Vehicle%20Arrow%20Traffic%20Signal%20Supp%20(16August2007).doc and Caltrans (http://www.dot.ca.gov/hq/esc/ttsb/electrical/pdf/traffic_signal.pdf) with the following provisions:

a. The manufacturer shall submit reports from Intertek ETL that certify full compliance of LED signal modules to the referenced ITE specifications across the temperature range of -40 degrees centigrade to +74 degrees centigrade for all colors. Evidence of full compliance to all required testing methods, procedures, and sections as outlined in the above ITE document Figure 2, design Qualification Testing Flow Chart must be included without any exceptions, changes, or omissions. The manufacturer must also submit a data sheet showing the exact catalog number of the items submitted on the bid and the Independent Lab report must show the full qualification of this catalog number.

b. All modules are to be water tight and resist wicking water into the housing where wires or terminals penetrate the housing. Each unit shall be sealed by use of an O-ring gasket compressed radially or have a lens permanently sealed in production. Screwed on front lenses are not allowed.

c. All modules shall have a visual appearance similar to an incandescent lamp. They shall have a smooth, uniform, non-pixilated appearance.

d. All modules shall be warranted for 5 years. The warranty must cover workmanship, materials, and the modules must maintain minimum luminance intensity as per the ITE VTCSH- LED Vehicle Arrow Traffic Signal Modules specification for all colors throughout the warranty period.

e. LED modules must be GE GT1(-17A)or Dialight X/XOD series part numbers or equal.

f. All modules on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition, high-energy transients as stated in NEMA Standard TS-2-2003 section 2.1.8. In addition the module shall comply with the following standards: 1) IEC 1000-4-5, ANSI/IEEE C62.41.2-2002 at 3KV with a 2 ohm source impedance, and 2) IEC 1000-4-12 & ANSI/IEEE C62.41.2-2002 at 6KV, 30 Ohms, 200A, and 100 kHz ring wave.

g. For uniformity of appearance the unlit lens shall be the color of the LED output and the manufacturer must comply with the specifications for all three colors.
8. Testing and warranty information for LED vehicle modules shall be submitted as follows:

   a. Manufacturer’s testing data shall be submitted to SFMTA’s Traffic Engineer, 1 South Van Ness Avenue, 7th Floor, SF CA 94103-5417, not Caltrans (overrides Caltrans LED specification sections 9.4.2.1 and 9.4.2.2).

   b. All warranty documentation shall be given to SFMTA’s Traffic Engineer, 1 South Van Ness Avenue, 7th Floor, SF CA 94103-5417 (overrides Caltrans LED specification section 10).

   c. All units shall meet one of the following conditions:
      i. Model shall be on the Caltrans pre-qualified product list of LED Traffic Signal Modules, or
      ii. Manufacturer shall provide verification that the submitted model(s) have been submitted to and tested by an independent testing lab, and that the submitted model has passed all tests as identified in the Caltrans LED specifications and these contract documents (see item 1 above).

9. Conductors to the end terminal of lamp receptacles shall be with insulation color-coded red, yellow and one of the following: Black, blue or brown.

10. The visor bolt pattern on the signal head housing shall match the bolt pattern of heads and visor stocked by the SFMTA Signal Shop as follows:

     8 and 7/8 inches center-to-center for 8-inch heads
     12 and 5/8 inches center-to-center for 12-inch heads.

11. No vehicle signal heads shall be considered pre-accepted by the City. Some signal heads manufactured by PEEK (TCT), Traffic Parts, Inc, and McCain Traffic Supply have demonstrated the ability to meet the City’s specifications in the past. It is the Contractor’s responsibility to demonstrate that each traffic signal head meets or exceeds the City’s requirements as set forth in this Section. In order for a manufacturer other than those specified above to be considered for acceptance, a working sample must be submitted to the City’s Traffic Signal Division for a minimum of one year for installation and field testing prior to being allowed for use on any of the traffic signals within the City.

2.2 LOUVERS AND VISORS

   A. All louvers and visors shall be installed per State of California Department of Transportation’s (CALTRANS) Standard Specifications (2010). Louvers shall be Directional Louvers as per Caltrans Standard Plan ES-4C. Visors for signal faces shall be aluminum.

   B. Visors shall be attached to signal heads with “universal” clips. The contractor shall apply an anti-seize compound (brand name "Never-Seeze" or equal) to the threads of the screws used to secure visors to signal heads.

   C. Unless indicated otherwise on the plans, angle visors shall be dimensioned as follows:
      1. 12-inch heads 12"x12"x27"

2.3 PEDESTRIAN SIGNALS


   B. Front screen shall be egg-crate type and a visor shall not be required.
1. The egg-crate grid screen can be plastic or metallic.

2. The door frame and egg-crate grid screen shall be separate units, with the egg-crate screen being easy to remove and replace.

C. Countdown Pedestrian Signal Module (Combination Raised Hand and Walking Person with Two Digit Countdown Timer) shall be of the LED type. Countdown pedestrian signal LED module shall comply with current LED pedestrian signal modules specifications from the Institute of Transportation Engineers (http://www.ite.org/standards/PTCSI_Part2_0406.pdf) and Caltrans (http://www.dot.ca.gov/hq/esc/ttsb/electrical/pdf/traffic_signal.pdf) with the following provisions:

1. The manufacturer shall submit reports from the 3rd party independent lab reports that certify full compliance of LED signal modules to these specifications across the temperature range of -40 degrees centigrade to +74 degrees centigrade for both colors. Evidence of full compliance to all required testing methods, procedures, and sections as outlined in the above ITE document Attachment 2, Design Qualification Testing Flow Chart must be included without any exceptions, changes, or omissions. The manufacturer must also submit a data sheet showing the exact catalog number of the items submitted on the bid and the Independent Lab report must show the full qualification of this catalog number.

2. LED modules must be GE GT1(-26A) or Dialight X series part numbers or other approved by the city and County of San Francisco prior to bid advertisement.

3. LED modules must fit in Caltrans standard pedestrian housings.

4. All modules shall have a visual appearance similar to an incandescent lamp. They shall have a smooth, uniform, non-pixelated appearance. Hand and Person icons are to appear solid. No outline icons are allowed.

5. The module shall display the correct countdown display when a Walking/Person follows a Flashing Red/Hand without an intervening display of Solid Red/Hand.

6. The module shall countdown through Flashing Red/Hand only. No mode switch is to be provided which could enable other countdown display choices.

7. All modules are to be water tight and resist wicking water into the housing where wires or terminals penetrate the housing.

8. All modules on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition, high-energy transients as stated in NEMA Standard TS-2-2003 section 2.1.8. In addition the module shall comply with the following standards: 1) IEC 1000-4-5, ANSI/IEEE C62.41.2-2002 at 3KV with a 2 ohm source impedance, and 2) IEC 1000-4-12 & ANSI/IEEE C62.41.2-2002 at 6KV, 30 Ohms, 200A, and 100 kHz ring wave.

9. Conductors shall be 1 meter (.33 ft) in length, with fully insulated female quick disconnect terminals attached to a 6.35 mm (.25") tab, and conform to Section 86-4.01B, "Electrical Components," of the Caltrans Standard Specifications. (Additional information to Caltrans LED pedestrian specification section 2.7)

10. LED timer shall count down the duration of the "Flashing Raised Hand" phase. Timer shall start at the beginning of the "Flashing Raised Hand" signal phase and blank out after the end of the "Flashing Raised Hand" signal phase.

11. The LED timer shall have a dipswitch, which shall enable or disable the countdown display.

12. The countdown display shall be two digits, and the numbers 00 to 99 on the numerical display shall have a minimum height of 180 mm (7 inches) and shall be Portland Orange in color.

13. The reflector shall be removed.

14. The countdown timer shall utilize the standard 3 field wire configuration found in a typical pedestrian signal head; a neutral wire, a hot wire for the walking man, and a hot wire for the solid/flashing hand.
15. When Solid Fill Pedestrian Signal Face is displayed, both the raised hand and the walking man indications shall be formed with an array of LEDs such that the indications provide a filled-in/solid appearance.

16. The countdown display shall be able to countdown 2 or more times in the same “GREEN” phase.

17. There shall be user selectable display modes, including the option to have numbers of countdown display remain solid (i.e. not flash) during the flashing red hand.

18. After initial power up when the countdown module requires 2 to 3 signal cycles to “learn” the programmed countdown, the countdown portion of the display shall remain blank.

D. Testing and warranty information for countdown pedestrian signal LED modules shall be processed as follows:

1. Test units and manufacturer’s testing data shall be submitted to SFMTA’s Traffic Engineer, 1 South Van Ness Avenue, 7th Floor, SF CA 94103-5417, not Caltrans (overrides Caltrans LED specification sections 4.4.2.1 and 4.4.2.2).

2. All warranty documentation shall be given to SFMTA’s Traffic Engineer, 1 South Van Ness Avenue, 7th Floor, SF CA 94103-5417 (overrides Caltrans LED pedestrian signals specification section 5).

3. All units shall meet one of the following conditions:
   a. Model shall be on the Caltrans pre-qualified product list of LED Traffic Signal Modules, or
   b. Manufacturer shall provide verification that the submitted model(s) have been submitted to and tested by an independent testing lab, and that the submitted model has passed all tests as identified in the Caltrans LED specifications and these contract documents (see item 1 above).

2.4 PEDESTRIAN PUSH BUTTONS

A. The pedestrian push button station (housing and sign frame) shall comply with 2010 CTSP type B specifications. The button itself shall be a Polara Engineering Bulldog (Part Number BDLL2-Y) or equal. The button shall have the following characteristics: made from aluminum and hard nickel plated; vandal resistant; and diameter of at least 2”. In addition, it shall have a piezo driven solid state switch and essentially no moving parts. A red LED indication shall stay on until the walk cycle to indicate the push button has been activated by a pedestrian. In addition, the button shall emit a two-tone beep each time the push button is operated (2.6 khz when pressing and 2.3 khz when releasing).

B. A Polara Engineering latching push button control unit (Part number LPBCU) or equal shall be provided as a power supply for the latching pedestrian push button. This unit shall be installed in the intersection controller cabinet so that the red LED indication on the pedestrian push button stays on during the walk cycle.

C. The pedestrian push button station shall be installed on crosswalk side of pole with appropriate walking man directional symbol sign unless otherwise noted on the plans. Custom sized stations shall be provided to fit various pole diameters. The back of the station shall be flush with the curvature of the pole. Generic one-size-fits-all or adjustable stations are not allowed.

D. Tamper proof screws shall be used to secure buttons and signs. Tamper proof screws shall be #15 torx star pins, Harrison & Bonini part number 8-32 x 3/8 BH PIN TO RX 18-8 T15 or equivalent.

E. Pedestrian push buttons shall be installed in accordance with Caltrans 2010 Standard Plans ES-5C.
2.5 PEDESTRIAN PUSH BUTTON POST

A. Pedestrian push button posts shall be installed in accordance with Caltrans 2010 Standard Plan ES-7A.

B. The post shall be bonded to a point directly behind the station sign.

2.6 ACCESSIBLE PEDESTRIAN SIGNALS

A. General

1. This section describes the Accessible Pedestrian Signal (APS) pedestrian push button stations, the control units, and the hand-held wireless infrared device for programming the system settings.

2. No substitutions or alternatives will be accepted.

B. Accessible Pedestrian Signal (2-Wire System)

1. General

The accessible pedestrian signal (APS) pedestrian push button station (housing and sign frame) shall comply with Caltrans Standard Plans Type B specifications and shall be yellow in color. The APS unit shall be connected to a central control unit mounted inside the traffic controller cabinet using existing pedestrian push button wiring (2 wires). The sign plate shall conform to the California Manual on Uniform Traffic Control Devices, shall have the street name in Braille (unless otherwise noted) and shall have a graffiti armor coating. The APS unit shall have special voice message capabilities (see additional details below). The button itself shall have the following characteristics: made from cast aluminum and hard nickel plated; vandal resistant; ADA compliant; vibro-tactile with a raised directional arrow; and diameter of at least 2”.

A red LED indication shall stay on until the walk cycle to indicate the push button has been activated by a pedestrian. The station shall be provided with a weather-proof speaker for which all sounds and tones will emanate from, and the speaker shall be protected by a vandal resistant screen. The button shall emit a brief “tick” each time the push button is operated. In addition, the unit shall have the capability of emitting the following tone/sounds:

a. Locating tone at 880 Hz plus harmonic, 0.1 second duration, 1 second interval during pedestrian clearance and don’t walk interval.

b. Cuckoo sound at 1250 Hz and 1000 Hz, 0.6 second duration, 1.8 second interval, during walk intervals only.

c. Chirp sound from 2700 Hz to 1700 Hz, 0.2 second duration, 1 second interval, during walk intervals only.

The firmware and voice messages shall be updatable via the USB port at the push button station.

2. Programming

The various settings of the APS unit shall be programmable using a hand-held wireless infrared device. The programmable settings include but are not limited to:

a. locator tone minimum volume
b. locator tone maximum volume
c. standard WALK minimum volume
d. standard WALK maximum volume
e. extended push message minimum volume
f. extended push message maximum volume
g. volume over ambient
h. locator tone volume over ambient
i. WALK mode, selecting the sound played during the WALK phase among at least the following 11 choices:
   i. none
   ii. cuckoo
   iii. chirp
   iv. standard Rapid Tick (4 variations)
   v. standard Rapid Tick #2
   vi. standard Rapid Tick #3
   vii. standard Rapid Tick #4
   viii. custom message (3 customizable variations)
   ix. custom message #2
   x. custom message #3
   xi. WALK sign is on for all crossings

j. WALK sound pause
k. WALK sound trigger
l. Clearance phase sound, selecting the sound played during the clearance phase among a few standard clearance sounds, a customer specified tone or verbal clearance countdown
m. DON’T WALK phase sound, selecting the sound played during the DON’T WALK phase among a few standard locate sounds or a customer specified tone.

3. Customization
   a. The APS unit shall provide the following custom message and sound options:
      i. Custom Locate Sound – plays a sound at a selectable interval to assist a blind pedestrian in locating the push button station
      ii. Custom Location Message – plays a custom message to state the street being crossed and cross street names, and other vital information to help pedestrian with location and direction
      iii. Custom Walk Message – plays a custom message to alert pedestrians that the WALK interval has begun and name of street being crossed
      iv. Custom Clearance Sounds/Countdown – plays a sound to let pedestrians know they should clear intersection crosswalk.
   b. Audible messages shall be fully customizable in multiple languages (up to two).
   c. The APS (2-Wire System) shall be the following or equivalent in all features and functions:
      i. 2-Wire EZ Communicator Navigator (Part Number EN25AB1-Y) by Polara Engineering Inc.

4. Central Control Unit for 2-Wire System
   a. A central control unit shall be provided as a power supply and control unit for the audible and latching pedestrian push button features of the APS unit as described in previous sections. The central control unit shall be installed inside the traffic controller cabinet and connected to its associated push button stations using existing pedestrian push button wiring (2 wires).
   b. The Central Control Unit shall support up to 16 push button stations in a maximum of 4 channels up to 4 push button stations per channel.
   c. The Central Control Unit shall have Ethernet access to the push button stations to change settings of the push button stations as well as monitor the stations and report back to a Centralized Traffic Management Center.
d. The firmware for the Central Control Unit shall be upgradable via the USB port on the Central Control Unit.

e. The Central Control Unit shall be the following or equivalent in all features and functions:
   i. 2-Wire EZ Communicator Central Control Unit (Part Number CCU/2EN) by Polara Engineering, Inc.

C. Accessible Pedestrian Signal (4-Wire System)

1. General

   The accessible pedestrian signal (APS) pedestrian push button station (housing and sign frame) shall comply with Caltrans Standard Plans Type B specifications and shall be yellow in color. The APS unit shall be connected to a power and control unit mounted inside its associated pedestrian signal housing using a 4-wire cable. The sign plate shall conform to the California Manual on Uniform Traffic Control Devices, shall have the street name in Braille (unless otherwise noted), and shall have a graffiti armor coating. The APS unit shall have special voice message capabilities (see additional details below). The button itself shall have the following characteristics: made from cast aluminum and hard nickel plated; vandal resistant; ADA compliant; vibro-tactile with a raised directional arrow; and diameter of at least 2”. A red LED indication shall stay on until the walk cycle to indicate the push button has been activated by a pedestrian. The station shall be provided with a weather-proof speaker for which all sounds and tones will emanate from, and the speaker shall be protected by a vandal resistant screen. The button shall emit a brief “tick” each time the push button is operated. In addition, the station shall have the capability of emitting the following tone/sounds:
   a. Locating tone at 880 Hz plus harmonic, 0.1 second duration, 1 second interval during pedestrian clearance and don’t walk interval.
   b. Cuckoo sound at 1250 Hz and 1000 Hz, 0.6 second duration, 1.8 second interval, during walk intervals only.
   c. Chirp sound from 2700 Hz to 1700 Hz, 0.2 second duration, 1 second interval, during walk intervals only.

   The firmware and voice messages shall be updatable via the USB port at the push button station.

2. Programming

   The various settings of the APS unit shall be programmable using a hand-held wireless infrared device. The programmable settings include but are not limited to: locator tone minimum volume; locator tone maximum volume; standard WALK minimum volume; standard WALK maximum volume; extended push message minimum volume; extended push message maximum volume; volume over ambient; locator tone volume over ambient; WALK mode, selecting the sound played during the WALK phase among at least the following 11 choices: none, cuckoo, chirp, standard Rapid Tick (4 variations), custom message (3 customizable variations), and WALK sign is on for all crossings; Walk sound trigger; clearance phase sound, selecting the sound played during the clearance phase among a few standard clearance sounds, a customer specified tone or verbal clearance countdown; DON’T WALK phase sound, selecting the sound played during the DON’T WALK phase among a few standard locate sounds or a customer specified tone.

3. Customization

   a. The APS unit shall provide the following custom message and sound options:
      i. Custom Locate Sound – plays a sound at a selectable interval to assist a blind pedestrian in locating the push button station
ii. Custom Location Message – plays a custom message to state the street being crossed and cross street names, and other vital information to help pedestrian with location and direction

iii. Custom Walk Message – plays a custom message to alert pedestrians that the WALK interval has begun and name of street being crossed

iv. Custom Clearance Sounds/Countdown – plays a sound to let pedestrians know they should clear intersection crosswalk.

b. Audible messages shall be fully customizable in multiple languages (up to two).

c. The APS (4-Wire System) shall be the following or equivalent in all features and functions:

i. 4-Wire EZ Communicator Navigator (Part Number EN45AB1-Y) by Polara Engineering Inc.

4. Ped Head Control Unit for 4-Wire System

a. A power and control unit shall be provided as a power supply and control unit for the audible and latching pedestrian push button features of the APS unit as described in previous sections. The power and control unit shall be installed in the pedestrian signal housing and connected to its associated push button station(s) using a 4-wire cable.

b. The Ped Head Control Unit shall be the following or equivalent in all features and functions:

i. Ped Head Control Unit (Part Number PHCU4W) by Polara Engineering, Inc.

D. Hand-held Wireless Infrared Programming Device for Accessible Pedestrian Signal

1. A hand-held wireless infrared programming device shall be provided as a remote used for configuring the settings of the Accessible Pedestrian Signals as described in previous sections. The hand-held device shall communicate with the individual APS unit or the central control unit via infrared. The hand-held device shall have a 2 line x 16 character liquid crystal display (LCD) with a backlight. It shall have an operating temperature range of 0°C to 50°C.

2. The hand-held device shall be password protected.

3. The hand-held device shall have the ability to save 4 user-defined and 3 factory pre-set program configurations.

4. The hand-held wireless infrared device shall be the following or equivalent in all features and functions:

a. EZ Communicator Navigator Configurator (Part Number EConfig) by Polara Engineering Inc.

E. Test and Acceptance

1. The apparent low bidder shall be required to supply a working sample of an Accessible Pedestrian Signal pedestrian push button station, a central control unit, a ped head control unit and a hand-held wireless infrared device for performance testing (at no cost or obligation to the City) prior to award. This shall be done within 10 working days of being notified of potential award. This sample unit, if accepted, shall be considered part of the total quantity of this purchase order. Failure to do so will render the bid nonresponsive.

2. Paragraph 2.6.E.1 above will not be required if, prior to the bid opening, the bidder has demonstrated that the Accessible Pedestrian Signal bid meets these specifications.
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, 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. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. Terminal compartment door screws shall be stainless steel and be ¾ inch in length.
H. 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.

I. The contractor shall apply an anti-seize compound (brand name “Never-Seeze” or equal) 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 TRAFFIC SIGNAL POLES

A. The traffic signal poles shall be installed as per 2010 CTSS Section 86-2.04 and 2010 CTSP ES-7A through ES-7K as applicable except that the location of pole handholes is not facing the street. Handholes are to be installed on the side NOT facing the roadway (i.e. furthest from the roadway or 180 degrees from the roadway). In addition, for combination luminaire and signal mast arm poles such as Caltrans Standard poles Type 17, 17A, 19, 19A, 24, 24A, etc., a second handhole shall be installed on the side 180 degrees from the mast arm connection to the pole. The centerline of the second handhole shall be 9 inches above the centerline of the mast arm connection. All other relevant details for the second handhole (such as reinforcement ring, handhold cover, bolt, etc.) are the same as the handhole near the base of the pole.

B. Anchor bolts shall extend no less than ¼ inch and no greater than 1-¼ inch beyond the face on the nut. Anchor bolts shall not be cut.

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 TRAFFIC CONTROLLER UNIT

A. The traffic signal controller shall be Type 2070LXN2. The traffic signal controller cabinet shall be NEMA TS2 Type 1. The 2070 controllers and TS2-Type 1 cabinets provided in this contract shall be 100% compatible with each other and with other compliant components. The 2070 controller shall provide complete functionality and interoperability in all TS2 cabinets built by other manufacturers. The TS2 cabinet assembly provided in this contract shall accept both 2070 and NEMA TS2 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 such as grounding of CVM signals or proprietary
interface devices that constrict compatibility of either the cabinet or the controller with other controllers and cabinets.

B. Each controller furnished in this contract shall be in compliance with the March 12, 2009 TEES. Units provided in this contract shall meet Caltrans standards. SFMTA may elect to request a third party testing lab to determine whether all applicable standards have been met. Controller composition shall be defined as 2070LXN2 chassis, 2070-1C CPU Module (See 2.2B4 for 2070-1C quantity, compliance and requirements), 2070-2N I/O module, 2070-3B front panel, 2070-4NA power supply, and 2070-7A module. The 2 2070-2B modules (testing only) shall also comply with 2.2B.

C. The controllers shall have the following components and features:
   1. Operate in accordance with NEMA TS2/Type 1 specifications.
   2. Operates via the SDLC connector
   3. 2070LXN2 chassis
   4. 2070-1C module (CPU module), Plus 1 (one) Additional 2070-1C module shall be provided with each controller purchased, and shipped in manufacturer’s original packaging.
      a. Comes preloaded with one of the following configurations (that will automatically load at start-up):
         i. SSH/SCP
         ii. FTP and Telnet
      b. Must NOT come preloaded with any processes (other than SSH, FTP or Telnet) that utilize an Ethernet port (i.e. web server, etc).
      c. Supplies the following drivers, all of which operate simultaneously and in full duplex:
         i. /dev/sp1
         ii. /dev/sp2
         iii. /dev/sp3s (153.6 Kbps by default)
         iv. /dev/sp4 or /dev/console
         v. /dev/sp5s (614.2 Kbps by default)
         vi. /dev/sp6 (38.4 Kbps by default)
      d. Supplies drivers for the following peripherals:
         i. USB flash drive
         ii. 2070 Datakey
      e. Must be integrated with Fourth Dimension Traffic's D4 Traffic Signal Software (integration not required if 2070-1C module complies 100% with either the ATC Version 5.2b or 2009 TEES specifications)
   5. 2070-2N, Field I/O
   6. 2070-3B Front Panel Assembly (8 line x 40 character display, 2 keypads)
   7. 2070-4AN, 10 AMP power supply (for future addition of VME cage assembly)
   8. 2070-7A Serial modem card
   9. All unused slots shall be covered by blank plates.

D. Performance Testing
   1. The SFMTA Traffic Signal Shop will select one of the units from the first shipment for performance testing.
   2. Evaluation of these tests is at the sole discretion of the SFMTA Traffic Signal Shop.
   3. Required to pass a 72 hour burn-in test conducted by SFMTA:
      b. Controllers must run in a TS2-Type 1 cabinet (consisting of 2 T/F BIUs, 1 Detector BIU and MMU) for the duration of the test with zero SDLC
c. Controllers must run in an ITS 342 cabinet (consisting of one single 14 position output assembly, one input assembly and a CMU) for the duration of the test with zero SDLC response errors.

d. Controllers will be exercised with Ethernet communication (once-per-second AB3418 polling messages) for the duration of the test.

e. Controllers will be connected to a Garmin GPS receiver via serial port connection for the duration of the test.

E. Warranty and Support

1. The controller 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 firmware and hardware characteristics of the controllers provided in this contract.

2. The controllers 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 controllers and/or related hardware modules 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.

3. Prior to delivery, the controller shall be tested by the controller manufacturer or authorized local distributor to ensure proper operation. The controller manufacturer shall provide certification that the controller has met all quality assurance tests.

2.11 TRAFFIC CONTROLLER UNIT FOR ITS CABINETS

A. The traffic signal controller shall be Type 2070LXN2. The traffic signal controller cabinet shall be NEMA TS2 Type 1. The 2070 controllers and TS2-Type 1 cabinets provided in this contract shall be 100% compatible with each other and with other compliant components. The 2070 controller shall provide complete functionality and interoperability in all TS2 cabinets built by other manufacturers. The TS2 cabinet assembly provided in this contract shall accept both 2070 and NEMA TS2 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 such as grounding of CVM signals or proprietary interface devices that constrict compatibility of either the cabinet or the controller with other controllers and cabinets.

B. Each controller furnished in this contract shall be in compliance with the March 12, 2009 TEES. Units provided in this contract shall meet Caltrans standards. SFMTA may elect to request a third party testing lab to determine whether all applicable standards have been met. Controller composition shall be defined as 2070LXN2 chassis, 2070-1C CPU Module (See 2.2B4 for 2070-1C quantity, compliance and requirements), 2070-2N I/O module, 2070-3B front panel, 2070-4NA power supply, and 2070-7A module. The 2 2070-2B modules (testing only) shall also comply with 2.2B.

C. The controllers shall have the following components and features:

1. Operate in accordance with NEMA TS2/Type 1 specifications.
2. Operates via the SDLC connector
3. 2070LXN2 chassis
4. 2070-1C module (CPU module), Plus 1 (one) Additional 2070-1C module shall be provided with each controller purchased, and shipped in manufacturer’s original packaging.
   a. Comes preloaded with one of the following configurations (that will automatically load at start-up):
      i. SSH/SCP
      ii. FTP and Telnet
   b. Must NOT come preloaded with any processes (other than SSH, FTP or Telnet) that utilize an Ethernet port (i.e. web server, etc).
   c. Supplies the following drivers, all of which operate simultaneously and in full duplex:
      i. /dev/sp1
      ii. /dev/sp2
      iii. /dev/sp3s (153.6 Kbps by default)
      iv. /dev/sp4 or /dev/console
      v. /dev/sp5s (614.2 Kbps by default)
      vi. /dev/sp6 (38.4 Kbps by default)
   d. Supplies drivers for the following peripherals:
      i. USB flash drive
      ii. 2070 Datakey
   e. Must be integrated with Fourth Dimension Traffic’s D4 Traffic Signal Software (integration not required if 2070-1C module complies 100% with either the ATC Version 5.2b or 2009 TEES specifications).

5. 2070-2N, Field I/O
6. 2070-3B Front Panel Assembly (8 line x 40 character display, 2 keypads)
7. 2070-4AN, 10 AMP power supply (for future addition of VME cage assembly)
8. 2070-7A Serial modem card
9. All unused slots shall be covered by blank plates.

D. Performance Testing
1. Evaluation of these tests is at the sole discretion of the SFMTA Traffic Signal Shop.
2. Required to pass a 72 hour burn-in test conducted by SFMTA:
   b. Controllers must run in a TS2-Type 1 cabinet (consisting of 2 T/F BIUs, 1 Detector BIU and MMU) for the duration of the test with zero SDLC response errors.
   c. Controllers must run in an ITS 342 cabinet (consisting of one single 14 position output assembly, one input assembly and a CMU) for the duration of the test with zero SDLC response errors.
   d. Controllers will be exercised with Ethernet communication (once-per-second AB3418 polling messages) for the duration of the test.
   e. Controllers will be connected to a Garmin GPS receiver via serial port connection for the duration of the test.

E. Warranty and Support
1. The controller 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 firmware and hardware characteristics of the controllers provided in this contract.
2. The controllers 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 controllers and/or related hardware modules 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.

3. Prior to delivery, the controller shall be tested by the controller manufacturer or authorized local distributor to ensure proper operation. The controller manufacturer shall provide certification that the controller has met all quality assurance tests.

2.12 TRAFFIC SIGNAL CABINET - TYPE G

NOT USED

2.13 TRAFFIC SIGNAL CABINET - TYPE M-SF STANDARD

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. Two hardcopies and one copy on Compact Disk, or USB Flash Drive in CAD and PDF format of the cabinet and wiring diagram shall be provided with each cabinet assembly. All cabinets shall be equipped with a 12" X 15" or larger plastic envelope, opened at one end, for storage of above documents, or a document storage area under the laptop shelf sufficient for two (2) sets of cabinet wiring diagrams. One of the two sets of cabinet wiring diagrams shall be folded to a finished size of 8 1/2" X 11".
      b. The cabinet shall be designed to mount on an M-SF concrete controller foundation. The M-SF cabinet shall meet the following additional requirements:

C. Enclosure
   1. The cabinet shall be weatherproof
   2. Enclosure shall be 0.125" aluminum.
   3. Dimensions shall be as follows:

<table>
<thead>
<tr>
<th>M-SF STANDARD</th>
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<tbody>
<tr>
<td>External Height 60&quot;</td>
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<td></td>
</tr>
<tr>
<td>------------------</td>
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<tr>
<td><strong>Width</strong></td>
</tr>
<tr>
<td><strong>Depth (with door)</strong></td>
</tr>
<tr>
<td><strong>Height</strong></td>
</tr>
<tr>
<td><strong>Width (Minimum)</strong></td>
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</tbody>
</table>

4. Base flange: front, back 3" and sides 3 ½".
5. 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 diagram at the end of this section for details. Concrete foundation bolts are not required or desired with cabinets.
6. Channels
   Two or more ¾" metal channels (unistrut or equal) 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.
7. Shelves
   The cabinet shall have at least one 11 ½" deep shelf. If the detector rack is to be mounted on a shelf, then two shelves are required and the detector rack would be mounted on the upper shelf. The front edge of the shelves shall have ¾" holes punched every 6 inches to accommodate tie wrapping of cables/harnesses. If used, the top shelf shall be reserved for peripherals such as variable message sign controllers or Ethernet switch. The lower shelf shall hold the controller, the MMU and if need be, the cabinet power supply.
8. 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.
9. 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. 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.
10. All exterior seams shall be continuously welded and ground smooth. Interior seams shall be spot welded and sealed.
11. Cabinet shall include a fluorescent or LED light with a door activated on/off switch.
12. The cabinet shall be equipped with a unique serial number.

D. Door
   (1) Dimensions:
      a. Height 53", Width 36"
   (2) Door shall be 0.125" aluminum.
   (3) The cabinet door shall be on the front, full width, full height, and 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:
      a. 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.

b. AUTO/FLASH SWITCH.

(4) The door shall be equipped with a three point latching mechanism with nylon rollers at the top and bottom.

(5) The door handle shall be stainless steel and shall have provisions for padlocking.

(6) The main door lock shall be a Corbin #1548-1 or equal (single locking mechanism with Corbin #2 key).

(7) The main door 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.

(8) Door opening stops at 90 and 180 degrees.

(9) All door hardware to be stainless steel.

(10) Door shall have a louvered air vent, filter retainer bracket, and air filter.

(11) Door shall have a fold out, spring loaded shelf for placing laptop computer or other equipment. Shelf shall be mounted approximately 20” up from the bottom of the cabinet and shall be oriented so it will not block vent openings or cabinet switch array when stowed. The shelf shall be 16” wide and 14.5” deep. A non-skid material shall be applied to the top of the shelf.

E. Finish

1. The exterior shall be powder coated forest green (Cardinal Industrial Products #T007-GN16) or equivalent at a minimum thickness of 2 mils. A final top coat of Nano Graffiti Armor (Evolution Surface Solutions) or equivalent shall be applied.

2. The interior shall be powder coated white (Cardinal Industrial Products #T009-WH11) or equivalent at a minimum thickness of 2 mils.

3. All surfaces, burrs, and welds to be cleaned and smoothed before painting.

F. Cabinet Power Distribution and Wiring

1. The cabinet shall be wired with a solid state contactor (relay). Mercury contactors will not be accepted.

2. All terminal block screws shall be tightened to the manufacturers recommended screw tightening torque.

3. The cabinet shall be powered by a 30A, 120/240V main circuit breaker (Square D cat. # QOU130 Series 3 or equal). This main circuit breaker shall be labeled as main disconnect. This main circuit breaker shall feed two (2) circuit breakers adjacent to it; these two breakers shall feed the following:

   a. One (1) 20 amp breaker to feed the fan/thermostat, cabinet light, and the 20 amp GFI receptacle. Labeled GFI, FAN, LIGHT.

   b. One (1) 20 amp breaker to feed all other cabinet functions, including the two 20-amp surge protected NEMA rated non GFI duplex outlets in item 2.13.F.16. Labeled EQUIP.

4. One Marathon #1423570 three-position power distribution block and one Marathon #1422570 two position power distribution block (or equal) shall be installed side by side. A jumper shall be wired in series between the two. A bonding jumper between ac- 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 below for diagram:
5. One eight-position terminal block shall be installed for power supply terminations to auxiliary devices. The minimum termination functions shall be AC Line, AC Neutral, Earth Ground, Logic Ground, +12 VDC, +24 VDC, 12 VAC, and Line Frequency Reference (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. 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.

6. 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 equal.

7. Terminals shall be provided for the flash circuits to the red and yellow indications of each loadbay. The cabinet drawing shall include instructions for flash color change or no flash. Loadbays 9,10,11,12 are optional for flash.

8. The default wiring of the cabinet shall be as follows. Loadbays 1,2,5,6,9,10,13,14 shall be on circuit one of the flasher, and loadbays 3,4,7,8,11,12,15,16 shall be on circuit two of the flasher. Loadbays 9,10,11,12 are optional for flash.

9. Spade terminal lugs shall not be used on field conductors.

10. The cabinet shall be wired to accommodate 16 load switches.

11. 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.

12. The cabinet shall have AC Neutral buss (15 positions minimum) for field neutrals.
13. The cabinet shall have ground buss (15 positions minimum) for field grounding system.
14. The back panel (load bay and field wire terminal blocks) shall be “fold-out” for easier access to the rear wires and 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.
15. Output channels to be wired as follows:
   a. Channels 1 – 8 Vehicles with flash relays
   b. Channels 9 – 12 Pedestrians with or without flash relays
   c. Channels 13 – 16 Overlaps with flash relays
16. The cabinet shall be furnished with the following outlets, in addition to the TS2 standard GFI convenience outlet.
   a. One (1) x 20A surge protected NEMA rated non-GFI duplex outlet located on the side panel above the top shelf. This outlet shall be connected to a 20A circuit breaker. See 2.13.F.3.b in this section.
   b. One (1) x 20A surge protected NEMA rated non-GFI duplex outlet located on the side panel between the first and second shelves. If only one shelf then install this outlet adjacent to above outlet. This outlet shall be connected to a 20A circuit breaker. See 2.13.F.3.b in this section.
17. 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. 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.)
18. Provide two terminals per signal output. Field wire terminals shall be Square D, class 9080 type GR6 or equal. Use color coded blocks as follows GRR6 for red signal outputs, GRY6 for yellow signal outputs and GRG6 for green signal outputs. Use 2 pole jumpers 9080 GH72 for continuity of terminal pairs. Mount blocks on din 3 AM1DP200 or 9080 MH3**. Use screw on end clamps MHA10. Use end barrier GM6B. Use vinyl marking strip (9080 GH220) with marking strip end plug (9080 GH60).
19. The harness wires for field channel inputs one through sixteen to the MMU shall be terminated readily accessible and easily movable on the front side of the cabinet back panel. Soldered wires are not acceptable.
20. One TS2 standard detector rack shall be provided for all cabinets. One BIU shall be provided in the 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 below.

### OPTICOM DETECTOR RACK SLOTS TABLE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SLOT 9 FUNCTIONS for OPTICAL TWO CHANNEL PHASE SELECTOR Driving PE 3 &amp; PE 4</th>
<th>SLOT 10 FUNCTIONS for OPTICAL TWO or FOUR CHANNEL PHASE SELECTOR or GPS PHASE SEL. Driving PE 1, PE 2, PE 3, &amp; PE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>----</td>
<td>-24 VDC</td>
</tr>
<tr>
<td>B</td>
<td>----</td>
<td>24 VDC</td>
</tr>
<tr>
<td>C</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>D</td>
<td>CHANNEL C PRIMARY DET. INPUT</td>
<td>CHANNEL A PRIMARY DET. INPUT</td>
</tr>
<tr>
<td></td>
<td>DETECTOR 24 VDC OUTPUT</td>
<td>DETECTOR 24 VDC OUTPUT</td>
</tr>
<tr>
<td>---</td>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>F</td>
<td>CHANNEL C PRIORITY OUTPUT, COLLECTOR (+)</td>
<td>CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, COLLECTOR (+)</td>
</tr>
<tr>
<td>H</td>
<td>CHANNEL C PRIORITY OUTPUT, EMITTER (-)</td>
<td>CHANNEL A PRIORITY OUTPUT / REAR OUTPUT 1, EMITTER (-)</td>
</tr>
<tr>
<td>J</td>
<td>CHANNEL D PRIMARY DET. INPUT</td>
<td>CHANNEL B PRIMARY DET. INPUT</td>
</tr>
<tr>
<td>K</td>
<td>DETECTOR GROUND</td>
<td>DETECTOR GROUND</td>
</tr>
<tr>
<td>L</td>
<td>EARTH GROUND</td>
<td>EARTH GROUND</td>
</tr>
<tr>
<td>M</td>
<td>AC- IN (AC RETURN)</td>
<td>AC- IN (AC RETURN)</td>
</tr>
<tr>
<td>N</td>
<td>AC+ IN (115 VAC)</td>
<td>AC+ IN (115 VAC)</td>
</tr>
<tr>
<td>P</td>
<td>-----</td>
<td>CHANNEL C PRIMARY DET. INPUT</td>
</tr>
<tr>
<td>R</td>
<td>DETECTOR 24 VDC PWR. OUTPUT</td>
<td>DETECTOR 24 VDC PWR. OUTPUT</td>
</tr>
<tr>
<td>S</td>
<td>-----</td>
<td>CHANNEL C PRIORITY OUTPUT / REAR OUTPUT 3, COLLECTOR (+)</td>
</tr>
<tr>
<td>T</td>
<td>-----</td>
<td>CHANNEL C PRIORITY OUTPUT / REAR OUTPUT 3, EMITTER (-)</td>
</tr>
<tr>
<td>U</td>
<td>-----</td>
<td>CHANNEL D PRIMARY DET. INPUT</td>
</tr>
<tr>
<td>V</td>
<td>DETECTOR GROUND</td>
<td>DETECTOR GROUND</td>
</tr>
<tr>
<td>W</td>
<td>CHANNEL D PRIORITY OUTPUT, COLLECTOR (+)</td>
<td>CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, COLLECTOR (+)</td>
</tr>
<tr>
<td>X</td>
<td>CHANNEL D PRIORITY OUTPUT, EMITTER(-)</td>
<td>CHANNEL B PRIORITY OUTPUT / REAR OUTPUT 2, EMITTER (-)</td>
</tr>
<tr>
<td>Y</td>
<td>-----</td>
<td>CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, COLLECTOR(+)</td>
</tr>
<tr>
<td>Z</td>
<td>-----</td>
<td>CHANNEL D PRIORITY OUTPUT / REAR OUTPUT 4, EMITTER(-)</td>
</tr>
<tr>
<td>19</td>
<td>-----</td>
<td>TRANSMIT DATA</td>
</tr>
<tr>
<td>21</td>
<td>-----</td>
<td>RECEIVE DATA</td>
</tr>
</tbody>
</table>

21. 300 series Marathon/Kulka or equivalent terminal blocks for loop wires shall be provided for 16 channels.
22. 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.
23. 300 series Marathon/Kulka or equivalent terminal blocks for Opticom wires shall be provided for 4 channels.
24. The following switches shall be included inside the cabinet:
   a. AUTO/FLASH SWITCH.
   b. 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.
   c. STOP TIME SWITCH. The switch shall have two positions: stop time and normal.
   d. 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.
   e. DOOR SWITCH. The switch shall call alarm 1 when the cabinet door is open. It shall be a normally closed switch.
25. The Opticom green sensing block shall not be provided.
26. The SDLC Bus shall be constructed as follows. Place eight 15 pin D-sub female sockets with screw-locks in one row on a flat back mount panel. The D-sub sockets shall have gold plated soldered terminals and shall meet the TS-2 Specification. The panel shall measure approximately 1 ¾" wide x 9 ½" long x 1"
deep. 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. All D-sub female terminals shall be wired as per the TS-2 specifications. Any unused female terminals shall be populated. Mount this panel in the cabinet at an accessible location.

27. Provide SDLC cables with screw-locks on one end to connect to the SDLC buss in item 26 above 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 that meet and are wired as per TS-2 Specification. Any unused male terminals shall be fully populated on the spring-lock end as a minimum.

G. Traffic Signal Controller Cabinet Components/Equipment for 2070 M-SF Cabinets
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 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 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 equal.

6. Each cabinet shall be equipped with two (2) Flasher Unit. The flasher unit shall be PDC model SSF-87 or EDI model 810 or equal.

7. Each cabinet shall be equipped with six (6) or eight (8) NEMA Flash transfer relays. Flash transfer relays shall be Struthers-Dunn 21XBXPL33-120VAC or equal.

8. Each cabinet shall include two (2) Garmin GPS units, Model GPS 17X HVS, Garmin Part # 010-00694-00 or equal. These units are not to be installed in the cabinet.

9. Each cabinet shall include two (2) Cisco Industrial Ethernet Switches model (IE-3000-8TC), and two (2) Cisco power Modules model (PWR-IE3000-AC), and four (4) Cisco model (GLC-LH-SM), or equal. These units are not to be installed by cabinet vendor. See Section 34 41 14 for details.

10. Each cabinet shall include two (2) SC-LC, duplex single mode fiber optic patch cords, 2 meters in length.

11. Each cabinet shall include one (1) Belkin A3L791-08-GRN CAT5e Patch Cable RJ45M / RJ45M; 8’ Green or equal.

12. For each ten (10) Cabinets purchased or fraction thereof provide the following spare parts: 1 power filter, 1 surge protector, 1 of all types of MOV’s used in the cabinet, 1 of all types of RC networks used in the cabinet, 1 of all types of diodes used in the cabinet, 1 of all types of resistors used in the cabinet, 1 relay used in section 2.13.F.6, and 1 solid state contactor.

H. 120 Volt 12-Conductor Interconnect Cable Components
1. Install a 12 position terminal Block Marathon 1112S or equal, or use 24 Black (GRB6) terminal blocks as per section 2.13.F.18. 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.

<table>
<thead>
<tr>
<th>Color &amp; Terminal Strip Order</th>
<th>FUNCTION</th>
<th>LABEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Offset 1</td>
<td>O1</td>
</tr>
<tr>
<td>Blue w/ black stripe</td>
<td>Offset 2</td>
<td>O2</td>
</tr>
<tr>
<td>Green w/ black stripe</td>
<td>Offset 3</td>
<td>O3</td>
</tr>
<tr>
<td>Black</td>
<td>Cycle 2</td>
<td>C2</td>
</tr>
<tr>
<td>Blue</td>
<td>Cycle 3</td>
<td>C3</td>
</tr>
<tr>
<td>Orange w/ black stripe</td>
<td>Flash</td>
<td>FL</td>
</tr>
<tr>
<td>Red</td>
<td>Split 2</td>
<td>ST2</td>
</tr>
<tr>
<td>Orange w/ black stripe</td>
<td>Split 3</td>
<td>ST3</td>
</tr>
<tr>
<td>White w/ black stripe</td>
<td>Spare</td>
<td>SP1</td>
</tr>
<tr>
<td>Red w/ black stripe</td>
<td>Spare</td>
<td>SP2</td>
</tr>
<tr>
<td>Black w/ white stripe</td>
<td>Spare</td>
<td>SP3</td>
</tr>
<tr>
<td>White</td>
<td>Interconnect Common</td>
<td>COM</td>
</tr>
</tbody>
</table>

I. 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).

J. 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.

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.
2.14 TRAFFIC SIGNAL CABINET – TYPE M-SF TALL
   NOT USED

2.15 TRAFFIC SIGNAL CABINET - TYPE ITS (MODEL 340)
   NOT USED

2.16 TRAFFIC SIGNAL CABINET - TYPE ITS (MODEL 342)
   NOT USED

2.17 TRAFFIC SIGNAL CABINET – TYPE CT-SF
   NOT USED

2.18 TRAFFIC SIGNAL CABINET FOUNDATION – TYPE G, M-SF, ITS, CT-SF
   A. Foundations for Type G cabinets shall be Type G foundation as shown on the Type G foundation detail drawing in the contract plans.
   B. Foundations for Type M-SF cabinets shall be Type M-SF foundation as shown on the M-SF Foundation detail drawing in the contract plans.
   C. Foundations for Type ITS cabinets shall be Type ITS foundation as shown on the ITS Foundation detail drawing in the contract plans.
   D. Foundations for Type CT-SF cabinets shall be Type CT-SF foundation as shown on the CT-SF Foundation detail drawing in the contract plans.

2.19 CABINET ANCHOR FOR EXISTING FOUNDATIONS
   A. General
      1. The Contractor shall install new cabinets onto existing foundations where indicated on the Plans. This shall be done by drilling new anchor bolt holes and installing new anchors to match the location new cabinet bolt holes. Anchors shall be secured via an epoxy or mechanical anchor.
   B. Anchor
      1. Anchors shall be ¾” (No. 6) steel rebar, sized as shown on the plans and as directed in Part 3-Execution. Epoxy anchor material shall be the Power-Bond Epoxy Pump System, by Power Fasteners, Inc (see http://www.powers.com/184-185.pdf and http://www.powers.com/186-191.pdf, Catalog #8401), or equivalent in all features and functions.
      2. Mechanical anchor shall be the Power-Stud by Power Fasteners, Inc. (see http://www.powers.com/manual/24.htm, Catalog #7748) or equivalent in all features and functions.

2.20 TRAFFIC SIGNAL CONTROLLER AND CABINET TRAINING, SUPPORT, AND WARRANTY
   A. The controller/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 firmware and hardware characteristics of the controllers and cabinets provided in this
contract. The vendor shall provide technical assistance with the programming of all controllers provided in this contract.

B. If necessary, the controller/cabinet vendor shall provide field activation assistance by qualified personnel for all controllers supplied in this contract during the warranty period.

C. The controller and 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 controllers 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.

D. Prior to delivery, the controller and/or cabinet assembly shall be tested by the controller and/or cabinet manufacturer or authorized local distributor to ensure proper component integration and operation. All inputs and outputs shall be tested. The controller manufacturer shall provide certification that the controller has met all CALTRANS quality assurance tests. The cabinet manufacturer shall provide certification that the cabinet assembly has met all NEMA quality assurance tests.

E. A bid allowance for software training is included in this contract to pay for software training from a controller manufacturer to be specified by the City at a later date.

2.21 GPS DEVICE WITH GPS RECEIVER FOR RESETTING CLOCK TIME IN TRAFFIC SIGNAL CONTROLLERS

A. General
1. The GPS device with GPS receiver shall have the capability of resetting clock time in 170, 2070, and NEMA traffic signal controllers. This specification sets forth the minimum acceptable design requirements for a GPS device with a GPS receiver.
2. The GPS device and receiver shall be designed to reset the clock time in 170, 2070 and NEMA type traffic signal controllers using the time reference received from Global Positioning Satellites (GPS). It is intended for use in traffic control systems, and shall be of all solid state construction except for the relay output. All components shall be made available to the purchaser for servicing for five years after expiration of the manufacturer’s warranty, or shall be so identified that they may be purchased from industrial electronics suppliers. The GPS unit shall have the ability to operate from both 115VAC and 12VDC power sources.
3. The GPS device with GPS receiver shall be the following or equivalent in all features and functions: Model TR-3, GPS Time Reference by RTC Manufacturing, Inc.
   a.

B. Functional Capabilities
1. The GPS device shall operate from a nominal 115 VAC, 60HZ power source, and shall operate satisfactorily between 95 and 135 VAC. The GPS device shall also operate from a 12VDC, +/- 2VDC. The GPS device shall operate satisfactorily between -30 and +74 degrees C.
2. Timing of the GPS device shall be derived from data received from the GPS receiver when the GPS receiver is locked on to at least three (3) satellites. During a power failure, or when the GPS receiver is locked on to fewer than three (3) satellites, the GPS device shall disable its outputs. Upon resumption of
power, the GPS device shall automatically re-enable its outputs when the GPS receiver has again locked on to at least three (3) satellites.

3. All programming shall be accomplished via rotary switches and jumpers that are an integral part of the GPS device circuit board. GPS devices that require external programmers such as a PDA or PC computer will not be accepted.

4. Provision shall be made for the user to set the hour of the day that the GPS device resets the traffic signal controller time. The user shall select the hour via a rotary switch or other acceptable means. If the hour rotary switch is set incorrectly, the LCD display shall indicate HOUR ERROR.

5. Provision shall be made for the user to select whether the GPS device resets the traffic signal controller time on the hour or on the half-hour. This selection shall be made with a push-on jumper or other acceptable means.

6. Changeover from standard time to daylight savings time or vice versa shall be accomplished automatically. The user shall be able to defeat the daylight savings time feature with a push-on jumper or other acceptable means. The unit shall automatically adjust for the new 2007 DST law.

7. Provision shall be made for the user to select the time zone in which the GPS device will be operating. The user shall select the time zone via a rotary switch or other acceptable means. The GPS device shall be programmable to the following time zones:
   a. AST - Atlantic Standard Time
   b. EST - Eastern Standard Time
   c. CST - Central Standard Time
   d. MST - Mountain Standard Time
   e. PST - Pacific Standard Time
   f. AST - Alaska Standard Time
   g. HST - Hawaii Standard Time

8. If the time zone rotary switch is set incorrectly, the LCD display shall indicate ZONE ERROR.

9. Provision shall be made for the user to select the day or days of the week that the GPS device resets the traffic signal controller time. The user shall select the day or days of the week via a rotary switch or other acceptable means. The day or days of the week shall be selectable as follows:
   a. EDAY - Every day of the week
   b. SUN – Sunday
   c. MON – Monday
   d. TUE – Tuesday
   e. WED – Wednesday
   f. THU – Thursday
   g. FRI – Friday
   h. SAT – Saturday

10. If the day/s rotary switch is set incorrectly, the LCD display shall indicate DAYS ERROR.

C. System Hardware

1. The GPS device shall be equipped with a means for mounting to a suitable back plane. Mounting holes that provide clearance for at least a No. 10 screw will be acceptable.

2. The GPS device shall not exceed 3.7"w x 7.6"h x 1.55"d. A case shall be provided to protect the GPS device from dust. The GPS device shall fasten securely to the case and must be easily removable from the case with the use of simple tools. The case need not be dust proof or rain tight since the GPS device will be installed in a new or existing traffic signal cabinet.

3. Interface to the power source and to the traffic signal controller shall be provided by means of a quick disconnect connector with a 48" mating harness. The AC and DC power inputs shall each be protected with a fuse and MOV. The harness
shall include an AC power cord with a standard 3 prong plug, wires for the relay output and wires for the optional RS-232 serial output.

4. The GPS receiver shall not exceed 1.2”h x 3.5”w when mounted on the top or side of a traffic signal cabinet. The GPS receiver shall connect to the GPS device inside the traffic signal cabinet using a 48” wiring harness.

5. Integral with the GPS device shall be an easy to read 16 character alphanumeric liquid crystal display (LCD). When the GPS receiver is locked on to at least three (3) satellites, this display shall provide a clear indication of the day-of-week and the time-of-day. When the GPS receiver is not locked on to at least three (3) satellites, the display shall indicate “acquiring sats.”

6. Provision shall be made to allow the user to review the setup of the GPS device. The user shall review the GPS device program by pressing a push-button located on the front of the GPS device. By pressing this button, the user shall view 1) the day or days of the week and the time of day that the GPS device is programmed to reset the traffic signal controller time, 2) the time zone selected and 3) whether the GPS device is programmed to adjust for daylight savings time. This program review shall not affect the current operation of the GPS device.

7. The GPS device shall have a single-pole, double-throw relay output with a contact rating of at least 15 amps at 120 VAC resistive load. The common and normally open contacts of this relay shall be used with traffic signal controllers that can reset their clock when logic ground is applied to a selected pin in the “D” (or other) connector.

8. The GPS device shall have an optional RS-232 serial output. This serial output shall be used with traffic signal controllers that reset their clock using a data string through its RS-232 input.

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
b. 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.

c. 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.
   d. The sensor shall sample the radar pulse and reflected energy at a user selectable rate of 1 to 2 Hz.
   e. The sensor shall communicate time-stamped ON and OFF vehicle detection events.
   f. Each sensor shall automatically recalibrate in the event of a detector lock.
   
   g. 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.

h. 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.

i. Each magnetometer sensor in an installation shall be capable of being individually configured with its own sensitivity level.

ii. 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.

iii. 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.

iv. 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.

j. Each radar sensor in an installation shall be capable of being individually configured with its own range level.
k. 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.

l. At least 2 User selectable ranges within the above defined detection area shall be available

m. 4 foot radius

n. 6 foot radius

o. 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.

p. Each sensor, AP, APCC, SPP and RP shall be capable of accepting software and firmware upgrades.

q. 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
Bayview Gateway and Tulare Parks

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)

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.

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

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.

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

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**
  - Pre-installed on buses.

- **Receiver**
  - Install on poles at the intersections.

- **Optical Signal Processor (OSP)**
  - Connect to traffic controller and install in cabinet.

- **Traffic Controller**
  - 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 reliably 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 communicate 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:

<table>
<thead>
<tr>
<th>Qty./Intersection</th>
<th>Equipment Description</th>
</tr>
</thead>
</table>

2/12/2014
34 41 13 - 39
Traffic Signals
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 BATTERY BACKUP SYSTEM (BBS) WITH CABINETS

A. BBS Units
1. The Battery Backup System (BBS) shall comply with Caltrans BBS specifications dated July 2004 with the following revisions and exceptions:

<table>
<thead>
<tr>
<th>Caltrans BBS Reference</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1.1</td>
<td>The BBS shall provide a minimum of 2 hours of full-run time operation and an additional 2 hours of Red Flash only</td>
</tr>
<tr>
<td>Section 2.1.2</td>
<td>The Power Transfer Relay and Manual Bypass switch shall be mounted in a separate cabinet (See Section 34 41 14). This cabinet shall also house the inverter and batteries</td>
</tr>
<tr>
<td>Section 2.2</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Section 2.3</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Section 4.1</td>
<td>Individual batteries shall be 12V, 80 amp-hour minimum, and shall be easily replaced and commercially available off the shelf</td>
</tr>
<tr>
<td>Figure 1</td>
<td>Model 332 Cabinet shall be replaced with Model M-SF cabinet.</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
2. In addition to the Caltrans specification, the unit shall meet the following specifications:
   a. The unit shall have a RS232 serial interface for communications and shall include a shielded serial cable used to connect it to the serial interface in the M-SF cabinet.
   b. The inverter unit shall be capable of switching from full 3-color operation to FLASH mode after a preset time or a battery percentage remaining to be programmed by SFMTA.
   c. The inverter, power transfer switch, manual bypass switch, and batteries shall be housed in a separate cabinet as described below.
   d. The manufacturer shall provide training in the form of two 4 hour sessions to be scheduled on different days at SFMTA Signal Shop located at 901 Rankin Street, San Francisco.
   e. For units that require a minimum of 875W/1250VA output, the unit shall be Myers Powerback 1250, or Myers Powerback 2000, or equivalent.
   f. For units that require a minimum of 1500W/2000VA output, the unit shall be Myers Powerback 2000 or equivalent.
   g. BBS Locations and Wattage Requirements

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Minimum Wattage</th>
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h. BBS Cabinet
   i. The BBS cabinet shall be a NEMA 3R rated cabinet and meet Caltrans Type III Service Equipment Enclosures (2010 CTSP ES-2C). A hardcopy of the cabinet and wiring diagram shall be provided with each controller and cabinet assembly. All cabinets shall be equipped with a 13" X 10" plastic envelope, opened at one end.
   ii. The cabinet shall be designed to mount on the BBS concrete controller foundation. The BBS cabinet shall meet the following additional requirements:
       1. Enclosure
          a. External: Height 57", Width 12", Base Depth 11.75".
          b. The cabinet shall be weatherproof
          c. The cabinet shall have a door opening to the entire cabinet.
          d. Base flange: front and back 3", sides .25"
          e. Four Anchor bolt holes in base flange: diameter 3/4", pattern 2 @ 5.25" center-to-center (front & back) and 2 @ 8" center-to-center (sides) to match BBS foundation anchor bolt pattern. See BBS foundation detail.
          f. Material shall be 0.125" aluminum.
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2. Door
   a. The cabinet door shall be on the front and provide an opening for the entire cabinet.
   b. The door shall be equipped with a three point latching mechanism with nylon rollers at the top and bottom.
   c. The door shall be made of 0.125" aluminum.
   d. The door handle shall be stainless steel and shall have provisions for padlocking.
   e. The main door lock shall be a Corbin #1548-1 or equal (single locking mechanism with Corbin #2 key).
   f. The main door shall be sealed with a closed-cell neoprene gasket.
   g. The main door shall have a heavy duty gauge continuous hinge with a 1/4" diameter stainless steel hinge pin. The hinge pin shall be secured with 1/4-20 stainless steel carriage bolts and stainless steel lock nuts.
   h. Door opening stops at 90 and 180 degrees.
   i. All door hardware to be stainless steel.
   j. Door shall have a louvered air vent, filter retainer bracket, and air filter

3. Finish
   a. The exterior shall be painted in Dark Olive Green color (Caltrans Color Chip No. 68).
   b. The finish coat shall be baked alkali enamel.
   c. Finish paint for the interior shall be white enamel.
   d. All surfaces, burrs, and welds to be cleaned and smoothed before painting.
e. The exterior of the cabinets shall be painted to a dry film with minimum thickness of 1.00 mils over the prime coating.

2.24 RED LIGHT CAMERA

A. For service and phase wiring, the Contractor is permitted to use Anixter 2AS-1401TOS cable (with 3 #14 wires) or equal. For the detector lead-in cable (DLC) the Contractor is permitted to use Belden 8718 cable (with 2 #12 wires) or equal. For the auxiliary flash, two separate cables shall be used. The first shall be a Belden 8720 cable (with 2 #14 wires) or equal for the auxiliary flash power recharge. The second shall be a Belden 8720 cable (with 2 #14 wires) or equal for the auxiliary flash trigger system.

B. New red light camera wires shall be color-coded and labeled in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Grounded and Common</th>
<th>CONDUCTORS</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Black with a Pink stripe</td>
<td></td>
</tr>
<tr>
<td>Detector lead-in</td>
<td>Gray with a Blue stripe</td>
<td></td>
</tr>
<tr>
<td>Phase cable</td>
<td>Black with an Orange stripe</td>
<td></td>
</tr>
<tr>
<td>Auxiliary flash (power recharge)</td>
<td>Gray with a Purple stripe</td>
<td></td>
</tr>
<tr>
<td>Auxiliary flash (trigger system)</td>
<td>Gray with a Yellow stripe</td>
<td></td>
</tr>
</tbody>
</table>

SFMTA also requires that all conductors be labeled in accordance with the following schedule and guidelines:

<table>
<thead>
<tr>
<th>CONDUCTORS</th>
<th>LABELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Camera Service</td>
</tr>
<tr>
<td>Detector lead-in Cable</td>
<td>Camera--Phase--Lane Numbers</td>
</tr>
<tr>
<td>Phase cable</td>
<td>Camera Phasing</td>
</tr>
<tr>
<td>Auxiliary Flash</td>
<td>Flash Phasing</td>
</tr>
</tbody>
</table>

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. The Contractor shall label the DLC with the corresponding lane number and phase number for which the loop is associated. Lane numbers begin with the inside lane (nearest the centerline on two-way streets or the far left hand side of the roadway for one way streets) and the number 1.

D. 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 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.

5. All poles shall be painted “Embarcadero Blue” to match existing signal standards along The Embarcadero and King Street corridor for the following blocks:
   a. The Embarcadero between Jefferson Street and Townsend Street
   b. King Street between Townsend Street and 5th Street
   c. Beach Street between The Embarcadero and Jones Street
   d. Jefferson Street between The Embarcadero and Jones Street
   e. Jones Street between Beach Street and Jefferson Street

   The color is available from the Tnemec Company. Contractor shall submit paint sample to the Engineer for approval prior to applying paint or, if factory-painted, ordering the pole.

6. All poles along Ocean Avenue between Junipero Serra Boulevard and I-280 that are furnished and installed by the Contractor shall be factory painted “Dark Blue-Green” to match existing signal standards on that route. The “Dark Blue-Green” color (G1549) is available from the Tnemec Company and shall have a semi-gloss finish with a coat schedule as follows:
   a. Coat 1: Tnemec Series V69 Epoxoline or equal (at 3.0 to 4.0 mils dry film thickness)
   b. Coat 2: Tnemec Series 750 Endura-Shield or equal (at 2.0 to 3.0 mils dry film thickness)
   c. Coat 3: Tnemec Series 750 Endura-Shield or equal (at 2.0 to 3.0 mils dry film thickness)

   Contractor shall submit a paint sample to the Engineer for approval prior to ordering of factory-painted poles or application of touch-up paint to existing poles on Ocean Avenue.

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 ACCESSIBLE PEDESTRIAN SIGNALS INSTALLATION

   A. Install as per manufacturer’s instructions.

3.2 GPS DEVICE WITH GPS RECEIVER FOR RESETTING CLOCK TIME IN TRAFFIC SIGNAL CONTROLLERS

   A. Warranty
   1. Each GPS device and GPS receiver shall be warranted to be free from defects in material and workmanship for a period of three (3) years from the date of shipment from the factory.
   2. Any warranty service required shall be promptly performed at the manufacturer’s facility or the manufacturer’s authorized service agency. The purchaser will pay transportation costs to such service point, and the manufacturer will pay those costs to return the unit by normal surface transportation means.
3. Service information shall be available to the purchaser consisting of at least schematics, parts locators and parts lists.

B. Test and Acceptance
1. The apparent low bidder shall be required to supply a working sample of the GPS device and the GPS receiver for performance testing (at no cost or obligation to the City) prior to award. This shall be done within 10 working days of being notified of potential award. This sample unit, if accepted, shall be considered part of the total quantity of this purchase order. Failure to do so will render the bid nonresponsive.

2. Section 3.14A1 will not be required if, prior to the bid opening, the bidder has demonstrated that the GPS device and the GPS receiver bid meets these specifications.

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. Program all SET POINT in the optical signal processor using a transmitter equipped Muni diesel bus.
      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
3.4 TRAFFIC SIGNAL CONTROLLERS AND CABINET ASSEMBLIES

A. The Contractor shall deliver all traffic signal controllers units and related components within the time allowance provided in Appendix B, Table 1. Related components shall be considered as all components that do not require tools to remove or install. For example, the MMU, load switches, BIUs, and loop amplifiers do not require tools. City forces will program the controllers and conduct field activations.

B. The controller units and related components shall be boxed and delivered to the SFMTA Traffic Signal Shop at 901 Rankin Street, San Francisco, CA 94124. All components for each contract shall be delivered in a single shipment. Partial shipments shall not be accepted. Each box shall be numbered and tagged to identify the project name and Contractor. A complete inventory listing all boxes and their individual contents shall be provided upon delivery to facilitate inspection by SFMTA Traffic Signal Shop staff. See Shipping Requirements for Traffic Signal Cabinets additional requirements.

C. Shipping Requirements for Traffic Signal Cabinets
Traffic Signal Cabinets shall be shipped on pallets and properly secured to prevent cabinet movement during shipment. Pallet specifications and mounting details are listed below for each cabinet type.

1. Pallet Specifications for Type G, M-SF, and ITS Model 342 Cabinets
   Pallet Size: 40” wide x 29” deep
   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)
   Riser Construction: 3 each 2” x 4” x 29” S4S (surfaced 4 sides) board on edge (1 at left & right edge and 1 centered)
   Base Construction: 3 each 1” x 4” x 40” S4S slat flat (1 at front & rear edge and 1 centered) Attached using 2 each 6D pallet nails per slat and per riser (18 each)
   Cabinet 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 and center cabinet on pallet including door handles)

2. Pallet Specifications for Type ITS Model 340 Cabinets
   Pallet Size: 50” wide x 40” deep
   Top Construction: 1 each 7 ply (minimum) ¾” D-D Structural Plywood (type used in concrete forming) Attached using 9 each 6D pallet nails per riser (27 each)
   Riser Construction: 3 each 4” x 4” x 40” S4S board (1 at left & right edge and 1 centered)
   Base Construction: 3 each 1” x 4” x 50” S4S slat flat (1 at front & rear edge and 1 centered) Attached using 2 each 6D pallet nails per slat and per riser (18 each)
   Cabinet 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 and center cabinet on pallet including door handles)

For questions, the Contractor shall contact one of the SFMTA Traffic Signal Shop supervisors at (415) 550-2736 between 8:00 A.M. AND 2:00 P.M.on weekdays.

D. 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. 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 boxes as directed by the SFMTA Traffic Signal Shop supervisor.

E. Prior to delivery, each controller and cabinet assembly shall be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation. The vendor shall provide certification that the cabinet and controller assembly has met all applicable Caltrans quality assurance tests. Approval certificates for each controller and cabinet assembly shall be delivered at the time the controller units and related components are delivered.

F. The City reserves the right to reject an entire shipment of controller/cabinet assemblies if ten percent or more of the total number (sample included) prove to be defective within a thirty (30) day period after installation, or fail any performance test.

G. The Contractor shall install each cabinet directly to a controller foundation in the field. The Contractor shall perform the final signal wire terminations by connecting the field wires to the appropriate terminal locations in the controller cabinet as required preparatory work prior to activation. All field wires shall be labeled per this Section as part of the preparatory work.

H. Installing New Anchor Bolts into Existing Foundations

The Contractor shall drill new holes for anchor bolts and install anchor bolts with approved materials (see Part 2 for approved bolt and anchor material). The bolts should extend above the concrete by 1.5” (2” max). The depth below the surface of the concrete should be 10-10.5” for epoxy or 6.5 to 7” for the mechanical anchor.

3.5 CABINET EQUIPMENT INSTALLATION

The Contractor shall install interior cabinet equipment (e.g. MMU and BIU in existing cabinets) per the Plans, and as further directed by the Engineer. The equipment shall be securely fastened to a shelf, wall or rail, i.e. it shall not be left free-standing unless otherwise noted or directed by the Engineer. The Contractor shall provide training on the setup, configuration, and operation of all equipment.

3.6 BATTERY BACKUP SYSTEM INSTALLATION

A. Install Battery Backup System foundation, cabinet, and equipment as directed by Engineer.

3.7 RED LIGHT CAMERA INSTALLATION

A. Install as per manufacturer’s instructions and 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 pick up 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 901 Rankin Street. 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 901 Rankin Street. 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 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, (Fax# 415-550-2930). 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 be written and shall also include a 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.

3.10 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 prosecution 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 3/8" stainless steel BAND-IT (or equal) straps and buckles. 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 1999 Bryant Street, telephone 415-554-9785, 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.

3.11 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:

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DEDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Signal Head</td>
<td>$200 per section</td>
</tr>
<tr>
<td>Programmed Visibility Signal Head</td>
<td>$500 per section</td>
</tr>
<tr>
<td>Pedestrian Signal Face</td>
<td>$150 each</td>
</tr>
<tr>
<td>Traffic Signal Mounting Assembly</td>
<td>$100 each</td>
</tr>
<tr>
<td>Red, Yellow, or Green Vehicular LED module</td>
<td>$100 each</td>
</tr>
<tr>
<td>Pedestrian LED module</td>
<td>$100 each</td>
</tr>
<tr>
<td>Traffic Signal Standard</td>
<td>$350 each</td>
</tr>
<tr>
<td>Traffic Signal Controller and Cabinet</td>
<td>$3,000 each</td>
</tr>
<tr>
<td>Lighting Standard</td>
<td>$400 each</td>
</tr>
<tr>
<td>Metal Lids from Cast-In-Place Pull Boxes</td>
<td>$200 each</td>
</tr>
</tbody>
</table>

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.

3.12 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 901 Rankin Street, San Francisco.

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) 554-9785
   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 901 Rankin. 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”.

3.13 SERVICE CONNECTION

A. The Contractor shall coordinate with PG&E through Resident Engineer to provide all new service connections. The Contractor is advised that a minimum of 6 weeks notice may be required for PG&E to provide this service. The Contractor shall complete the foundation work and secure service connection dates in a timely manner. Service connection shall be completed no later than 72 hours in advance of the scheduled signal switchover or turn-on; otherwise, the switchover or turn-on will be canceled.

B. The Contractor shall provide temporary service protection at the controller foundation prior to switchover or turn-on.

END OF SECTION
APPENDIX “A” TO SECTION 34 41 13
SIGN INVENTORY FORM
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

<table>
<thead>
<tr>
<th>Product Data and Shop Drawings</th>
<th>Calendar Days</th>
<th>Time Requirement Restrictions on Submittal Task</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>Maximum number of days after notice to proceed that product data and shop drawings can be submitted by Contractor</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Maximum number of days City has to review product data and shop drawings</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Maximum number of days Contractor has to resubmit product data and shop drawings, if necessary</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Maximum number of days City has to review resubmittals, if necessary</td>
</tr>
<tr>
<td>Samples</td>
<td>30</td>
<td>Maximum number of days City has to inspect and test samples after paper submittals have been approved by the City</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Maximum number of days Contractor has to resubmit samples, if necessary</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Maximum number of days City has to inspect and test new resubmitted samples, if necessary</td>
</tr>
<tr>
<td>Additional Requirements for Traffic Signal Controllers and Cabinets</td>
<td>7</td>
<td>Maximum number of days after approval of controller and cabinet samples that Contractor shall submit copies of purchase orders to the Signal Shop</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>Minimum number of days before the scheduled turn-on that Contractor must deliver the controllers to the Signal Shop</td>
</tr>
</tbody>
</table>

Notes:
1. The above time allowances shall not be changed due to unrelated contract time extensions.