



## **SPECIFICATION**

### **UPGRADE ENTRY, ROAD, PARKING AND LIGHTING**

#### **PHASE 1**

MENLO PARK DIVISION (MPD)  
795 WILLOW ROAD  
MENLO PARK, CA

PROJECT NUMBER: 2101  
VA PROJECT NUMBER: 640AO-12-204FCA

**100% CONSTRUCTION DOCUMENT**

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DEPARTMENT OF VETERANS AFFAIRS  
 MPD Upgrade Entry, Roads, Parking  
 And Lighting.  
 795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

**DEPARTMENT OF VETERANS AFFAIRS  
 VHA MASTER SPECIFICATIONS**

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## **DEPARTMENT OF VETERANS AFFAIRS PALO ALTO HEALTH CARE SYSTEM**

The guidelines published in this issue are for the use and convenience of construction and maintenance contractors, vendors and others performing contract work at all Divisions of the VA Palo Alto Health Care System.

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- A. **CONTRACT WORK HOURS.** Normal available core work hours for the contract are from 7:00a.m. To 4:30 p.m. Monday through Friday, unless noted otherwise. Work may also being performed based upon project requirements (off normal working hour & weekend), excluding national holidays. The (10) holidays observed by the Federal Government are:

New Years Day	Presidents Day
Martin Luther King's Birthday	Memorial Day
Independence Day	Labor Day
Columbus Day	Veterans Day
Thanksgiving Day	Christmas Day

.Contractors may request, in writing, approval to work other hours or weekends. Except for emergencies, the contract person should receive such requests two weeks before the scheduled work. When possible, Contractors will submit emergency requests at least two days before the scheduled work.

- B. **UTILITIES.** No utility service such as water, gas, medical air and gas, steam, sewer, electric, fire protection or communication shall be interrupted without prior approval of the COTR. This includes those interruptions required by the contract. Construction contracts include provisions for maintaining utility systems or providing temporary facilities. Written requests for utility shutdowns shall be completed by the contractor and submitted to the COTR at least two weeks before the scheduled work. Lock-out / tag-out (LOTO) must be follow Health Care System Memorandum No. 138-09-28, on any disruption or shut-down of any energy source. Any EMERGENCY REQUIRING AN IMMEDIATE SHUTDOWN WILL BE REPORTED IMMEDIATELY to the COTR. The COTR will in turn immediately notify the Engineering Office and the appropriate Chief, Maintenance and Repair or site designee. The Contractor will prepare and forward to the Chief, Engineering Service, a written report of the situation, why it happened, a schedule of any further corrective work needed, and what, if any steps are being taken to prevent a recurrence. The request for utility shutdown is found in **Attachment A, A1, A2, and A3**

- C. **PROTECTIVE CLOTHING/EQUIPMENT.** All workers will wear and/or use protective clothing and gear when required. This includes hard hats, goggles, protective shoes, gloves, masks or breathing apparatus, etc. The Contractor shall provide any protective equipment that may be required.
- D. **SECURED WORKSITES** Contractor will be responsible to secure their worksite and provide construction safety and/or infection control barriers, including but not limited to temporary fencing, trench covers, etc. wherever work could cause injury to workers, visitors, VA personnel, or dependents. The Contractor shall conform to the rules and regulations as set forth by OSHA Safety and Health Standards, 29 CFR Part 1926 - Safety and Health Regulations for Construction and Title 8, California Administrative Code - Construction Standards. When the standards differ, the more restrictive standard shall apply. Construction site signage is required. Construction sites outside of existing structures shall be enclosed by 6 feet tall metal fencing. Examples of such fencing is found on **Attachment B**

- E. **TELEPHONES.** Contractors will provide their own telephones. Government telephones will not be used for private business or personal calls. Contractors or their workers may use the Government telephones to call/page the contact person, the Engineering Service office, or when authorized by the contact person - to call their office concerning contract matters. Telephone calls for contract workers will not be accepted by the Health Care System.
- F. **ELEVATORS/CORRIDORS.** Contractors and workers may use corridors and elevators for travel to and from the job sites when in proper attire (shirt and shoes required) provided they don't track mud, wet cement or any form of "dirt" into the buildings. The COTR will assign specific routes, times and elevators to use for transportation of materials and equipment. The Contractor will clean-up any mess caused by their workmen. Elevators will not be used during an emergency.
- G. **TOILETS.** The Contractor is to provide their own toilet facilities, however, the COTR will advise the Contractor which toilet facilities (if available) may be used by the Contractor's workmen. The Contractor will ensure that the facilities are kept clean and will be responsible for any damage done by the Contractor's workers.
- H. **PARKING/TRAFFIC.** Specific parking areas may be assigned for workers on larger construction projects. Workers on smaller construction or maintenance contracts may use any parking space that is not reserved if no parking area is designated. Contractors, including maintenance contractors and workers are specifically prohibited from parking in those spaces reserved for Engineering Vehicles or lawn areas. Further, the Contractor is not to "back in" the space.
- I. **DELIVERIES.** The contact person will assign routes for the delivery of materials and supplies to the job site. The Contractor or construction traffic will not block any Health Care System road or street, walk or building egress without requesting approval in a timely manner.
- J. **LOADING/UNLOADING.** Building loading docks and landings may be used to load or unload construction materials when approved by the contact person. However, any vehicle left unattended for more than a few minutes may be cited by the VA Police. Some areas may be reserved for Health Care System operations only during certain hours.
- K. **VA POLICE.** The VA Police are Federal Police Officers with full authority to make arrests, investigate crime, and to issue citations. Citations issued for driving, parking violations or other offenses may require an appearance in the Federal District Court and/or payment of a fine. FOR THE SAFETY OF PATIENTS, speed limits and other driving and parking codes are strictly enforced. The speed limit on VA roads is 15 MPH under ideal conditions. In parking lots, the speed limit is 5 MPH.
- L. **LOCKED AREAS.** The Contractor is to coordinate access to locked areas with the contact person, including obtaining keys required for access to work sites. All buildings at the Health Care System are locked during other than normal work hours. When the Contractor has approval to work other than normal work hours, he will need to make arrangements for his workers to have access to job sites.
- M. **OPERATIONS AND STORAGE AREAS** will be confined to areas designated by the contract or approved in writing by the contact person or the Contacting Officer. The Government will not be responsible for any tools, equipment or



materials left or stored on Government facilities, unless exceptions are provided in the contract.

- N. **CONSTRUCTION WASTE AND DEBRIS** is the property of the contractor and will not be disposed of on station or in Health Care System trash containers or dumpsters. The Contractor may provide his own bin or dumpster, however, the use and location of such must be approved in writing by the contract person. Construction waste and debris will not be accumulated in corridors or other building areas where it might cause a fire or safety hazard. Debris will be covered when taken from work sites to dump area. This is critical when carried through patient care areas.
- O. **RECREATIONAL FACILITIES** such as swimming pools, gym, tennis courts, etc. are not to be used by Contractors or Contractor's workers.
- P. **DISPOSAL OF HAZARDOUS MATERIALS.** Several buildings at the VAPAHCS contain asbestos containing materials (ACM). Some typical types of materials found to contain ACMs are pipe insulation, transit wall panels, floor tile, linoleum backing, floor/roof mastics and others. Contractors are required to communicate this information to all of their employees and subcontractors that will be working at any of the VAPAHCS sites, and failure to do so could result in OSHA citation(s). **Contractors are also required to alert the VAPAHCS immediately in the event any known or suspected ACM is accidentally disturbed or will need to be disturbed before proceeding with work.** If not indicated in the contract drawings, known locations of ACMs can be determined from the current VAPAHCS asbestos survey. Disposal of any hazardous or potentially hazardous materials in sanitary or storm sewer systems or on Health Care System grounds is strictly prohibited. Hazardous materials, such as asbestos materials, used cleaning solutions and other harmful chemicals shall be disposed of in accordance with State and/or local laws and regulations. In case of an accidental spill of hazardous materials, the contractor is expected to take immediate action to contain the spill and at the same time notify the C.O.T.R./Contracting Officer of the spill. Action should be taken to mitigate the situation until you receive direction from the VAPAHCS Quality Management personnel.
- Q. **WASH DOWN.** Washing leftover cement, plaster, paint, oil or grease, solvents, etc. into any drains and the washing down of cement trucks or other delivery vehicles is strictly prohibited. **REPORT ANY ACIDENTAL SPILLS THAT MAY RUN INTO STORM DRAINS IMMEDIATELY TO THE ENGINEERING SERVICE AT EXTENSION 62468.** Even accidental spills, particularly those not immediately controlled or contained, may result in legal action by local or state authorities against the responsible parties.
- R. **REMOVAL OF GOVERNMENT PROPERTY**, including empty boxes, crates, wood, etc. is prohibited, except approved by the Chief, Supply Service. Contractors or vendors taking Government equipment off station for repairs will notify the contact person of such action. In most cases, a receipt will be required.
- S. **SEXUAL HARASSMENT** is strictly prohibited. This includes deliberate or unsolicited verbal comments or gestures of a sexual nature, unwelcome sexual advances, requests for sexual favors and/or other unwelcome verbal or physical conduct of a sexual nature.

- T. **DRUGS AND ALCOHOL.** Possession or use of non-prescription drugs or alcohol, including beer and wine, on the Health Care System grounds is strictly prohibited. Used appropriately, over the counter medications such as Tylenol or Aspirin would be okay.
- U. **CONTRABAND.** Contraband is any item prohibited by Federal Law on VA grounds. These items also include any item or material that a person might use in a threatening manner. Examples include, but are not limited to:
- Firearms, BB guns, CO2 guns, pellet guns, slings, slingshots, blowguns, and starter pistols.
  - Knives with overall blade length in excess of 3.0 inches, including, but not limited to lock blades, pocket knives, cane swords, and machetes.
  - Explosive materials/Flammables: fireworks, gunpowder, ammunition, butane, propane, and lighter fluid.
  - Other weapons: mace, taser, martial arts equipment, tear agent, and Spears.
  - Illegal/Illicit substances: alcohol, drugs, and drug paraphernalia.
- V. **SMOKING POLICY.** Smoking is prohibited in all Health Care System Buildings particularly in corridors, elevators, offices and patient areas, except in designated areas. Smoking is generally not permitted within 35 feet of an entrance to a VA health care building or office building that is routinely used by patients, residents, employees or staff.
- W. **LOST AND FOUND.** Any article or money found on the premises should be delivered immediately to the contact person or Volunteer Services for safekeeping. Anyone losing an article or money should contact the Volunteer Service Lost and Found Department to determine if it has been turned in.
- X. **SMOKE/FIRE BARRIER PENETRATIONS.** Any penetrations to smoke or fire barrier walls, ceiling or floor slabs shall be properly sealed immediately. We recommend Hilti Fire Stop 601 or 635 for walls and ceilings and Hilti Fire Stop 657 for floor penetrations.
- Y. **WELDING AND/OR BURNING:** Any person planning welding or other such burning operations will in advance, obtain a 24 hour burning permit from the Safety Office, extension 65894. Welding and/or burning operations are allowed only during normal working hours. Sample of the burn permit is found on **Attachment C**
- Z. **LOW VOLTAGE CABLE INSTALLATION:** The contractor shall install low voltage cable in raceways trays whenever practical, only after scheduling the work with the contact person. Whenever feasible, low voltage cables to be in the ceiling will be installed before the ceiling tile is installed.
- AA. **OCCUPATIONAL HEALTH AND SAFETY:** Contractors and their employees are expected to comply with and are subject to applicable OSHA and CAL-OSHA regulations as at any construction site. Contractor's On-site Superintendent shall conduct daily construction site safety reviews using **Attachment D**
- BB. **INJURY ACCIDENTS:** The Health Care System does not have the equipment, facilities, or personnel trained to handle serious injuries. Call 911 for emergency medical assistance and notify the VA Police at extension 65500 at Palo Alto.
- CC. **DAMAGE TO GOVERNMENT PROPERTY** caused by the Contractor or his workmen, whether accidental or incidental to the work, shall be corrected

immediately at the Contractor's expense. This includes damage to lawns, shrubbery, irrigation systems, curbs, etc. Caused by construction vehicles/traffic and other operations.

- DD. **DUST AND FUME CONTROL** will be exercised on all construction operations. Workers will be careful not to operate any vehicles, gas or diesel engines, or to perform any fume or dust generating process near a building intake system. Appropriate dust barriers will be utilized to mitigate dust entering into patient areas and/or the HVAC System. Barriers will be approved by Infection Control prior to work commencing. If Safety requires a more stringent barrier, the more stringent barrier will apply with Infection Control requirements are also satisfied.
- EE. **NOISE** will be held to a minimum at all times. Jack-hammering, core drilling and other noisy or disturbing operations may have to be rescheduled to avoid interfering with surgery or other programs. OSHA standards related to decibels are a requirement in any event.
- FF. **ROADS & WALKS.** Any debris dropped along egress from the station will be cleaned up immediately. Mud and dirt on roads and walks will be cleaned up as soon as the construction operation is complete or at the end of each day.
- GG. **FIRE SAFETY PRECAUTIONS.** Contractors are expected to comply with all fire safety precautions. In the event of a fire or during regular fire drill, the contractor must vacate the construction site within the zone affected.

--- E N D ---

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for The Entry Road Project as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of Polytech Associates, as Architect - Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by COR or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COR.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant

competency training, as determined by RE/COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.

2. Submit training records of all such employees for approval before the start of work.

H. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section

#### **1.2 STATEMENT OF BID ITEM(S)**

- A. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, roads, walks, grading, drainage, mechanical and electrical work, utility systems, and includes the necessary removal of existing structures and construction and certain other items.

#### **1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. AFTER AWARD OF CONTRACT, (3) three sets of specifications and drawings will be furnished. These drawings and specifications will consist of those returned by prospective bidders.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from CD Rom furnished by Issuing Office.

#### **1.4 CONSTRUCTION SECURITY REQUIREMENTS**

- A. Security Plan:
  1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
  2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the COR so that security and escort arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the COR.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the COR.

C. Guards:

1. The General Contractor shall provide unarmed guards at the project site 24 hours a days, 7 days a week after construction hours.
2. The guard shall have communication devices to report events as directed by VA police.
3. The general Contractor shall install equipment for recording guard rounds to ensure systematic checking of the premises.

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.



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E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
4. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the COR upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of COR.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify COR and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

#### **1.5 FIRE SAFETY**

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-2009.....Surface Burning Characteristics of Building  
Materials

2. National Fire Protection Association (NFPA):

10-2010.....Standard for Portable Fire Extinguishers

30-2008.....Flammable and Combustible Liquids Code

51B-2009.....Standard for Fire Prevention During Welding,  
Cutting and Other Hot Work

70-2011.....National Electrical Code

241-2009.....Standard for Safeguarding Construction,  
Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Resident Project Engineer and Facility Safety Manager Officer for review for compliance with contract

requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Resident Project Engineer and facility Safety Manager Officer.
- F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Resident Project Engineer and facility Safety Manager Officer.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Resident Project Engineer. Obtain permits from facility Safety Manager Officer at least \_\_\_\_ hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

- J. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Resident Project Engineer and facility Safety Manager Officer.
- K. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- L. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- M. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- N. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

#### **1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the COR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the COR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the COR, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the COR, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the COR. When materials are

transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as shown on the drawings, and as determined by the COR.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the Utility Company involved:

1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- H. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR and Contractor, as follows:
- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the

Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center . Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
  5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

- L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
  - 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
  - 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- M. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

#### **1.8 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Resident Project Engineer and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to



determine impact of construction activities on indoor air quality. In addition:

1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.

C. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

## 1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of Site Work, or parts thereof, shall be disposed of as follows:

1. PCB Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

(TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the COR who will annotate the contract file and transmit the Manifest to the Medical Center's Cemetery's Chief.

a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:

40 CFR 261.....Identification and Listing of Hazardous Waste

40 CFR 262.....Standards Applicable to Generators of Hazardous  
Waste

40 CFR 263.....Standards Applicable to Transporters of  
Hazardous Waste

40 CFR 761.....PCB Manufacturing, Processing, Distribution in  
Commerce, and use Prohibitions

49 CFR 172.....Hazardous Material tables and Hazardous Material  
Communications Regulations

49 CFR 173.....Shippers - General Requirements for Shipments  
and Packaging

49 CFR 173.....Subpart A General

49 CFR 173.....Subpart B Preparation of Hazardous Material for  
Transportation

49 CFR 173.....Subpart J Other Regulated Material; Definitions  
and Preparation

TSCA.....Compliance Program Policy Nos. 6-PCB-6 and  
6-PCB-7

**1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the COR.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the COR may have the necessary work performed and charge the cost to the Contractor.

**(FAR 52.236-9)**

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical

center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

#### **1.11 RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired,

reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.12 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

#### **(FAR 52.236-4)**

- B. A copy of the soil report will be made available for inspection by bidders upon request to the COR at the VA Medical Center, and shall be considered part of the contract documents.
- C. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

#### **1.13 PROFESSIONAL SURVEYING SERVICES**

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

#### **1.14 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the COR. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the COR until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the COR may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

**(FAR 52.236-17)**

- B. Establish and plainly mark center for lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such Site Work, roads, parking lots, are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey

shall include, but not be limited to, location of lines and grades of curb, major utilities and elevations of all site work.

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as curbs, utilities and other major controlling features) is placed.

D. During progress of work, and particularly as work progresses, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of road way, site work.
2. Elevations of bottoms of curbs, road way, and related site work.
3. Lines and elevations of sewers and of all outside distribution systems.
4. Lines of grave plot documentation.
5. Lines of elevations of all swales and interment areas.
6. Lines and elevations of roads, streets and parking lots.

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.

F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.15 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **1.16 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.

#### **1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
  - 1. Permission to use each unit or system must be given by COR. If the equipment is not installed and maintained in accordance with the



- following provisions, the COR will withdraw permission for use of the equipment.
2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  4. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feed water heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

#### **1.21 TEMPORARY TOILETS**

- A. Provide where directed by COR, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies, and

all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

#### **1.22 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the COR, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Contractor shall install meters at Contractor's expense and furnish the COR a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the VA Menlo Park Campus electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR's discretion) of use of water from Medical Center's system.

#### **1.24 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the COR. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

#### **1.25 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be

complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

#### **1.27 RELOCATED EQUIPMENT ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as water, drain, and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

#### **1.29 CONSTRUCTION SIGN**

- A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the COR.

- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

### **1.30 SAFETY SIGN**

- A. Provide a Safety Sign where directed by COR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COR.
- D. Standard Detail Drawing Number SD10000-02(Found on VA TIL) of safety sign showing required legend and other characteristics of sign is shown on the drawings.
- E. Post the number of accident free days on a daily basis.

### **1.31 PHOTOGRAPHIC DOCUMENTATION**

- A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The commercial photographer or the subcontractor used for this work shall meet the following qualifications:
  - 1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.
  - 2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active

projects of similar type, size, duration and complexity as the Project.

B. Photographic documentation elements:

1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
2. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date-stamped) and location throughout the project.
3. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones. Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.
4. Before construction, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
5. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior

improvements beginning when stud work commences and continuing until Project completion.

6. As-built condition of site utilities shall be documented prior to placing concrete and/or backfilling. This process shall include all underground utilities within the scope of work, and utility runs in the immediate vicinity of the buildings. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.
7. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation. This process shall include all finished systems located within the Project scope of work. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
8. As-built conditions of utilities and roads shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.
9. As-built finished conditions of the scope of work shall be documented at certificate of occupancy or equivalent as directed by the COR. Overlapping photographic techniques shall be used to insure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled "Slideshowes," allowing this information to be stored in the same "place" as the formal scope.
11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.



12. Weekly (52 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
  13. Detailed Exact-Built of all project road way and curb pours just prior to placing concrete or as directed by the COR.
  14. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Images shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in the picture.
  - D. Coordination of photo shoots is accomplished through COR. Contractor shall also attend construction team meetings as necessary. Contractor's operations team shall provide regular updates regarding the status of the documentation, including photo shoots concluded, the availability of new Progressions or Exact-Built viewable on-line and anticipated future shoot dates.
  - E. Contractor shall provide all on-line domain/web hosting, security measures, and redundant server back-up of the documentation.
  - F. Contractor shall provide technical support related to using the system or service.
  - G. Upon completion of the project, final copies of the documentation (the "Permanent Record") with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard-drive.

### **1.33 HISTORIC PRESERVATION**

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

- - - E N D - - -

**SECTION 01 30 00.1**  
**ADMINISTRATIVE REQUIREMENTS - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies construction administration procedures for work within the City of Menlo Park right of way.

**1.2 GENERAL:**

1. Construction administration of work within the City of Menlo Park right of way shall conform to the following sections of the 2006 edition of the Caltrans Standard Specifications, as modified below:

- a. Section 5, CONTROL OF WORK
- b. Section 6, CONTROL OF MATERIALS
- c. Section 8, PROSECUTION AND PROGRESS
- d. Section 11, MOBILIZATION

**1.3 AUTHORITY OF THE CITY**

Section 5-1.01 of the Standard Specifications is adopted without revision, with the exception that the term "City" shall be replaced with "the City".

**1.4 PLANS, SHOP DRAWINGS AND SUBMITTALS**

The following is added to Section 5-1.02 of the Standard Specifications:

- The City Standard Details are incorporated as part of these project specifications
- Where conflicts are encountered among the Contract Documents, the order of precedence is defined in section 5-4 below.

Shop Drawings and other Submittals, as required in the Plans or elsewhere in these project specifications, shall be provided to the City prior to furnishing or fabricating the products or performing the work to which they apply.

The City shall have 7 working days to review any one Submittal or shop drawing and for each resubmittal. Rejection of Submittals or shop drawings shall not constitute delays to the project: it shall be the Contractor's responsibility to provide the correct Submittals in sufficient time to avoid delaying the work.

Unless otherwise required in the Plans or elsewhere in these project specifications, or by the City, the Contractor shall submit a minimum of three copies of each submittal. Two of those will be retained by the City and the third will be returned to the Contractor with evidence of approval, and it will be the Contractor's responsibility to make copies for their own or their subcontractors' use. If submittals are physical

samples, the Contractor shall make prior arrangements with the City if more than one approved sample is desired back.

#### **1.5 WORKING DRAWINGS AND SHOP DRAWINGS**

- A. Submit new prepared information drawn accurately to scale and clearly labeled. Highlight, encircle or otherwise indicate deviations from the contract documents.
- B. **INCLUDE AT LEAST THE FOLLOWING INFORMATION:**
  - 1. Full name of the project.
  - 2. For a drawing or other prepared document:
  - 3. Date of preparation.
  - 4. Name, address and phone number of firm that prepared the document.
  - 5. Name of person responsible for document preparation.
  - 6. License or other certification of responsible person, if applicable.
  - 7. Legend or other identification of symbols used.
  - 8. Dimensions or scale on graphics.
  - 9. Notation of dimensions established by field measurement.
  - 10. References to specified standards.
  - 11. Identification of all items or materials, either directly or by reference to other documentation provided.
  - 12. Such notes as are necessary to explain the functioning, applicability and suitability of the subject of the drawings.
- C. Sheet Size: Except for templates, patterns and similar full size drawings, submit drawings on sheets at least 8-1/2" by 11 inches (215 by 280 mm) but not larger than 36 inches by 48 inches (890 by 1220 mm). The scale and drawing size shall be appropriate for displaying the necessary information sufficiently clearly.
- D. Submit 3 black or blue line prints for the City's review. The City will return one print stamped with approval or further action required. Contractor shall make copies of the approved print as needed. One copy shall be maintained clean except for "red-lined" record of field revisions, which shall be used in preparation of the final "as-built" record.
- E. Do not use working drawings or shop drawings without a final stamp indicating approval.

#### **1.6 MANUFACTURERS' DOCUMENTATION**

- A. When documentation of a product's suitability is demonstrated by providing documentation from the manufacturer, the documentation needs to show clearly and explicitly that the proposed item or product

complies with the project requirements.

- B. If the manufacturer's documentation covers multiple models or alternates, the proposed model or item needs to be selected and unmistakably identified, and its specifications need to be presented clearly.

#### **1.7 SAMPLES**

- A. Provide samples identical to the proposed item or product. Identify them as described under "submittals identification" below.
- B. Unless otherwise specified, submit two samples. One will be retained by the City. By prearrangement in specific cases, a single sample may be submitted for review and when approved, be installed in the work at a location agreed upon by the City or his authorized representative.
- C. Unless the precise color and pattern are specifically called out in the plans or elsewhere in these project specifications, when a choice of color or pattern is available in the specified product submit the accurate color and/or pattern to the City for selection.

#### **1.8 SUBMITTALS IDENTIFICATION**

- A. Consecutively number all submittals (one number to cover all identical copies or samples within a single submittal). When an item is resubmitted for any reason, transmit under a new letter of transmittal with a new transmittal number. On resubmittals, cite the original submittal number for reference.
- B. Accompany each submittal with a transmittal form identifying and describing the submittal, labeled with the date that the submittal is conveyed to the city. Always show the submittal number in the transmittal.
- C. Identify occurrence(s) of item or product in the contract plans, by referencing sheet and detail number(s), or in the standard specifications or these project specifications by section number.
- D. Maintain an accurate submittal log for all the duration of the work, showing status of all submittals at all times. Make this log available to the City for his review upon request.

#### **1.9 SUBSTITUTIONS**

Substitutions will be considered only when one or more of the following conditions are satisfied as determined by the City:

- A. Extensive revisions to the contract documents are not required.
- B. Proposed changes are kept with the general intent of the contract documents.

- C. The request is timely, fully documented and properly submitted.
- D. The specified product or method of construction cannot be provided within the contract time. The City will not consider the request if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
- E. The request is directly related to an "or equal" clause or similar language in the contract documents.
- F. The requested substitution offers the city a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities the city must assume. The city's additional responsibilities may include compensation to the redesign and evaluation services, increased cost of other construction by the city and similar considerations.
- G. The specified product or method of construction cannot receive necessary approval by another governing authority and the requested substitution can be approved.
- H. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and the Contractor certifies that the substitution will overcome the incompatibility.
- I. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certified that the proposed substitution can be coordinated.
- J. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

**1.10 CONFORMITY WITH CONTRACT DOCUMENTS; DISCREPANCIES**

The following is added to section 5-1.03 of the standard specifications:

The Contractor shall not take advantage of any apparent error or omission in the contract documents. In the event Contractor discovers any apparent error, discrepancy or omission, he shall immediately inform the City whose decision on the matter shall be final.

**1.11 COORDINATION AND INTERPRETATION OF PLANS, STANDARD SPECIFICATIONS, AND PROJECT SPECIFICATIONS**

Section 5-1.04 of the standard specifications is revised as follows:  
The second bulleted paragraph of sec. 5-1.04 is replaced with the following:

- Change orders, special directives or agency permit requirements shall take precedence over these contract provisions;
- Within the contract documents, the order of precedence from highest to lowest is as follows: agreement, bid proposal including all proposal forms, notice to bidders, project specifications, and exhibits.
- Information directly included in these project specifications shall take precedence over the project plans or drawings;
- The project plans, or drawings take precedence over the city standard details;
- The city standard details take precedence over the caltrans standard specifications;
- The standard specifications take precedence over the standard plans

#### **1.12 ORDER OF WORK**

The following is added to section 5-1.05 of the standard specifications:

#### **1.13 GENERAL REQUIREMENTS**

The Contractor shall efficiently sequence the various phases of work to avoid conflicts between trades or subcontractors.

No additional time shall be granted if the contractor cannot complete the work on schedule due to his failure to maintain an efficient and orderly progression of work.

Work within a particular location or area shall not be started without prior approval of the City.

Unless otherwise directed by the City and approved by the transportation division, work will only be allowed on one side of the street at any given time with additional consideration being given to staggering blocks, so that vehicular, bicycle and pedestrian travel is not unduly interrupted.

Concrete demolition and replacement at any one location shall be completed

within five (5) working days from the date work commenced at that particular location except for locations where special written permission for additional time is approved by the City. Failure by the Contractor to complete the concrete and/or asphalt demolition and replacement work shall be deemed as non-compliance with the requirements of this section. Liquidated damages in the amount of five

hundred (\$500.00) dollars per calendar day will be assessed the Contractor until the said work is complete.

Restoration work (backfilling, repairing unnecessary concrete damage, irrigation repairs, replanting, re-landscaping, etc.,) shall be completed within five (5) working days from the date work is generally completed at that particular location. Failure by the Contractor to complete the said restoration work shall be deemed as non-compliance with the requirements of this section. Liquidated damages in the amount of five-hundred (\$500.00) dollars per calendar day will be assessed the Contractor until the said work is complete.

The Contractor shall complete one area before moving to the next unless otherwise directed by the City.

Where the Contractor does not comply with the above performance requirement, the city may have the work performed by others and the appropriate costs charged against this Contractor.

#### **1.14 PROJECT-SPECIFIC REQUIREMENTS**

Within 5 days of contract execution, the Contractor shall submit for review the submittals for the following list of equipment and materials:

1. Standards and poles
2. Conduit
3. Pull boxes
4. Controller
5. Controller cabinet assembly
6. Type iii AF service assembly including battery back-up system and service cabinet
7. Signal heads and hardware
8. Pedestrian signal heads and hardware
9. Pedestrian push buttons
10. Luminaires and lighting fixtures
11. Video detection system
12. Emergency preemption system

For submittal requirements, the Contractor shall refer to section 86-1.04 of these project specifications.

The Contractor shall submit 2 copies of the above data. The City will review within 15 days.

Due to material lead time, within three days from approval of submittal for the traffic signal standards and poles and prior to the receipt of



the notice to proceed, the Contractor shall order the traffic signal poles.

#### **1.15 SUPERINTENDENCE**

Section 5-1.06 of the standard specifications is adopted without revision.

#### **1.16 LINES, GRADES AND GEOTECHNICAL TESTING**

The following is added to section 5-1.07 of the standard specifications:

The city will provide a geotechnical testing firm to check compliance with the contract documents. The Contractor shall cooperate with the firm's technicians and shall make corrections during the course of work as indicated from tests performed.

#### **1.17 INSPECTION**

The following is added to section 5-1.08 of the standard specifications:

The City may authorize a third-party firm or individual to provide inspection services for the project. If such is the case, that firm or individual shall carry the authority designated to them as though they were an employee of the city.

Requests for inspection shall be made at least two business days prior to when needed.

#### **1.18 REMOVAL OF REJECTED AND UNAUTHORIZED WORK**

Section 5-1.09 of the standard specifications is adopted without revision.

#### **1.19 [SECTIONS 5-1.10 THROUGH 5-1.115 OF THE STANDARD SPECIFICATIONS ARE NOT USED IN THIS PROJECT]**

#### **1.20 DIFFERING SITE CONDITIONS**

Section 5-1.116 of the standard specifications is adopted without revision.

#### **1.21 CHARACTER OF WORKERS**

Section 5-1.12 of the standard specifications is adopted without revision.

#### **1.22 FINAL INSPECTION**

Section 5-1.13 of the standard specifications shall be replaced with the following:

When the work has been essentially completed, the City will inspect it in detail. Any defects or items of work not completed to his satisfaction will be noted on a punchlist to be conveyed to the

Contractor. The Contractor shall correct all items prior to requesting a final inspection. If the Contractor disagrees with any item on the punchlist, he may protest as described in section 015526.01 of these specifications. The procedure for acceptance of the contract is defined in section 013500.01 of these specifications.

#### **1.23 STORAGE OF MATERIALS**

The following is added to section 6-1.03 of the standard specifications:

Stockpiling of materials or spoils within the public right-of-way shall not be permitted unless explicitly authorized in advance, in writing, by the City.

#### **1.24 ITEMS DELIVERED AND STORED PRIOR TO INSTALLATION**

Unless approved by the City in advance, in writing, the Contractor shall retain ownership of all materials and components of the work until they are installed, and payment will not be made for them until that time. Materials stockpiled or items stored in the vicinity of the project shall not be considered installed until they have been set and secured in their permanent location.

#### **1.25 SUBCONTRACTING**

The second bulleted paragraph of section 8-1.01 of the standard specifications is replaced with the following:

Any of the Contractor's subcontractors, or subcontractors of the Contractor's subcontractors, shall be directed by the Contractor, and the Contractor shall be held responsible for their work as if it had been performed by his own forces. Suppliers and vendors of materials or components of the work shall likewise be directed by the Contractor, and the Contractor shall be held responsible for the quality and suitability of those materials and components.

#### **1.26 PRECONSTRUCTION CONFERENCE**

Prior to the issuance of the notice to proceed, a pre-construction conference will be held at the office of the Citying services manager between the city and the Contractor. The purpose of this meeting shall be to discuss the scope of work, the plans and specifications, existing conditions, materials to be ordered, equipment to be used, schedule and form, and all matters pertaining to the prosecution and satisfactory completion of the project. The Contractor's representatives at this conference shall include the field superintendent, supervisors, and major subcontractors.

**1.27 COMMENCEMENT OF WORK**

The first bulleted paragraph of section 8-1.03, "Beginning of Work" of the standard specifications is replaced with the following:

The Contractor shall not begin work until the notice to proceed is issued by the City. The contractor shall begin work within five (5) working days from the date of issuance of the notice to proceed.

At least 48-hours prior to commencement of work the contractor shall notify the following agencies:

City of Menlo Park Maintenance Division	(650) 330-6780
City of Menlo Park Transportation Division	(650) 330-6770
Menlo Park Police Department	(650) 330-6300
Menlo Park Fire District	(650) 688-8400

**1.28 OVERALL SCHEDULE**

At the preconstruction conference described above, the contractor shall present a detailed schedule for the entire project. All major portions of the work shall be listed for each separate phase or section if the job is broken into phases or sections.

The format of the schedule shall be as agreed to by the City.

**1.29 UPDATES**

As requested by the City at the preconstruction conference, or as revised by the City during the course of the project, the contractor shall provide updated versions of the overall schedule, in the same format as the initial presentation.

**1.30 REGULAR LOOK-AHEAD SCHEDULES**

As frequently as requested by the City, in order to be able to coordinate other activities or notifications of different affected neighborhoods, the contractor shall provide an up-to-date schedule of the activities to take place just during the upcoming time period stipulated by the City. Unless otherwise directed, this will occur on a bi-weekly basis.

**1.31 TEMPORARY SUSPENSION OF WORK**

The following is added to section 8-1.05 of the standard specifications:

The City may temporarily suspend the work, or any portion of the work, if he determines that it imposes undue hardship on the affected residents or businesses. Such a temporary suspension, to allow for accommodations to be made to somewhat mitigate the hardship, shall be considered to be of the same nature as the reasons given in the first

paragraph of section 8-1.05 of the standard specifications, and shall be treated accordingly. The contractor shall not be entitled to compensation for the inconvenience of having to move his operations to a different portion of the project, nor for the delay unless it is found to be unreasonable as defined in section 8-1.05

### **1.32 TIME OF COMPLETION**

The following paragraphs are added to section 8-1.06 of the standard specifications.

The Contractor's working day activities shall be limited to the hours between 8:00 am and 5:00 pm, Monday through Friday, excluding designated city holidays. Work adjacent to or within the vicinity of any school while in session will be restricted at the start and the end of school day in accordance with a traffic control plan approved by the City.

Deviation from normal working hours will not be allowed without prior written consent of the City.

If work is allowed by the City outside of normal working hours at the request of the Contractor, inspection service fees may be levied against the Contractor at a rate established within the City of Menlo Park master fee schedule, including travel time where applicable, with a minimum hourly charge of four (4) hours. The above charge may also be levied if inspection services become necessary to protect public safety or if unique circumstances require additional inspection to ensure the quality of work.

The following are the designated city holidays:

1. January 1 (New Year's Day)
2. The Third Monday in January (Martin Luther King's Birthday)
3. The Third Monday in February (Washington's Birthday)
4. The Last Monday in May (Memorial Day)
5. July 4 (Independence Day)
6. The First Monday in September (Labor Day)
7. November 11 (Veterans' Day)
8. The Fourth Thursday in November (Thanksgiving Day)
9. The Day After Thanksgiving Day
10. December 24 (Christmas Eve)
11. December 25 (Christmas Day)
12. December 31 (New Year's Eve)

When a designated holiday falls on a Sunday, the following Monday shall

be a designated holiday. When Christmas Day falls on a Sunday or Monday the preceding Friday shall be a holiday.

### **1.33 LIQUIDATED DAMAGES**

The following is added to the end of the first bulleted paragraph of section 8-1.07 of the standard specifications:

The amount to be charged per day for liquidated damages shall be five hundred dollars **(\$500.00)**.

### **1.34 TERMINATION OF CONTROL**

Section 8-1.08 of the standard specifications is replaced with the following:

Failure to supply an adequate working force, or material of proper quality, or failure to pay subcontractors as required by law, or in any other respect to prosecute the work with the diligence and force specified by the contract, is grounds for termination of the Contractor's control over the work and for taking over the work by the City.

### **1.35 RECORD DOCUMENTATION**

Prior to receiving final payment, the Contractor shall provide to the City a "red-lined" set of plans that identifies all aspects of the work that vary from the original contract documents. The Contractor shall maintain an "office-copy" set of plans on which all changes are marked as soon as they occur. All revisions due to change orders, City's directives, field-decisions, and Contractor's judgment shall be noted, indicating the nature of the revision and its precise location. It shall remain available for the City's inspection throughout the course of the project.

### **1.36 UTILITY COMPANY CONTACTS**

The Contractor shall notify the following utility companies at least 48-hours prior to intentionally disturbing their facilities or immediately upon accidentally damaging their facilities:

Pacific Gas & Electric Co.	(800) 743-5000
AT&T	(408) 493-7134
California Water Service	(650) 367-6800
West Bay Sanitary District	(650) 321-0384
City Of Menlo Park/Maintenance Division	(650) 330-6780

### **1.37 LOCATING UNDERGROUND UTILITIES:**

At least two working days, and no more than fourteen calendar days, prior to any disturbance of the ground or pavements, the Contractor

shall notify underground service alert (USA North) at 800-227-2600, and shall file a service request. No digging shall be allowed until all operators of subsurface utilities have responded. If a utility operator has failed to respond by the intended excavation date on the USA North ticket, the Contractor must pursue the follow-up procedures outlined by USA North. The Contractor shall be entirely responsible for any damage caused to subsurface utilities if the procedure prescribed by USA North was not followed, or if the markings left by the operators of the utilities were not respected.

The USA North service request number shall be provided to the City.

While the best efforts will be made, by the project designers and by the operators of underground utilities, to identify the correct locations of buried facilities, the Contractor bears the final responsibility for avoiding such facilities. If, during construction, any indication of possible unmarked utilities is observed, the Contractor shall immediately stop working and attempt to resolve the question by careful manual probing and digging.

The Contractor shall notify the City immediately upon discovery of any unmarked facilities.

#### **1.38 MOBILIZATION**

The following paragraphs are added to section 11, "mobilization" of the standard specifications:

#### **1.39 CONVEYANCE AND STORAGE**

Except as otherwise specified, the Contractor shall furnish all necessary means of conveyance for the transfer of material to its proper place at work, storage of materials for work, and disposal of refuse and unused materials, and shall pay all costs of rentals or leases thereby made necessary.

As required, adequate precautions shall be taken by the Contractor to protect and preserve stored items, including providing fencing, barricades, reflective tapes, etc. The Contractor is not allowed to use the project site (i.e. The public right-of-way or city property) for staging equipment, storing materials or establishment of offices, buildings or other facilities necessary for work on the project without prior written authorization of the City. The Contractor is responsible for locating and renting such facilities as necessary to complete the project.

No trucks, trailers or equipment licensed for street driving shall be left parked overnight within the right of way. Non-licensed equipment remaining in the right of way shall be neatly stored at the end of each working day in such a fashion as to not create a hazard.

#### **1.40 TEMPORARY FACILITIES**

Temporary structures and facilities, necessary for the execution of the work or for the convenience of the Contractor, shall be subject to the following:

- A. Storage areas for materials shall be secured to exclude the public, and shall be protected against contamination of groundwater or surface run-off. Sufficient space shall be provided to allow unloading or loading of materials or equipment in such a manner as to avoid blocking sidewalks, driveways or adjacent streets.
- B. Sanitary toilets shall be provided for all persons working on the project. They must be cleaned at least weekly and shall be protected against contamination of groundwater or surface run-off. They shall not be located close to decks, patios or windows of adjacent private properties. Upon direction of the City they shall be relocated.
- C. Field offices, whether at the option of the Contractor or as called-for in the contract documents, shall be located so as to not impede pedestrian or vehicular traffic or impair safe sight-distances, for traffic in the right-of-way or for traffic entering or leaving a privately-owned site. They shall not be located where they would cast shadows onto structures, including decks and patios, on adjacent private property. If located in residential neighborhoods, they shall not produce noise, glare or odors above existing ambient levels.
- D. Lighting of temporary facilities for safety or security shall not shine directly, or indirectly off highly reflective surfaces, into adjacent residential properties.
- E. Upon completion of the project, the Contractor shall remove all temporary structures and facilities from the site and clean and restore the area.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**--- E N D ---**

**SECTION 01 32 16.15**  
**PROJECT SCHEDULES**  
**(SMALL PROJECTS - DESIGN/BID/BUILD)**

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

**1.2 CONTRACTOR'S REPRESENTATIVE:**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

**1.3 CONTRACTOR'S CONSULTANT:**

- A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:
1. The name and address of the proposed consultant.
  2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
  3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.
- B. The COR has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar



days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

#### **1.4 COMPUTER PRODUCED SCHEDULES**

- A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the COR; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

#### **1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the COR's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget

amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the COR. The contractor shall make a separate written detailed request to the COR identifying these date constraints and secure the COR's written approval before incorporating them into the network diagram. The COR's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- D. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the COR or his representative, will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
  2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the COR. The revised submission will be reviewed by the COR and, if found to be as previously agreed upon, will be approved.
- E. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule

until subsequently revised in accordance with the requirements of this section.

F. The Complete Project Schedule shall include all major activities/events.

#### **1.6 WORK ACTIVITY/EVENT COST DATA**

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.
- D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

#### **1.7 PROJECT SCHEDULE REQUIREMENTS**

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
  - 1. Show activities/events as:
    - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.

- b. COR's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
  - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
  - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
  - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
- 2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
  - 3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
  - 4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  - 5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
- 1. The appropriate project calendar including working days and holidays.
  - 2. The planned number of shifts per day.
  - 3. The number of hours per shift.

Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

#### **1.8 PAYMENT TO THE CONTRACTOR:**

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

#### **1.9 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
  2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  5. Completion percentage for all completed and partially completed activities/events.
  6. Logic and duration revisions required by this section of the specifications.
  7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the COR representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and resident engineer for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for**

**contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**

- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, COR representatives, and all subcontractors needed, as determined by the COR, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

#### **1.10 RESPONSIBILITY FOR COMPLETION**

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
  2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
  3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

#### **1.11 CHANGES TO THE SCHEDULE**

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file

(s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:

1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
  2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
  3. The schedule does not represent the actual prosecution and progress of the project.
  4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the COR for approval.
- C. COR's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.12 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time



under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The COR's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The COR will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the COR's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the COR in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples (including laboratory samples to be tested) test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by COR, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals (including any laboratory samples to be tested) will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant

to request therefor by COR, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The COR and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. COR assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of VA Menlo Park Campus, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
    1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
    2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the VA Menlo Park Campus, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
    3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

- C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by COR.
1. Laboratory shall furnish COR with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
  3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both COR and to Architect-Engineer simultaneously with submission of material to a commercial testing laboratory.
  - //4. Contractor shall forward a copy of transmittal letter to Resident Engineer simultaneously with submission to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to COR for appropriate action.
  6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to

Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including VA Menlo Park Campus location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect under one cover.

- 1-10. Samples (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

Polytech Associates\_\_\_\_\_

(Architect)

235 Pine Street 19<sup>th</sup> Floor\_\_\_\_\_

(Address)

San Francisco, CA 94104\_\_\_\_\_

(City, State and Zip Code)

- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR.

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**SECTION 01 35 00.01**  
**SPECIAL PROCEDURES - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies special procedures regarding project site maintenance within the City of Menlo Park right of way.

**1.2 GENERAL:**

A. Special Procedures within the City of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, Section 7, LEGAL RELATIONS AND RESPONSIBILITY, to the following paragraphs, as modified below:

1. 7-1.01F
2. 7-1.01I
3. 7-1.02
4. 7-1.04
5. 7-1.06
6. 7-1.08
7. 7-1.09
8. 7-1.10
9. 7-1.11
10. 7-1.15
11. 7-1.16
12. 7-1.17

**1.3 AIR POLLUTION**

The following is added to Section 7-1.01F of the Standard Specifications:

Particular attention is directed to the requirements of the Bay Area Air Quality Management District (939 Ellis Street, San Francisco, Phone: 415/771-6000).

**1.4 SOUND CONTROL REQUIREMENTS**

The following is added to Section 7-1.01I of the Standard Specifications:

The noise level from the Contractor's operations, between the hours of 7:00 a.m. and 10:00 p.m., cannot exceed 60 dBA at a residential property line. All construction noise during the hours of 8 a.m. and 6

p.m., Monday through Friday, is exempt from the 60 dBA limit except that noise generated by powered equipment may not exceed 85 dBA measured at 50 feet from the source (Ordinance No.892). Note the limitation on working hours in Section 8-6.

Said noise level requirement shall apply to all equipment on the job or related to the job including, but not limited to, trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

### **1.5 LOAD LIMITATIONS**

The following is added to Section 7-1.02 of the Standard Specifications:

Truck Route Permits are required for all trucks over 3 tons that enter the City of Menlo Park. Additional information, including permit requirements, can be found on the City's website at:

**<http://www.menlopark.org/departments/trn/truckroutepermits.html>**

The Contractor's attention is directed to the Truck Routes Map on figure 7-5.1, showing truck routes in the City of Menlo Park per Ordinance No. 718, as well as the following notice:

#### **CITY OF MENLO PARK TRUCK ROUTES**

Menlo Park Municipal Code Section (11.48.035) establishes Willow Road from Bayshore (Highway 101) Freeway to, and including, Middlefield Road as a "special limited truck route." Trucks with a "maximum gross weight," including load, *EXCEEDING THREE (3) TONS*, are excluded from this (limited) truck route. Trucks entering the City of Menlo Park for a destination in the vicinity of Willow Road or Middlefield Road or a truck on a trip originating within this area will be permitted.

Trucks exceeding three tons with a Downtown or other central Menlo Park destination must enter and exit such locations via El Camino Real (Highway 82) or other designated truck routes unless they have made a stop at a destination on Willow Road or Middlefield Road. NO TRUCKS WITH A PALO ALTO DESTINATION ARE PERMITTED ON WILLOW ROAD.

Questions regarding this notice should be directed to the City's Transportation Division, at (650) 330-6770, or to the Menlo Park Police Department at (650) 330-6300.



## 1.6 PERMITS AND LICENSES

The following is added to Section 7-1.04 "Permits and Licenses" of the Standard Specifications:

Prior to commencement of work, the Contractor shall obtain and pay for all applicable permits from the City. The following City permits are required:

A. Business License (obtain from Finance Department)

B. Truck Route Permits (obtain from Transportation Division)

A City of Menlo Park Business License is required of any person who transacts or conducts any business, trade, profession, calling or occupation in the City of Menlo Park. The Contractor shall submit to the City a copy of his receipt or other evidence of having procured a current City of Menlo Park Business license.

See the preceding section regarding the Truck Route Permits. A separate permit is required for each truck in excess of 3 Tons. When the work is to be done at multiple locations, attachments shall be issued for each permit indicating the entry/exit point and the work area for which it can be used.

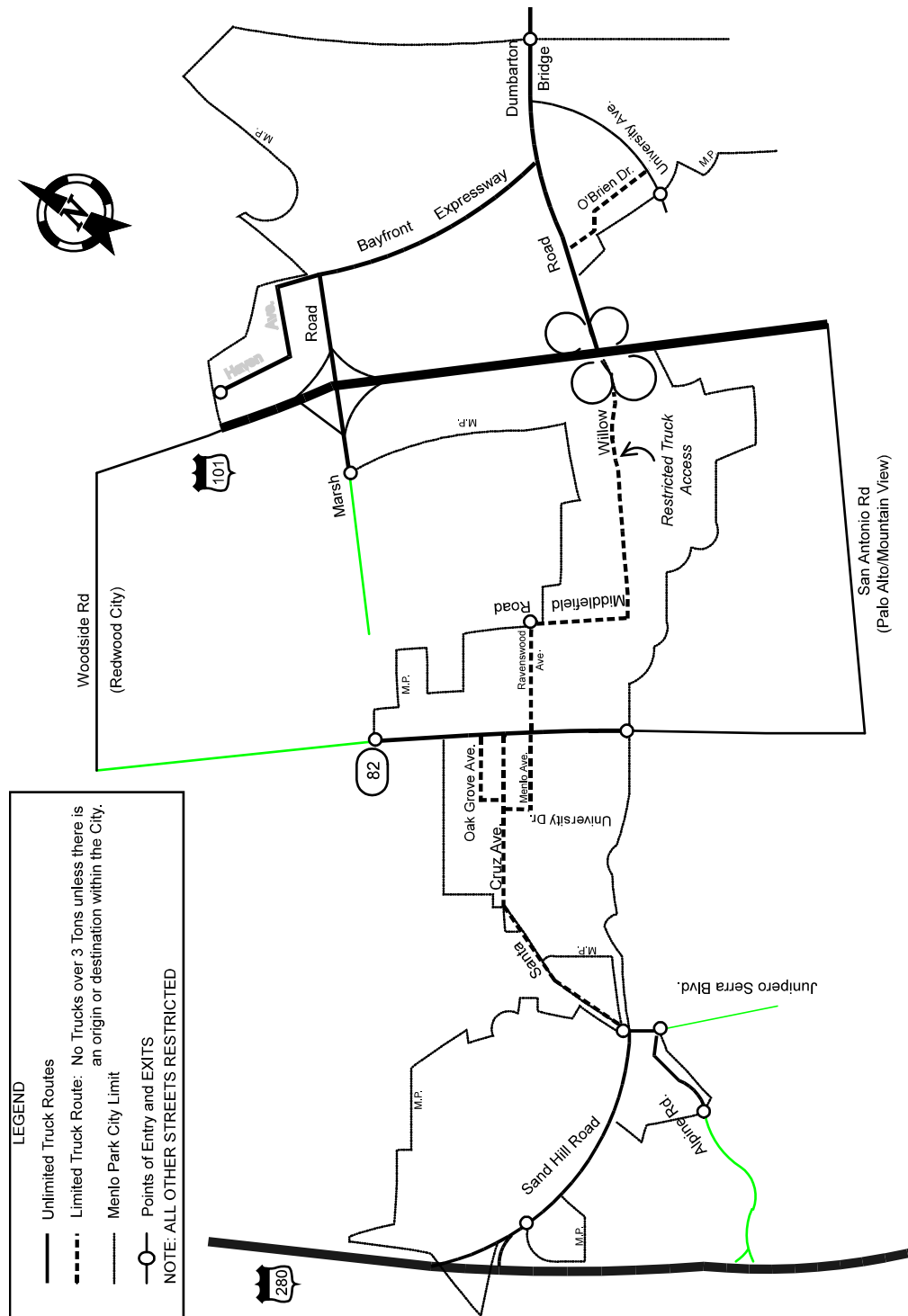
Contractor shall obtain and pay for State and County permits, and permits from other jurisdictions that may be required for the project. Contractor shall pay fees associated with such permits.

The Contractor shall comply with all conditions set forth in these permits and agreements, and shall bear the full costs of all expenses incurred in such compliance.

Contractor represents and warrants to the City that they have all licenses, permits, qualifications and approvals of whatsoever nature, which are legally required for Contractor to practice their profession. Contractor represents and warrants to the City that Contractor shall, at his sole expense, keep in effect at all times during the term of this Agreement any licenses, permits, and approvals which are legally required for Contractor to perform the work required hereunder.

Full compensation for conforming to the provisions in this section shall be considered as included in the Contract prices paid for the various items of work, and no separate payment will be made therefore.

fig. 7-5.1 - TRUCK ROUTE MAP



#### **1.7 SAFETY AND HEALTH PROVISIONS**

The following is added to Section 7-1.06 of the Standard Specifications, prior to the last bulleted paragraph:

Contractor shall follow the safety practices and procedures contained in the State of California Department of Transportation Construction Manual.

Notwithstanding any provisions of the Standard Specifications and these Project specifications, the Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property, during performance of the work. Construction review by the owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the scheduled construction areas. This requirement will apply continuously and will not be limited to normal working hours. Safety and sanitary provisions shall conform to applicable Federal, State, County, and Local Laws, Regulations, Ordinances, Standards and Codes. Where any of these are in conflict, the more stringent requirement shall be followed.

#### **1.8 PUBLIC CONVENIENCE**

The following is added to Section 7-1.08, "Public Convenience," of the Standard Specifications.

Contractor shall not obstruct public pedestrian pathways with construction material or equipment.

Access for local residents and businesses shall be maintained. At the end of each working day, any closed lanes shall be reopened to through traffic with proper barricades, warning devices and temporary striping. No two adjacent streets shall be closed at the same time during the construction of any segment. The Contractor shall furnish and maintain all signs, lights, barricades, and flagpersons necessary as determined by the City. If any street is authorized for closure, the Contractor shall proceed expeditiously and with consideration for public convenience from the start of excavation to completion of paving.

The Contractor is directed to Section 011526.01 of these Specifications for requirements pertaining to notifications to affected persons.

#### **1.9 PUBLIC SAFETY**

The following is added to Section 7-1.09, "Public Safety" of the Standard Specifications:

When surfaces have been moistened by rain or dew, the Contractor shall take additional precautions than might otherwise have been sufficient, regardless of whether or not directed to do so by the City or the Contract Documents.

When reference is made to "...the free and safe passage of public traffic..." with respect to the storage of material or equipment or the placement of temporary facilities, it shall be understood that this applies to pedestrian and bicycle traffic as well as vehicular traffic and to pedestrian and bicycle facilities as well as roadways.

The Contractor shall correct any hazardous conditions reported by the City within two (2) hours of notification. If the Contractor fails to correct the hazardous condition within two (2) hours of notification, the City reserves the right to install or have installed the necessary lights, barricades, etc. The cost involved shall be deducted from any payment due to the Contractor.

#### **1.10 EXPLOSIVES**

Section 7-1.10 of the Standard Specifications is replaced with the following:

No explosives of any kind, other than power-actuated tools properly used by persons certified to use them, are allowed to be employed without the specific, written permission of the City.

#### **1.11 PRESERVATION OF PROPERTY**

The following is added to Section 7-1.11 of the Standard Specifications:

No right-of-way monument may be disturbed without prior written consent of the City. If permitted, a licensed surveyor, hired by the Contractor, shall take and record whatever measurements might be necessary to relocate it, and that information shall be given to the City prior to disturbing the monument.

If any damage is done to existing Portland Cement Concrete gutters, curbs, sidewalks, or handicapped access ramps during pavement repair, rehabilitation or replacement operations, the Contractor shall be responsible for replacing the damaged concrete as directed by the City, regardless of the cause of the damage. Generally, concrete work shall be saw-cut and replaced in sections between existing joints or score lines.

#### **1.12 INDEMNIFICATION AND INSURANCE**

The Contractor shall procure and maintain for the duration of the Contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

A. Minimum Scope of Insurance. Coverage shall be at least as broad as:

13. Insurance Services Office form number GL 0002 (Ed. 1/73) covering Comprehensive General Liability and Insurance Services Office form number GL 0404 covering Broad Form Comprehensive General Liability; or Insurance Services Office Commercial General Liability coverage ("occurrence" form CG 0001).

14. Insurance Services Office form number CA 0001 (Ed. 1/78) covering Automobile Liability, code 1 "any auto" and endorsement CA 0025.

15. Workers' Compensation insurance as required by the Labor Code of the State of California and Employers Liability insurance.

B. Minimum Limits of Insurance. Contractor shall maintain limits no less than:

1. Commercial General Liability: \$2,000,000 combined single limit, annual aggregate for bodily injury, personal injury and property damage; and with a minimum of \$1,000,000.00 per occurrence.

2. Automobile Liability: \$1,000,000 combined single limit per accident for bodily injury and property damage.

3. Workers' Compensation and Employers Liability: Workers' compensation limits as required by the Labor Code of the State of California and Employers Liability limits of \$1,000,000 per accident.

C. Deductibles and Self-Insured Retentions. Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the City, either the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the City, its officers, officials and employees; or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.

D. Other Insurance Provisions. The policies are to contain, or be endorsed to contain, the following provisions:

1. General Liability and Automobile Liability Coverages.

- a. The City, its officers, officials, employees and volunteers are to be covered as insureds as respects: liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor, premises owned, occupied or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of the protection afforded to the City, its officers, officials, employees or volunteers.
  - b. The Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, employees and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, employees or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
  - c. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the City, its officers, officials, employees or volunteers.
  - d. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
2. Workers' Compensation and Employers Liability Coverage. The insurer shall agree to waive all rights of subrogation against the City, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the City.
  3. All Coverage.  
Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the City.
- E. Acceptability of Insurers. Insurance is to be placed with insurers with a Bests rating of no less than A:XII.
  - F. Verification of Coverage. Contractor shall furnish City with certificates of insurance and with original endorsements effecting coverage required by this clause. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The certificates and

endorsements are to be received and approved by the City before commencing work. The City reserves the right to require complete, certified copies of all required insurance policies, at any time.

- G. Subcontractors. Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein.

#### **1.13 FAILURE TO MAINTAIN INSURANCE**

During the term of this Agreement and until final completion and acceptance of work by the City, the Contractor shall maintain in full force and effect insurance coverage in the forms and amounts specified in the Contract Documents. If, at any time during the performance of this Contract, Contractor fails to maintain any item of required insurance in full force and effect, Contractor shall immediately discontinue all work under the Contract.

#### **1.14 RESPONSIBILITY FOR DAMAGE**

Attention is directed to Section 7-1.15 and 7-1.16 of the Standard Specifications regarding Contractor's responsibility for the work. The City of Menlo Park and all officers and employees thereof connected with the work, including but not limited to the City, shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof; for any loss or damage to any of the materials or other things used or employed in performing the work; for injury to or death of any person, either work persons or public; or for damage to property from any cause which might have been prevented by the Contractor, or his workers, or anyone employed by Contractor.

It is the intent of the parties that the Contractor will indemnify and hold harmless the City, its officers and employees from any and all claims, suits or actions as set forth above, regardless of the existence or degree of fault or negligence on the part of the City, Contractor, subcontractor or employee of any of these, other than the active negligence of the City, its officers and employees.

#### **1.15 HOLD HARMLESS AND RESPONSIBILITY OF CONTRACTOR**

Contractor shall take all responsibility for the work, shall bear all losses and damages directly or indirectly resulting to him, to any subcontractor, to the City, to City officers and employees, or to

parties designated by the City, on account of the performance or character of the work, unforeseen difficulties, accidents, occurrences or other causes predicated on active or passive negligence of the Contractor or of any subcontractor. The Contractor shall indemnify, defend and hold harmless the City, its officers, officials, directors, employees and agents from and against any or all loss, liability, expense, claim costs (including costs of defense), suits, and damages of every kind, nature and description directly or indirectly arising from the performance of the work. This paragraph shall not be construed to exempt the City, its employees and officers from its own fraud, willful injury or violation of law whether willful or negligent. By execution of this agreement, Contractor acknowledges and agrees that he has read and understands the provisions hereof and that this paragraph is a material element of consideration. City's acceptance of the insurance documents does not relieve the Contractor or subcontractors from liability under this provision.

#### **1.16 ACCEPTANCE OF CONTRACT**

Section 7-1.17 of the Standard Specifications is replaced with the following:

When the all of the Contract Work, except for plant establishment work (if included in the Contract), has been completed and has passed inspection as provided in Section 5-1.13, "Final Inspection" of the Standard Specifications and as modified in these Project specifications, and when all required warranties from subcontractors or suppliers have been provided to the City, the City will recommend to the City Council that they accept the Work. The City Council, at its discretion, may accept - or conditionally accept - the Work and direct the City to file a Notice of Completion.

If landscaping and irrigation are part of the project, partial acceptance of the Work will be allowed upon completion of all Contract Work except for plant establishment work as described in Section 20-4.08, "Plant Establishment Work" of the Standard Specifications and as modified in these project specifications.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----



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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

**1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)**

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

**1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)**

The specifications and standards cited in this solicitation can be examined at the following location:

VA Menlo Park Campus  
795 Willow Road  
Menlo Park, California 94025

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**1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)**

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>

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AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASAE	American Society of Agricultural Engineers <a href="http://www.asae.org">http://www.asae.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>

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ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>

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CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.etl.com">http://www.etl.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
FPS	The Forest Products Society <a href="http://www.forestprod.org">http://www.forestprod.org</a>

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GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HI	Hydraulic Institute <a href="http://www.pumps.org">http://www.pumps.org</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
\ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org/">http://www.ieee.org/</a>
IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>

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NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NLMA	Northeastern Lumber Manufacturers Association, Inc. <a href="http://www.nelma.org">http://www.nelma.org</a>
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation <a href="http://www.nsf.org">http://www.nsf.org</a>

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NWWDA	Window and Door Manufacturers Association <a href="http://www.nwwda.org">http://www.nwwda.org</a>
OSHA	Occupational Safety and Health Administration Department of Labor <a href="http://www.osha.gov">http://www.osha.gov</a>
PCA	Portland Cement Association <a href="http://www.portcement.org">http://www.portcement.org</a>
PCI	Precast Prestressed Concrete Institute <a href="http://www.pci.org">http://www.pci.org</a>
PPI	The Plastic Pipe Institute <a href="http://www.plasticpipe.org">http://www.plasticpipe.org</a>
PEI	Porcelain Enamel Institute, Inc. <a href="http://www.porcelainenamel.com">http://www.porcelainenamel.com</a>
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">http://www.post-tensioning.org</a>
RFCI	The Resilient Floor Covering Institute <a href="http://www.rfci.com">http://www.rfci.com</a>
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. <a href="http://www.rma.org">http://www.rma.org</a>
SCMA	Southern Cypress Manufacturers Association <a href="http://www.cypressinfo.org">http://www.cypressinfo.org</a>
SDI	Steel Door Institute <a href="http://www.steeldoor.org">http://www.steeldoor.org</a>
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">http://www.igmaonline.org</a>



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SJI	Steel Joist Institute <a href="http://www.steeljoist.org">http://www.steeljoist.org</a>
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. <a href="http://www.smacna.org">http://www.smacna.org</a>
SSPC	The Society for Protective Coatings <a href="http://www.sspc.org">http://www.sspc.org</a>
STI	Steel Tank Institute <a href="http://www.steeltank.com">http://www.steeltank.com</a>
SWI	Steel Window Institute <a href="http://www.steelwindows.com">http://www.steelwindows.com</a>
TCA	Tile Council of America, Inc. <a href="http://www.tileusa.com">http://www.tileusa.com</a>
TEMA	Tubular Exchange Manufacturers Association <a href="http://www.tema.org">http://www.tema.org</a>
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated <a href="http://www.ul.com">http://www.ul.com</a>
ULC	Underwriters' Laboratories of Canada <a href="http://www.ulc.ca">http://www.ulc.ca</a>
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651

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WRCLA      Western Red Cedar Lumber Association  
             P.O. Box 120786  
             New Brighton, MN 55112  
             (612) 633-4334

WWPA      Western Wood Products Association  
             <http://www.wwpa.org>

- - - E N D - - -

**SECTION 01 55 26.01**  
**TRAFFIC CONTROL - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies traffic control procedures within the city of Menlo Park right of way.

**1.2 GENERAL:**

- A. Traffic control within the city of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, sections 4, SCOPE OF WORK, and Section 12, CONSTRUCTION AREA TRAFFIC CONTROL DEVICES, as modified below.

**1.3 INTENT OF PLANS AND SPECIFICATIONS**

The last sentence of Section 4-1.01 of the Standard Specifications is revised to read as follows:

"Unless otherwise specified, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals, and do all the work involved in executing the contract in a workmanlike manner to the satisfaction of the City."

**1.4 SIGN REMOVAL**

The following is inserted immediately prior to the last sentence in Sec. 4-1.02 of the Standard Specifications:

The Contractor shall remove all temporary signs that have been rendered obsolete by the completion of the work, such as warnings of uneven or rough surfaces or lane closures.

**1.5 DETOURS**

The following is added to Section 4-1.04 of the Standard Specifications:

Detours, as well as lane closures and closures of streets to public traffic, if they are allowed at all, must be approved by the City in advance. A detailed Traffic Control Plan for the Project, or for portions of the Project, may be required per this specification section. Prior to implementation of any traffic diversion, the affected neighborhood shall be notified as described in this specification section. This applies to staging of equipment and temporary storage of materials as well as to the work described in the Plans or Drawings and these Provisions.

Unless a road closure is approved, the contractor is required to keep one lane open in each direction of travel at all times during construction. For streets scheduled to have an adjacent traffic lane open during resurfacing operations, a single, reversible, flagger-controlled, minimum lane width of not less than ten feet (10') with an additional 2-feet of clearance from the curbs, shall be maintained for vehicular traffic.

The Contractor shall conduct his construction operations in such a manner so as to minimize the hazard, inconvenience and disruption to the public.

Irrespective of anything stated or implied elsewhere in the Contract Documents, residents shall be allowed to access or leave their residences at all times, other than brief transient delays, unless explicit authorization to the contrary is granted by the City.

#### **1.6 TRAFFIC CONTROL**

Traffic in the vicinity of the work shall be maintained and controlled using the provisions in Section 12 of the Standard Specifications, except as modified herein.

Whenever, in the opinion of the City, field conditions require additional or revised measures to safely control the movement of vehicles, bicycles or pedestrians, the Contractor shall implement such measures as directed by the City. No additional compensation shall be paid unless it was impossible to have anticipated the circumstances requiring the change.

#### **1.7 FLAGGING**

The following is added to Section 12-2.01 of the Standard Specifications:

At least one full-time flagger shall be provided whenever traffic flow must be halted. Temporary electric signals may be substituted for flagger control if approved in advance by the City. Flaggers shall be dedicated entirely to the task, without other duties diverting their attention.

Flagger control will be required wherever traffic must be diverted into an oncoming lane or onto the opposite side of the street, unless well-defined corridors in both directions are established by temporary or semi-permanent devices or markings, with sufficient advance signage, according to a Traffic Control Plan (see below) approved in advance by the City. If traffic cannot be stopped sufficiently before the work

area to allow opposing traffic to get past, or if a single flagger cannot safely stop traffic coming from both directions, flaggers will be required at both ends of the work area. When multiple flaggers are needed and they cannot see each other clearly enough to understand each others' actions, each must be provided with an electronic communications device capable of immediate contact with the other. If conditions require additional flaggers they shall be provided as needed.

#### **1.8 TRAFFIC HANDLING EQUIPMENT AND DEVICES**

The term "hours of darkness" shall also include periods when visibility is significantly impaired by dense fog or heavy rain.

#### **1.9 BARRICADES**

The following is added to Section 12-3.02 of the Standard Specifications:

All barricades shall have functioning warning lights. Barricades shall be placed no more than twenty (20) feet apart, center to center, or closer together where necessary or where directed by the City.

#### **1.10 FLASHING ARROW SIGNS**

The following is added to Section 12-3.03 of the Standard Specifications:

Flashing arrow signs (24-hour operation) shall be required by the City if deemed necessary for safe construction operations at busy streets.

#### **1.11 TEMPORARY MARKERS, MARKINGS AND SIGNAGE**

The following is added to Section 12-3 of the Standard Specifications: Immediately after resurfacing, short-term temporary pavement markers (floppies) and tape shall be installed where striping previously existed, prior to opening the street to traffic. Temporary pavement markers shall be day/night retro-reflective raised pavement markers as manufactured by Davidson Plastics company (or equal), conforming to the requirements of Section 85 of the State Standard Specifications and the MUTCD. Temporary markers and markings shall be monitored, maintained and replaced by the contractor as necessary until such time that permanent striping can be applied.

Center Line Delineation - At a minimum, temporary pavement markers shall be placed 24-feet on center, in the quantity and appropriate colors to delineate centerlines (two yellow markers spaced 3-inches apart) and travel lanes (single white marker). Edge lines, median lines and bike lanes shall not be marked.

Stop Bar Delineation - A minimum of five temporary markers in a row shall be placed in a straight line from the centerline to the gutter to designate the stop bar at all stop-controlled intersections.

Temporary Stop Signs, Stop Ahead Signs and Night-Time Type II barricades - At all stop signs where temporary delineation is being implemented, and at a distance approximately 50 to 100 feet prior to the stop sign, as approved by the City, the Contractor shall place and maintain temporary Type II barricades with functioning night-time warning lights. The barricade at the stop sign shall contain a temporary STOP sign and shall be secured to the stop sign pole with bailing wire or cable locks. The barricade 50 to 100 feet prior to the stop sign shall be placed just past driveways to avoid being blocked by parked cars and to be visible to approaching vehicles. Stop Ahead barricade shall also be secured in a manner approved by the City.

#### **1.12 GENERAL NOTICES**

The Contractor shall post written informational notices every 100' describing the work that will take place, the hours and approximate dates, any restrictions that will be imposed and a Contractor contact name and phone number. The wording of the notices shall be provided to the City for approval at least five working days prior to distribution, and must be posted at least 72 hours prior to commencing work. Failure to properly post notices shall be sufficient cause for the City to suspend the work until such notices are properly posted.

Notices shall be delivered to all dwelling units and/or places of business and shall be secured on barricades. If different notices are used for different areas, the Contractor shall take special care to deliver the appropriate notice to the correct location.

The first barricade of each block, on both sides of the street, in both directions of travel (4 total) shall contain, in addition to the "No Parking - Tow Away" sign, the advance notice flyer to provide property owners with a general description of the work to be done.

#### **1.13 SPECIFIC NOTIFICATIONS**

Notices for each street segment included in the Project shall include the specific dates upon which work will be performed on that particular street segment, including the working hours.

#### **1.14 PARKING RESTRICTIONS**

The Contractor may establish "No Parking" zones contiguous to the work area by posting No Parking signs. The City will enforce parking

restrictions only when the Contractor has posted the proper signs and has notified the City Police Department a minimum of 72 hours in advance of the required restriction period. Signs shall be posted on the front and back of Type II barricades, spaced no greater than 100-feet apart. Only the date in which the parking restriction is needed shall be printed (in 2-inch letters) on the sign. All signs must be removed immediately after the work requiring the parking restriction has been completed. Access to private property shall be maintained at all times.

#### **1.15 COORDINATION WITH GARBAGE COLLECTION**

The Contractor must coordinate with the City's garbage collection franchisee to avoid or resolve conflicts with the normal collection schedule.

#### **1.16 TRAFFIC CONTROL PLANS**

The Contractor shall submit a detailed, site-specific Traffic Control Plan (TCP) for the City's approval prior to commencing work that requires any temporary diversion of one or more lanes of traffic or any bicycle lane or pedestrian walkway.

The City's guidelines for Traffic Control Plans can be found on the City's website. at:

[http://www.menlopark.org/departments/trn/traffic control guidelines.pdf](http://www.menlopark.org/departments/trn/traffic%20control%20guidelines.pdf)  
Construction signs, lights, barricades, etc., shall conform to the 2003 Manual of Uniform Traffic Control Devices and the MUTCD 2003 California Supplement and Sheets T10 through T17 of the California Department of Transportation Standard Plans of May 2006, as appropriate to the location of work.

Any Traffic Control Plan must be submitted at least two weeks prior to the time that the traffic diversions are needed in order to allow the City time to specify changes prior to implementation without causing the work to be delayed.

#### **PART 2 - MATERIALS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
  - 1. Adversely effect human health or welfare,
  - 2. Unfavorably alter ecological balances of importance to human life,
  - 3. Effect other species of importance to humankind, or;
  - 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
  - 1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
  - 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
  - 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
  - 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
  - 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.



6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
7. Sanitary Wastes:
  - a. Sewage: Domestic sanitary sewage and human and animal waste.
  - b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

## **1.2 QUALITY CONTROL**

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

## **1.3 REFERENCES**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):  
33 CFR 328.....Definitions

## **1.4 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

- d. Description of the Contractor's environmental protection personnel training program.
  - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
  - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
  - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
  - h. Permits, licenses, and the location of the solid waste disposal area.
  - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
  - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
  - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

#### **1.5 PROTECTION OF ENVIRONMENTAL RESOURCES**

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period

of this contract. Confine activities to areas defined by the specifications and drawings.

- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
  2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
    - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
    - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
    - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
  3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
  4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
    - a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local //\_\_\_\_// (design year) storm. After each storm, pump

- the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
- b. Reuse or conserve the collected topsoil sediment as directed by the Resident Engineer. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.
  - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown. on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
  6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes
  7. Manage and control spoil areas on and off Government property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
  8. Protect adjacent areas from despoilment by temporary excavations and embankments.
  9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
  2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
  3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of California's Air Pollution Statute, Rule, or Regulation // and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic

- precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

SPEC WRITER NOTE: Insert additional information as needed when unique to a particular VA Medical Center site.

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
  - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80

PUMPS	75	BLASTING	--
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
  - c. Provide soundproof housings or enclosures for noise-producing machinery.
  - d. Use efficient silencers on equipment air intakes.
  - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
  - f. Line hoppers and storage bins with sound deadening material.
  - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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**SECTION 01 57 19.01**  
**TEMPORARY ENVIRONMENTAL CONTROLS - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

- A. This section specifies dust control and stormwater control within the city of Menlo Park right of way.
- B. This section also specifies requirements to assist the VA with compliance of the State General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, order 2009-0009-DWQ, for both onsite and offsite construction activity.

**1.2 RELATED SECTIONS:**

- A. Section 015723.01, TEMPORARY STORM WATER POLLUTION CONTROL - OFFSITE.

**1.3 DUST CONTROL**

The application of sufficient water or dust palliative to prevent dust shall be included in the Contract Prices paid for the various items of work. The rate and number of applications shall be at the initiative of the Contractor, as directed by the City.

Prior to using a dust palliative, the manufacturer's documentation of composition and MSDS must be approved by the City.

The Contractor may not use the water service of any particular address included in the construction location, unless approved in advance in writing by the City. The City will not consider any such request unless it is accompanied by written permission signed by the owner of the property whose service is to be used. Signatures of tenants will not be considered.

If the Contractor elects to use water from a fire hydrant, they must obtain a hydrant meter from the City of Menlo Park Water Department or California Water and pay the appropriate fees.

Care must be taken not to cause dust, soil materials, or debris to enter the City's storm drainage system.

The fine for failure to comply with the above requirement will be \$100.00 per occurrence.



#### 1.4 STORMWATER POLLUTION PREVENTION PLAN

- A. The State Water Resources Control Board (SWRCB) has promulgated a General Permit for Storm Water Discharges Associated with Construction Activities (Permit No. 2009-0009-DWQ), hereafter referred to as the General Permit. The General Permit authorizes the discharge of stormwater associated with construction activity from construction sites. The Contractor shall coordinate with the VA's Legally Responsible Person (LRP) in providing the necessary documents and data to assist the VA in obtaining coverage under the General Permit.
- B. Qualified SWPPP Developer (QSD): The Contractor shall obtain the services of a QSD. The scope of services of the QSD shall be to prepare the Permit Registration Documents (PRDs), for the VA to obtain coverage under the General Permit. Revisions to the PRDs during construction shall also be included in the QSD's scope, to account for changes made in the field. The PRDs shall address construction stormwater management for onsite work in the VA Property and for offsite work in the City of Menlo Park right of way. The PRDs to be developed include, but are not limited to, the following:
  - 1. Notice of Intent (NOI)
  - 2. Risk Assessment
  - 3. Site Map
  - 4. Storm Water Pollution Prevention Plan (SWPPP).
  - 5. Annual Fee
  - 6. Signed Certification Statement
- C. Qualified SWPPP Practitioner (QSP): The Contractor shall obtain the services of a QSP. The scope of services of the QSP shall be to implement and maintain the SWPPP during construction, to inspect and maintain Best Management Practices (BMPs) on the construction site, and to provide data and reports required to allow the VA to be in compliance with the General Permit. Construction Stormwater Management shall occur both onsite on the VA Property and offsite in the City of Menlo Park right of way. Some of the tasks in this section include, but are not limited to, the following:
  - 1. Implementation of a Construction Site Management Program, including monitoring, sampling, and reporting of site stormwater discharges.
  - 2. Rain Event Action Plans
  - 3. Site inspections, maintenance, and repair of BMPs and construction site management housekeeping

4. Site assessments of potential pollutant sources
5. Annual reports
6. Obtaining evidence of post-construction site stabilization.
7. Other tasks required to maintain compliance with the General Permit.

D. Submittals:

1. The Contractor's QSD, as a data submitter for the VA, shall electronically submit PRDs to the State Water Board Storm Water Multi-Application and Report Tracking System (SMARTS), to obtain coverage under the General Permit.
2. The Contractor's QSP, as a data submitter for the VA, shall electronically submit annual reports and other necessary documents to the State Water Board Storm Water Multi-Application and Report Tracking System (SMARTS), to maintain compliance under the General Permit, and to terminate coverage from the General Permit at the completion of construction.
3. The Contractor shall provide the City of Menlo Park with the WDID number, a copy of the SWPPP, and any other documents requested by the City related to coverage under the General Permit.

E. Requirements:

1. The Contractor shall complete the SWPPP and obtain a WDID prior to the start of construction.

F. References (QSP):

1. Numerous guidance documents and references are available for developing a SWPPP or for evaluating and selecting approved BMPs. The Contractor is strongly urged to consult these resources, or other appropriate resources for preparing the SWPPP and selecting BMPs. Templates for producing a SWPPP specifically for Construction Activities, guidance documents, and BMP handbooks are all available electronically from the following agencies and web sites:
  - a. The State Water Resources Control Board General Construction Storm Water Permit at:  
<http://www.swrcb.ca.gov/stormwtr/construction.html>
  - b. The California Storm Water Association web site at:  
<http://www.cabmphandbooks.com/>  
 California Department of Transportation (Caltrans) at:  
<http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm>
  - c. National Storm Water Best Management Practices (BMP) Database at:  
<http://www.bmpdatabase.org/>

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

----- E N D -----

**SECTION 01 57 23.01**  
**TEMPORARY STORM WATER POLLUTION CONTROL - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies temporary storm water pollution control measures within the City of Menlo Park right of way.

**1.2 RELATED SECTIONS:**

A. Section 015719.01, TEMPORARY ENVIRONMENTAL CONTROLS - OFFSITE.

**1.3 GENERAL:**

B. Storm water pollution control within the City of Menlo Park right of way shall conform Section 015719.01 of these project specifications, and to the 2006 edition of the Caltrans Standard Specifications, section 14, WATER POLLUTION CONTROL, as modified below.

**1.4 OFFSITE STORM WATER INLETS**

Prior to start of construction, the Contractor shall cover or barricade storm water inlets and catch basins using storm water pollution prevention Best Management Practices (BMPs) measures, such as filter fabric, straw bales, straw wattles and bags and fine gravel dam to keep debris or water pollutants out of the storm drain system. When protecting an inlet or a catch basin, the Contractor shall ensure that the entire opening is covered. The Contractor shall shovel, absorb or vacuum saw cut slurry, and pick up waste before moving to the next location or at the end of each working day, whichever is sooner. If saw cut slurry enters catch basins, the Contractor shall remove the slurry from the storm drain system immediately.

**1.5 CONSTRUCTION**

Section 14-1.03A, "General", of the Standard Specifications is replaced with the following:

A. Install facilities and devices used for water pollution control practices before performing work activities. Install soil stabilization materials for water pollution control practices in all work areas that are inactive or before storm event as described herein. Repair or replace water pollution control practices within twenty-four (24) hours of discovering any damage, unless a longer period is authorized in writing. The City does not pay cleanup, repair, removal,

disposal, or replacement of water pollution control practices due to improper installation or neglect.

- B. The Contractor may request changes to the water pollution control work or the City may order changes to the water pollution control work. Changes may include additional or new water pollution control practices.
- C. The Contractor must retain a copy of the Storm Water Pollution Prevention Plan (SWPPP) onsite at all times.
- D. Previously Used Equipment - The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the U.S. Department of Agriculture (USDA) jurisdictional office for additional cleaning requirements.
- E. Resources - The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify and flag the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.
- F. Work Area Limits
  - 1. Work shall be limited to areas within public right-of-ways and storage and staging areas designated by the City. Isolated areas within the general work area, which are to be saved and protected shall also be marked or fenced prior to the start of construction. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects and have attended the training provided by the city appointed biologist.

G. Other Protection Measures

1. Traffic Restrictions: Traffic will be restricted to designated access roads and within the designated work area. Vehicle speeds will be restricted to 20 miles per hour or less except on county roads and state and federal highways. Night driving will be limited to the extent practicable. The Contractor will notify the City if night construction is unavoidable.
2. Dust: Dust abatement will be used in all construction areas, especially adjacent to the restricted areas identified by the City or its representatives. No chemicals will be used without written permission from the City.
3. Trash Disposal: Food-related trash will be deposited in closed containers and removed from the project site daily to avoid attracting wildlife to construction areas.
4. Pets and Firearms: Pets and firearms will not be permitted on construction sites.
5. Report Wildlife Injuries: All wildlife injuries or mortalities, whether related or unrelated to construction activities, will be reported to the City or its representatives. This does not apply to rabbits or squirrels.
6. Special-Status Birds: Nonessential construction activities and blasting within approximately 0.5 miles of any active bird nest may be prohibited during breeding season.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 01 74 00.01**  
**WASTE MANAGEMENT - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies construction waste management requirements within the city of Menlo Park right of way.

**1.2 CONSTRUCTION WASTE MANAGEMENT**

The Contractor shall minimize the creation of construction and demolition waste on the job site. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination, shall be minimized. Waste materials as shall be reused, salvaged, or recycled to the maximum extent practicable. Waste disposal in landfills shall be minimized.

**1.3 DIVERSION GOAL**

One hundred percent (100%) of inert wastes, and at least fifty percent (50%) of the remaining construction and demolition debris shall be diverted from landfills.

Inert wastes, such as concrete, brick, rock, asphalt, and soil not intended for on-site use, shall be taken to a facility for reuse or recycling.

Other mixed construction & demolition (C&D) wastes shall be taken to a facility with a C&D sorting program, as listed in the Construction and Demolition Debris Recycling Guide referenced below, if additional recycling is needed in order to meet the requirements set forth in this Section. If debris boxservice is used, the debris boxes must be taken to a C&D sorting facility if materials are not separated on-site for recycling.

The Contractor has the option of separating on-site for recycling non-inert materials, such as cardboard, paper, wood, metals, green waste, new gypsum wallboard, tile, porcelain fixtures, and other easily recycled materials, and directing them to recycling facilities and taking the remaining mixed waste (but no more than 50% by weight or yardage) to a facility for disposal. If waste is taken for disposal, documentation must be provided to show that 50% of C&D wastes (in addition to 100% of inert wastes) have been diverted.

#### **1.4 REFERENCES AND RESOURCES**

- A. Construction and demolition debris recycling guide is available online at [http://www.recycleworks.org/pdf/cd\\_office\\_guide.pdf](http://www.recycleworks.org/pdf/cd_office_guide.pdf) or contact the county of San Mateo's Recycleworks hotline at (888) 442-2666. The contractor's attention is directed to Appendix A for the county of San Mateo waste management plan form and the waste management daily transport report.

#### **1.5 WASTE MANAGEMENT PLAN & DAILY TRANSPORT REPORT**

The Contractor shall submit a Waste Management Plan shall be submitted to the City or his/her designee for approval within five (5) WORKING DAYS after pre-construction conference. The Waste Management Plan shall include a description of how the Contractor will meet the requirements of this Contract and shall include a list of disposal and recycling facilities where waste materials will be taken (Blue Line, Zanker Road, Newby Island, etc., or any other local user of the waste materials), a description of what will be taken to each facility (inert wastes, metals, wood, glass, plastics, mixed waste, etc.), a description of the means of transportation of recyclable materials (whether materials will be site-separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and designated center, or whether mixed materials will be collected by a waste hauler and removed from the site), an estimate of how often bins will need to be emptied, and an estimated amount (weight, yardage, etc.). Approval will be granted if the plan shows:

- One hundred percent (100%) of inert wastes being reused or recycled and at least fifty percent (50%) of C&D wastes being reused or recycled; or
- All waste that is not separated on-site for recycling is sent to a mixed C& D sorting facility for recycling.

#### **1.6 WASTE MANAGEMENT PLAN IMPLEMENTATION**

##### **A. Plan Distribution:**

The contractor shall provide copies of the approved Waste Management Plan to the project superintendent and each subcontractor.

##### **B. Instruction:**

The contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.



C. Meetings:

The contractor shall conduct monthly Construction Waste Management meetings or at least one meeting for projects with length of less than twenty (20) working days. Meetings shall include subcontractors affected by the Waste Management Plan. At a minimum, waste management goals and issues shall be discussed at regularly scheduled project meetings.

D. Separation Facilities:

The contractor shall designate a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid co-mingling of materials. Bins shall not be stored within the City Right of Way unless approved in writing in advance by the City. All bins used shall be protected during non-working hours from offsite contamination.

E. Materials Handling Procedures:

Materials to be recycled shall be protected from contamination, and shall be handled, stored and transported in a manner that meets the requirements set by the designated facilities for acceptance.

F. Hazardous Wastes:

Hazardous wastes shall be separated, stored, and disposed of according to local regulations. Unless specified in other sections, the City is not aware of any hazardous wastes within the project site. Contractor shall notify the City if hazardous waste is encountered.

G. Reporting:

The Contractor shall complete Waste Management Daily Transport reports for submittal to the City. The Contractor shall contact the City to obtain the necessary reporting forms.

The Contractor shall submit documentation to the City which demonstrates compliance with the approved Waste Management Plan. Such reports shall include, at a minimum, a summary of waste materials recycled, salvaged and disposed of for the Project. Documentation (receipts/scale tickets, waybills) showing the quantities and types of materials diverted and disposed shall be submitted with the Waste Management Daily Transport Reports signed by both the Contractor and the City. A Notice of Completion will not be filed for the project until all reports as required for the project are submitted and approved.

The summary and documentation shall contain the following information:

- For each material recycled and salvaged from the Project, include the amount (in cubic yards or tons, or in the case of salvaged items, state quantities by number, type and size of items) and the destination (i.e., recycling facility, used building materials yard or other local users).
- For each material landfilled or incinerated from the Project, include the amount (in cubic yards or tons) of material and the identity of the landfill, incinerator and/or transfer station.
- Documentation shall consist of photocopies of receipts and weight tags or other records of measurement or equivalent documentation from recycling companies, deconstruction contractors, and landfill and disposal companies. The contractor shall sign the completed Waste Management Plan to certify its accuracy prior to submitting it to the City.

#### **1.7 SITE CLEAN-UP**

Upon completion of work in a particular area, the Contractor shall clean the project location and vicinity and return them to their original condition within two (2) working days. Failure by the Contractor to clean and restore the areas shall be deemed as non-compliance with this section and liquidated damages in the amount of Five-Hundred (\$500.00) dollars per calendar day shall be assessed for each and every calendar day the areas remain unclean or un-restored.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

## **1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.
- C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.

## **1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.
  - 4. Construction error.
  - 5. Over ordering.
  - 6. Weather damage.
  - 7. Contamination.
  - 8. Mishandling.
  - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

### 1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  - 4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

## **1.6 APPLICABLE PUBLICATIONS**

- A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):  
LEED Green Building Rating System for New Construction

## **1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

### **3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.



- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

### **3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

- - - E N D - - -

**SECTION 02 21 00**  
**SITE SURVEYS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the gathering of research documents, performance of a topographic survey and preparation of a topographic survey map.

**1.2 DEFINITIONS**

- A. Professional Land Surveyor: One who possesses a valid state license as a "Professional Land Surveyor" from the state in which they practice.
- B. Professional Civil Engineer: One who possesses a valid state license as a "Professional Civil Engineer" from the state in which they practice. For this section, the term "surveyor" shall also include Professional Civil Engineers authorized to practice Land Surveying under the laws of the state in which they practice.

**PART 2 - EXECUTION**

- A. The surveyor shall research available public records for all mapping, monumentation, plats, governmental surveys etc. that may pertain to the subject property. Research all applicable public utilities for substructure data such as sewers, storm drains, water lines, electrical conduits etc.
- B. The survey shall be performed on the ground in accordance with the current "Accuracy Standards for Land Title Surveys" as adopted, from time to time, by the American Congress on Surveying and Mapping, the National Society of Professional Surveyors, and the American Land Title Association.
- C. The surveyor, when applicable, shall consult with the project Architect to determine scale of plat or map and size of drawings.
- D. The surveyor shall furnish two sets of prints of the plat or map of survey and an electronic CADD file. If the plat or map of survey consists of more than one sheet, the sheets shall be numbered, the total number of sheets indicated and the match lines be shown on each sheet.
- E. On the plat or map, the survey boundary shall be drawn to a convenient scale, or the scale designated by the Architect, with the scale clearly indicated. A graphic scale, shown in feet or meters or both, shall be included. A north arrow shall be shown and when practicable, the plat or map of survey shall be oriented so that north is at the top of the drawing. Symbols or abbreviations used shall be identified on the face

of the plat or map by use of a legend or other means. Supplementary or exaggerated diagrams shall be presented accurately on the plat or map where dimensional data is too small to be shown clearly at full scale. The plat or map shall be 30 by 42 inches.

F. The survey shall contain the following applicable information:

1. The name, address, telephone number, and signature of the Professional Land Surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.
2. The survey drawing(s) submitted shall bear the following certification adjacent to the Engineer's official seal:  
 "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to furnish complete and accurate information."
3. Vicinity map showing the property surveyed in reference to nearby highways or major street intersections.
4. Flood zone designation (with proper annotation based on Federal Flood Insurance Rate Maps or the state or local equivalent, by scaled map location and graphic plotting only).
5. Land area as defined by the boundaries of the legal description of the surveyed premises.
6. All data necessary to indicate the mathematical dimensions and relationships of the boundary represented by bearings and distances, and the length and radius of each curve, together with elements necessary to mathematically define each curve. The point of beginning of the surveyor's description and the basis of bearings shall also be shown.
7. When record bearings or angles or distances differ from measured bearings, angles or distances, both record and measured bearings, angles, and distances shall be clearly indicated. If the record description fails to form a mathematically closed figure, the surveyor shall so indicate.
8. Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets in urban or suburban areas, together with recovered lot corners and evidence of lot corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of streets and highways abutting the property surveyed and widths of rights of way shall be given. Observable evidence of access (or lack thereof) to

- such abutting streets or highways shall be indicated. Observable evidence of private roads shall be so indicated. Streets abutting the premises, which have been described in Record Documents, but not physically opened, shall be shown and so noted.
9. The identifying titles of all recorded plats, filed maps, right of way maps, or similar documents which the survey represents, wholly or in part, with their appropriate recording data. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document which has been delivered to the surveyor. Contiguity, gores, and overlaps along the exterior boundaries of the survey premises, where ascertainable from field evidence or Record Documents, or interior to those exterior boundaries, shall be clearly indicated or noted. Where only a part of a recorded lot or parcel is included in the survey, the balance of the lot or parcel shall be indicated.
  10. All evidence of found monuments shall be shown and noted. All evidence of monuments found beyond the surveyed premises on which establishment of the corners of the survey premises are dependent, and their application related to the survey shall be indicated.
  11. The character of any and all evidence of possession shall be stated and the location of such evidence carefully given in relation to both the measured boundary lines and those established by the record. An absence of notation on the survey shall be presumptive of no observable evidence of possession. The term "possession" does not imply "ownership".
  12. The location of all buildings upon the plot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. If there are no buildings, so state. Proper street numbers shall be shown where available.
  13. All easements evidenced by a Record Document which have been delivered to the surveyor shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this affect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads, rights-of-ways, water courses, drains, telephone, telegraph, or electric lines, water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. Surface indications, if any, or of underground easements and/or servitudes shall also be shown.

14. The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted. Without expressing a legal opinion, physical evidence of all encroaching structural appurtenances and projections, such as fire escapes, bay windows, windows and doors that open out, flue pipes, stoops, eaves, cornices, areaways, stoops, trip, etc., by or on adjoining property or on abutting streets, on any easement or over setback lines shown by Record Documents shall be indicated with the extent of such encroachment or projection.
15. Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the surveyor must so indicate on the plat or map with appropriate measurements.
16. Location, alignment and dimensions of all roads, curbs, walks, parking and paved areas abutting the subject land. Indicate road centerlines with true bearings and lengths by 50 foot stationing. Describe curves by designating the points of curvature and tangency by station. Include all curve data as well a location of radius and vertex points. Elevations on 50' centers on centerline of roads, edges of roads and top and bottom of curbs.
17. As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.
18. Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown. When a property surveyed contains a natural water boundary, the surveyor shall measure the location of the boundary according to appropriate surveying methods and note on the plat or map the date of the measurement and the caveat that the boundary is subject to change due to natural causes and that it may or may not represent the actual location of the limit of title. When the surveyor is aware of changes in such boundaries, the extent of those changes shall be identified.
19. Contours at a minimum interval of 1 foot. Base vertical control on the permanent (not assumed) National Geodetic Survey (NGS) or VA Medical Center Bench Mark. Note location, description and datum.
20. Identify and show if possible, setback, height, and floor space area restrictions of record or disclosed by applicable zoning or building

codes (in addition to those recorded in subdivision maps). If none, so state.

21. Exterior dimensions of all buildings at ground level. Show square footage of exterior footprint of all buildings at ground level and gross floor area of all buildings.
22. Measured height of all buildings above grade at a defined location. If no defined location is provided, the point of measurement shall be shown.
23. Elevations at each entrance to buildings, service docks, building corners, steps, ramps and grade slabs.
24. Substantial, visible improvements (in addition to buildings) such as signs, parking areas, swimming pools, etc.
25. Parking areas and, if striped, the striping and the type (eg. handicapped, motorcycle, regular, etc.) and number of parking spaces.
26. Indication of access to a public way such as curb cuts and driveways.
27. Location of utilities existing on or serving the surveyed property as determined by observed evidence together with plans and markings provided by utility companies, and other appropriate sources (with references as to the source of information. Locate and show all fire hydrants located within 500 feet of the subject property.
28. Railroad tracks and sidings.
29. Manholes, catch basins, valve vaults or other surface indications of subterranean uses.
30. Wires and cables (including their function) crossing the survey premises, all poles on or within ten feet of the surveyed premises, and the dimensions of all cross-wires or overhangs affecting the surveyed premises.
31. Utility company installations on the surveyed premises.
32. Names of adjoining owners of platted lands.
33. Observable evidence of earth moving work, building construction or building additions within recent months.
34. Any changes in street right-of-way lines either completed or proposed, and available from the controlling jurisdiction. Observable evidence of recent street or sidewalk construction or repairs.
35. Observable evidence of site use as a solid waste dump, sump or sanitary landfill.
36. All trees with a minimum diameter of 6" measured at 48" above the base of the tree. Perimeter outline only of thickly wooded areas with description of predominant vegetation.

- - - E N D - - -

**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

**1.2 RELATED WORK:**

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTHWORK.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- F. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
- G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
- I. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
  - 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
  - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Contracting Officer's Representative. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Contracting Officer's Representative's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.



- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES:**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 DEMOLITION:**

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
  - 1. As required for installation of new utility service lines.
  - 2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer's Representative. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer's Representative. When Utility lines are encountered that are not indicated on the drawings, the Contracting Officer's Representative shall be notified prior to further work in that area.

**3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Contracting Officer's Representative. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 02 41 00.01**  
**DEMOLITION - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies demolition and removal of existing improvements within the City of Menlo Park right of way.

**1.2 GENERAL:**

- A. Demolition of facilities within the City of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, Section 15, EXISTING HIGHWAY CONDITIONS, as modified below.

**1.3 DESCRIPTION:**

- A. The word "highway" in the first sentence of Section 15-1.01 of the Standard Specifications is changed to "structures or".

**1.4 PRESERVATION OF PROPERTY:**

- A. The following is added to Section 15-1.02 of the Standard Specifications:
  - 1. Contractor shall video the existing surfaces to be affected by the work, as well as the immediate surroundings including street trees, signs, electrolier poles, fences and other structures adjacent to the work, prior to commencing work. In addition, still photographs shall be taken to show any existing physical damage in detail. A copy of that record shall be given to the City prior to beginning the work. If questions arise as to the responsibility of the Contractor for damage after the work has been done, the Contractor shall be held responsible unless there is unmistakable photographic or video evidence to the contrary.
  - 2. Care must be taken by the Contractor and all those whom he utilizes in the work, either directly or indirectly, to prevent damage to anything in the vicinity of the work. Particular attention is directed to trees, streambeds and banks, private property (such as plantings, fences, mailboxes, driveways, vehicles), public facilities (such as adjacent streets, curbs, gutters, sidewalks, speed bumps, speed humps and speed tables, monuments, signs, poles and supports, electrical and communications equipment, valve covers, manholes, storm drainage facilities, bridges and culverts, and railroad equipment.

**1.5 LANDSCAPE IRRIGATION SYSTEMS:**

- A. When installation of the Work in accordance with the Plans unavoidably requires cutting private sprinkler lines and/or removing components, the Contractor shall repair the system so it continues to irrigate the remaining landscaping as closely as possible to the way it had prior to the work in accordance with Section 20 herein.

**1.6 DRIVEWAYS, WALKWAYS, PATIOS, OR OTHER PRIVATE HARDSCAPE:**

- A. When installation of the Work in accordance with the Plans unavoidably requires removal of a portion of a private hardscape improvement, the Contractor shall neatly and cleanly remove the improvement as closely as possible to the edge of the work being installed, and he shall align the new work to the edge of the existing improvement. If the existing surface is too far out of alignment with the new work for a simple field-adjustment, the City shall direct the Contractor how to establish a transition. If the existing hardscape consists of masonry or paving units, the Contractor shall protect them from damage until the work is accepted by the City.
- B. This section shall not apply to damage caused by the Contractor due to poor workmanship or lack of sufficient precaution; such damage shall be repaired - at the Contractor's sole expense - to the satisfaction of the City.

**1.7 FENCES:**

- A. The Contractor shall take care to protect all private fences from damage. The Contractor shall replace any fences damaged during construction to the satisfaction of the City.

**1.8 REMOVING ASPHALT PAVEMENT:**

- A. The following is added to Section 15 of the Standard Specifications:
  - 1. Removal Methods:
    - a. Saw-Cutting:
      - i. Where portions of existing A.C. pavement are to be removed, saw-cutting the edges shall only be allowed when explicitly directed by the Plans or these Project specifications or by written authorization of the City.
    - b. Cold-Milling (Cold-Planing):
      - i. Where portions of a roadway surface are removed to the depths indicated by the plans they must be removed by cold-milling unless directed by the Plans, Standard Specifications, or these Project specifications, or in writing by the City, to be otherwise removed. The requirements presented in Section 39 of

these Project specifications, pertaining to Cold-Milling, apply here to pavement removal.

c. Jack-Hammering:

- i. A.C. sidewalk, and small areas of A.C. roadway pavement, may be removed by pneumatic jack-hammer with a wide spade bit.

2. Protecting Adjacent Pavement:

- a. Any asphalt or concrete surface not specified in the Contract Documents to be removed, which is cracked or otherwise damaged as a result of the Contractor's operations, shall be removed to a line established by the City and shall be replaced with new matching material, entirely at the Contractor's expense.

3. Disposal:

- a. Removed material shall become the property of the Contractor, and shall be properly disposed of in accordance with the approved Waste Management Plan described in Section 017400.01 of these project specifications.

4. Clean-Up and Site Maintenance:

- a. While pavement is being removed, debris being generated must be continuously removed by sweeping or vacuuming or both. Loose material must be prevented from entering the storm drain system.
- b. Whenever a cold-milling machine is in use, a mechanical sweeper shall also be provided, and shall continuously clean adjacent to and immediately behind the milling machine, except that the mechanical sweeper shall not be used on exposed base rock surfaces. Manual sweeping shall also be done as needed to pick up whatever the mechanical sweeper fails to remove. The off-haul routes taken by dump trucks loaded with grindings or excavation spoils shall also be swept.

**1.9 CLEARING AND GRUBBING:**

A. Description:

- 1. The following is added to Section 16-1.01 of the Standard Specifications:

- a. This work shall consist of removing vegetation, railroad ties, large rocks, embedded wood or metal objects, scraps of concrete, masonry, glass, plastics or other non-natural matter, and other objectionable material from the work site. This section shall also apply to trees, stumps or bushes, or their roots, that substantially interfere with the proper installation of work described elsewhere in the Plans or the Project specifications. Minor roots or vegetation occasionally encountered shall be removed as directed by the City. Where indicated in the plans,

after removing the existing shrubs and their roots, the Contractor shall fill up ground with native soil, including holes, up to existing grade of the Asphalt Concrete pathway.

B. Preservation of Trees:

1. The following is added to Section 16-1.02 of the Standard Specifications:

- a. All roots over 2" in diameter shall be pruned under the direct supervision of the City Arborist.
- b. Prior to starting any demolition, cold-milling, saw-cutting or paving work, the Arborist shall examine the entire work zone and identify any trees that might likely be affected by the work. The Contractor shall notify the Arborist and City at least three workdays prior to starting work.
- c. The Arborist will provide direction and shall be present whenever large roots or branches are to be pruned or removed. The Contractor shall notify the Arborist of the work locations that have been or will be exposed and shall coordinate inspection of exposed tree roots. The Arborist shall provide guidance on which roots may be cut and which must be preserved.
- d. The Arborist may provide general direction as to what size roots of any specific tree species can be cut without the Arborist's immediate oversight. Roots smaller than that size may be cut by the Contractor, when encountered, in accordance with specific instructions provided by the Arborist. This will be monitored by the City.
- e. When tree roots are encountered that are greater than permitted by the Arborist to be cut at the Contractor's discretion, the Contractor shall immediately notify the Arborist and the City, and shall excavate further only as directed by the City.
- f. Roots shall be cut cleanly using a saw, loppers or hand shears prior to use of the backhoe or other excavator to remove material from the site. At no time shall mechanized equipment be used to remove live roots.
- g. If exposed roots cannot be covered within one week, cut ends shall be covered with petroleum jelly and the exposed portion shall be wrapped with burlap and kept moistened.
- h. Removal of existing paving, sidewalk, curb or gutter in the immediate vicinity of any species of oak shall only be done by handwork; mechanical loading equipment shall not be used until the paving or concrete has been manually stripped away.

- i. If the arborist recommends against pruning roots of a particular tree, then the City shall direct the Contractor as to how to accommodate those particular roots.
  - j. The contractor shall not perform root pruning on both sides of the tree within a 12-month period without authorization from the City.
  - k. Removal of stumps of trees formerly cut down, or of trees to be removed as part of this Contract, may be done using excavation equipment or a grinder, as directed by the City or as described on the Plans or elsewhere in the Project specifications.
  - l. See Section 39 or Section 73 of these Project specifications for Subgrade and Base Reconstruction following removal of roots.
  - m. The following are prohibited when working near trees:
    - a. DO NOT:
      - i. secure cable, chain or rope to trees or shrubs.
      - ii. discharge exhaust into foliage.
      - iii. allow fires under and adjacent to trees or other plants.
      - iv. cut, break, skin or bruise roots, trunks or branches.
      - v. store material, stockpile soil or spoils, or park vehicles within tree drip lines or in planted areas.
      - vi. allow run-off or spillage of damaging materials in the vicinity of root systems.
- C. Construction:
- 1. Section 16-1.03 of the Standard Specifications is replaced with the following:
    - a. The work site shall be cleared and grubbed to the extent indicated on the Plans or elsewhere in these Project specifications, or as directed by the City, but not beyond. The Contractor shall be held financially responsible for damage or disturbance beyond the limits established by the Contract Documents or by the City.
    - b. When work to be done encounters private improvements in the public Right of Way, refer to Section 15 of these Project specifications.
    - c. Existing sand, soil and organic debris covering the pavement shall be entirely removed to the edge of pavement, and beyond the edge the remaining material shall be cut to a slope not exceeding 2:1 (H:V). The removed material shall be disposed of along with the material removed for construction of the new work on the north side of the street.
- D. Removal and Disposal of Materials:
- 1. Section 16-1.04 of the Standard Specifications is replaced with the following:

- a. Removed material shall become the property of the Contractor, and shall be properly disposed of in accordance with the approved Waste Management Plan described in Section 13 of these Project specifications. No such materials may be buried on-site.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

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**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

**1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:**

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by Contracting Officer's Representative. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

**1.4 TOLERANCES:**

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

**1.5 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
  1. Reinforcing Steel.
  2. Cement.
- D. Manufacturer's Certificates:
  1. Abrasive aggregate.
  2. Lightweight aggregate for structural concrete.
  3. Air-entraining admixture.
  4. Chemical admixtures, including chloride ion content.
  5. Waterproof paper for curing concrete.
  6. Liquid membrane-forming compounds for curing concrete.
  7. Non-shrinking grout.
  8. Liquid hardener.
  9. Waterstops.
  10. Expansion joint filler.
  11. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement-fly ash ratio curves, concrete mix ingredients, and admixtures.

- G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by Contracting Officer's Representative (see FORMWORK) or Contractor.

#### **1.7 DELIVERY, STORAGE, AND HANDLING:**

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

#### **1.8 PRE-CONCRETE CONFERENCE:**

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
  - 1. Submittals.
  - 2. Coordination of work.
  - 3. Availability of material.
  - 4. Concrete mix design including admixtures.
  - 5. Methods of placing, finishing, and curing.
  - 6. Finish criteria required to obtain required flatness and levelness.
  - 7. Timing of floor finish measurements.
  - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Contracting Officer's Representative; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.

- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

#### 1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 117-10.....Specifications for Tolerances for Concrete Construction and Materials and Commentary
  - 211.1-91(R2009).....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
  - 211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
  - 214R-11.....Guide to Evaluation of Strength Test Results of Concrete
  - 301-10.....Standard Practice for Structural Concrete
  - 304R-00(R2009).....Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - 305.1-06.....Specification for Hot Weather Concreting
  - 306.1-90(R2002).....Standard Specification for Cold Weather Concreting
  - 308.1-11.....Specification for Curing Concrete
  - 309R-05.....Guide for Consolidation of Concrete
  - 318-11.....Building Code Requirements for Structural Concrete and Commentary
  - 347-04.....Guide to Formwork for Concrete
  - SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
- A135.4-2004.....Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
- A82/A82M-07.....Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
  - A185/185M-07.....Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
  - A615/A615M-09.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A653/A653M-11.....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A706/A706M-09.....Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

A767/A767M-09.....Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-07.....Standard Specification for Epoxy Coated Reinforcing Steel Bars

A820-11.....Standard Specification for Steel Fibers for Fiber Reinforced Concrete

A996/A996M-09.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

C31/C31M-10.....Standard Practice for Making and Curing Concrete Test Specimens in the field

C33/C33M-11A.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-12.....Standard Specification for Ready Mixed Concrete

C143/C143M-10.....Standard Test Method for Slump of Hydraulic Cement Concrete

C150-11.....Standard Specification for Portland Cement

C171-07.....Standard Specification for Sheet Materials for Curing Concrete

C172-10.....Standard Practice for Sampling Freshly Mixed Concrete

C173-10.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-07.....Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

C231-10.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C260-10.....Standard Specification for Air Entraining Admixtures for Concrete

C309-11.....Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

C330-09.....Standard Specification for Lightweight Aggregates for Structural Concrete

- C494/C494M-11.....Standard Specification for Chemical Admixtures  
for Concrete
- C618-12.....Standard Specification for Coal Fly Ash and Raw  
or Calcined Natural Pozzolan for Use in Concrete
- C666/C666M-03(R2008)....Standard Test Method for Resistance of Concrete  
to Rapid Freezing and Thawing
- C881/C881M-10.....Standard Specification for Epoxy Resin Base  
Bonding Systems for Concrete
- C1107/1107M-11.....Standard Specification for Packaged Dry,  
Hydraulic-Cement Grout (Non-shrink)
- C1315-11.....Standard Specification for Liquid Membrane  
Forming Compounds Having Special Properties for  
Curing and Sealing Concrete
- D6-95(R2011).....Standard Test Method for Loss on Heating of Oil  
and Asphaltic Compounds
- D297-93(R2006).....Standard Methods for Rubber Products Chemical  
Analysis
- D412-06AE2.....Standard Test Methods for Vulcanized Rubber and  
Thermoplastic Elastomers - Tension
- D1751-04(R2008).....Standard Specification for Preformed Expansion  
Joint Filler for Concrete Paving and Structural  
Construction (Non-extruding and Resilient  
Bituminous Types)
- D4263-83(2012).....Standard Test Method for Indicating Moisture in  
Concrete by the Plastic Sheet Method.
- D4397-10.....Standard Specification for Polyethylene Sheeting  
for Construction, Industrial and Agricultural  
Applications
- E1155-96(R2008).....Standard Test Method for Determining  $F_F$  Floor  
Flatness and  $F_L$  Floor Levelness Numbers
- F1869-11.....Standard Test Method for Measuring Moisture  
Vapor Emission Rate of Concrete Subfloor Using  
Anhydrous Calcium Chloride.
- E. American Welding Society (AWS):
- D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI):
- Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
- Report On.....Concrete Sealers for the Protection of Bridge  
Structures

## H. U. S. Department of Commerce Product Standard (PS):

PS 1.....Construction and Industrial Plywood

PS 20.....American Softwood Lumber

## I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

**PART 2 - PRODUCTS:****2.1 FORMS:**

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
  - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
  - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
  - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

**2.2 MATERIALS:**

- A. Portland Cement: ASTM C150 Type II. Conform to Caltrans Standard Specifications, Section 90-1.02B(2).

- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent. AASHTO M295, Class F. Conform to Caltrans Standards Specifications, Section 90-1.02B(3).
- C. Coarse Aggregate: ASTM C33. Conform to Caltrans Standard Specifications, Section 90-1.02C.
- D. Fine Aggregate: ASTM C33. Conform to Caltrans Standard Specifications, Section 90-1.02C.
- E. Aggregate Gradings: Conform to Caltrans Standard Specifications, Section 90-1.02C(4).
- F. Mixing Water: Fresh, clean, and potable. Conform to Caltrans Standard Specifications, Section 90-1.02D.
- G. Admixtures: Conform to Caltrans Standard Specifications, Section 90-1.02E
  - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
  - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
  - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
  - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
  - 5. Air Entraining Admixture: ASTM C260.
  - 6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
  - 7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Reinforcing Steel: ASTM A615, deformed, grade 40 or 60.
- I. Welded Wire Fabric: ASTM A185 or ASTM A497.
- J. Reinforcing Bars to be Welded: ASTM A706.
- K. Galvanized Reinforcing Bars: ASTM A767.
- L. Epoxy Coated Reinforcing Bars: ASTM A775.
- M. Cold Drawn Steel Wire: ASTM A82.



- N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- R. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- S. Non-Shrink Grout:
  - 1. ASTM C1107, in conformance with Caltrans Standard Specification 15-5.07B and 40-1.02J. Pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days.
- T. Adhesive Binder: ASTM C881.
- U. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
- V. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
- W. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

### **2.3 CONCRETE MIXES:**

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
  - 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
  - 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m<sup>3</sup> (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement-fly ash ratio, and consistency of each cylinder in terms of slump.
  - 3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.

4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify Contracting Officer's Representative immediately when change in source is anticipated.
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Contracting Officer's Representative or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Contracting Officer's Representative may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons. Fly ash shall not be used in high-early mix design.

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m <sup>3</sup> (lbs/c. yd)	Max. Water Cement Ratio
35 (5000) <sup>1,3</sup>	375 (630)	0.45	385 (650)	0.40
30 (4000) <sup>1,3</sup>	325 (550)	0.55	340 (570)	0.50
25 (3000) <sup>1,3</sup>	280 (470)	0.65	290 (490)	0.55
25 (3000) <sup>1,2</sup>	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
  2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
  3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
  4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II. Refer to Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS, for slump used for concrete walks, curbs, gutters, and pavements.

**TABLE II - MAXIMUM SLUMP, MM (INCHES)\***

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM

C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.
- K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Contracting Officer's Representative may require any

one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Contracting Officer's Representative may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Contracting Officer's Representative may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Contracting Officer's Representative.

#### **2.4 BATCHING AND MIXING:**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Contracting Officer's Representative. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Contracting Officer's Representative for consultation during

batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Contracting Officer's Representative.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
  - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Contracting Officer's Representative approves their reuse.
  - 2. Provide forms for concrete footings unless Contracting Officer's Representative determines forms are not necessary.
  - 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
  - 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
  - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
  - 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than  $1/270$  of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints

in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
  - 1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
  - 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
  - 1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
  - 2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
  - 3. Do not install sleeves in beams, joists or columns except where shown or permitted by Contracting Officer's Representative. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Contracting Officer's Representative, and require no structural changes, at no additional cost to the Government.

4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

**3.2 PLACING REINFORCEMENT:**

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
  1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
  2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.



3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
  2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength ( $f_y$ ) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
    - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
    - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
    - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Contracting Officer's Representative.
  3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength ( $f_y$ ) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
    - a. Initial qualification: In the presence of Contracting Officer's Representative, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
    - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Contracting Officer's Representative.

- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

### **3.3 CONSTRUCTION JOINTS:**

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Contracting Officer's Representative.

### **3.4 EXPANSION JOINTS AND CONTRACTION JOINTS:**

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

### **3.5 PLACING CONCRETE:**

- A. Preparation:
  - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
  - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
  - 3. Have forms and reinforcement inspected and approved by Contracting Officer's Representative before depositing concrete.
  - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
  - 1. Preparing surface for applied topping:

- a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
  - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
  - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of Contracting Officer's Representative.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD hours.
- 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
  - 3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) WEATHER.
    - 1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
    - 2. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
    - 3. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
    - 4. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

5. Concrete on metal deck:

- a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

- 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

- 1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
- 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

**3.6 HOT WEATHER:**

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Contracting Officer's Representative.

**3.7 COLD WEATHER:**

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Contracting Officer's Representative.

**3.8 PROTECTION AND CURING:**

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature

drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Contracting Officer's Representative.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m<sup>2</sup>/L (400 square feet per gallon) on steel troweled surfaces and 7.5m<sup>2</sup>/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

### **3.9 REMOVAL OF FORMS:**

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
  1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
  2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of

minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

- C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

### **3.10 CONCRETE SURFACE PREPARATION:**

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

### 3.11 CONCRETE FINISHES:

#### A. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Contracting Officer's Representative and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless Contracting Officer's Representative determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.

6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Contracting Officer's Representative from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
  - a. Areas covered with carpeting, or not specified otherwise in b. below:
    - 1) Slab on Grade:
 

a) Specified overall value	$F_F$ 25/ $F_L$ 20
b) Minimum local value	$F_F$ 17/ $F_L$ 15



- 2) Level suspended slabs (shored until after testing) and topping slabs:
    - a) Specified overall value FF 25/FL 20
    - b) Minimum local value FF 17/FL 15
  - 3) Unshored suspended slabs:
    - a) Specified overall value FF 25
    - b) Minimum local value FF 17
  - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
- b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
- 1) Slab on grade:
    - a) Specified overall value FF 36/FL 20
    - b) Minimum local value FF 24/FL 15
  - 2) Level suspended slabs (shored until after testing) and topping slabs
    - a) Specified overall value FF 30/FL 20
    - b) Minimum local value FF 24/FL 15
  - 3) Unshored suspended slabs:
    - a) Specified overall value FF 30
    - b) Minimum local value FF 24
  - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.
12. Measurements
- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by Contracting Officer's Representative, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after

completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.

- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
13. Acceptance/ Rejection:
- a. If individual slab section measures less than either of specified minimum local  $F_F/F_L$  numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
  - b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall  $F_F/F_L$  numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by Contracting Officer's Representative, until a slab finish constructed within specified tolerances is accepted.

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**SECTION 03 30 00.01**  
**PORTLAND CEMENT CONCRETE - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies Portland cement concrete within the City of Menlo Park right of way.

**1.2 GENERAL**

Work required under this Section consists of furnishing all materials, supplies, equipment, tools, transportation, facilities and performing all labor and services and incidentals for furnishing and installing concrete work as determined in this Section and as shown on the plans. The work shall include, but is not necessarily limited to:

- All form work including special forms as required for any special construction and/or to accommodate the work of others and removal of forms.
- All concrete reinforcement, placement, bending and forming thereof.
- All concrete finishing, all surface treatment and curing including non-slip finish.

The furnishing of all items required to be, or as shown on the drawings as, embedded in concrete that are not specifically required under other Sections.

- Finishing, curing and protecting concrete.
- Installing dowels to adjacent existing concrete.

A. Sawcutting

Where existing concrete is to be removed, a sawcut with a power driven saw shall be made at the first scoring line or as determined by the City.

B. Concrete Removal

Special precaution shall be taken to protect existing facilities and improvements. All concrete shall be removed to an expansion joint or sawcut scoremark or as determined by the City. Concrete shall be removed in such manner as to leave an even edge without spalling, breaks or chips on the remaining concrete.

C. Excavation And Grading For Concrete Work

Care shall be taken to preserve adjacent improvements. Water and gas service damaged by the contractor's operation shall be repaired at his/her expense. If a water service in the sidewalk section needs to be lowered, it will be done by California Water Service or the City of Menlo Park Water District. Extension of time to coordinate lowering of services will be granted if the delay causes the contractor to exceed the allowable working days on the project. Electrical line, gas service will be marked in the field by PG&E as requested.

All tree roots within the construction limit shall be cut and removed to a minimum depth 12 inches below the ground grade, backfilled with class 2 aggregate base. Wet and compact the aggregate base and the top 6 inches of native subbase to 95 percent relative compaction.

**1.3 CONCRETE FORM WORK**

A. Scope Of Work

Work required under this section consists of furnishing, design, installation and stripping of all concrete form work.

B. Related Work in Other Sections

1. Section 14, "Earthwork"
2. Section 21-3, "Cast-in-place Concrete"

C. Materials

All form work shall be true and shall have a smooth, straight upper edge.

Timber forms shall be surfaced on the side placed next to the concrete, and shall have a true surfaced upper edge, and shall not be less than 1-5/8 inches thick after being surfaced.

Thin plank forms may be used on curves, grade changes or on curb returns. When using thin plank form, it shall be sufficiently staked to prevent movement.

Form lumber for walls shall be 3/4 inch plywood, Exterior Type, DFPA Grade, "Concrete Form Exterior" or better. Metal forms may be used upon approval of the City.

D. Design And Construction

The Forms Shall Be Of Suitable Material And Of A Type, Size, Shape, Quality And Strength To Ensure Construction As Designed.

Forms shall be smooth, mortar-tight, true to the required lines and grades, and of sufficient strength to resist springing out of shape during the placing and vibrating of concrete. All dirt, chips, sawdust and other foreign matter shall be completely removed before concrete is deposited therein. The surface of forms shall be smooth and free from irregularities, dents and holes.

Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused. Before concrete is poured in form, all side surfaces of the forms shall be thoroughly wetted (sprinkled) with water.

E. Form Removal/Stripping

Forms shall be removed in such a manner as to insure the complete safety of the structure.

Form work for parts not supporting the weight of the concrete may be removed when the concrete has hardened sufficiently to resist damage from the removal operations.

Form work for parts that support the weight of concrete shall remain in place until the concrete has reached its specified 28 day strength, with a minimum of 14 days elapsed after the pouring of concrete.

When shores and other vertical supports are so arranged that the form facing material may be removed without loosening or disturbing the shores and supports, the facing material may be removed at an earlier age as specified or permitted by the City.

The shores and supports shall remain in place until the concrete has reached its specified 28 day strength, with a minimum of 14 days elapsed after pouring the concrete.

Whenever the form work is removed during the curing period, the exposed concrete shall be cured by one of the methods specified herein.

#### **1.4 CAST-IN-PLACE CONCRETE**

##### **A. Scope Of Work**

Work required under this Section consists of the construction of all cast-in-place concrete structures.

##### **B. Related Work In Other Sections**

1. Section 19, "Earthwork"
2. Section 21-2, "Concrete Form Work"
3. Section 21-4, "Concrete Tests and Inspection"
4. Section 21-5, "Reinforcing Steel"

##### **C. Applicable Standards**

1. All concrete shall be mixed and delivered according to the "Specifications for Ready-Mix Concrete" (ASTM C-94).
2. Section 51, "Concrete Structures," Section 52, "Reinforcement," Section 73, "Concrete Curbs and Sidewalks" of the Standard Specifications.
3. Section 90, "Portland Cement Concrete" of the Standard Specifications.
4. City of Menlo Park Standard "General Concrete Notes" and applicable standard drawings.

##### **D. Cold Weather Requirements**

When the mean daily temperature falls below 40°F concreting shall be according to the "Recommended Practice for Cold Weather Concreting - ACI306."

A written statement of the precautions proposed to be taken for depositing concrete below 40°F temperature shall be submitted to the City for approval.

##### **E. Materials**

1. Portland Cement. Portland Cement shall conform to ASTM C150 for Type II Modified Cement. Use one standard brand throughout the work.
2. Concrete Aggregates. Concrete aggregates shall conform to Section 90-2.02, "Aggregate" of the Standard Specifications, and the aggregate grading shall conform to Section 90-3, "Aggregate Grading" of the Standard Specifications. The combined aggregate grading shall be of 1 inch maximum grading.
3. Water. Water shall be clean and free from deleterious amounts of acid, alkalies or organic materials.

4. Classification and Design of Concrete Mixtures. Concrete shall be proportioned to secure the strength and durability required for that part of the structure in which it is to be used.

Portions of cement, water, aggregate and air entraining agent for the various classes given shall be so determined and fixed as to produce concrete having the 28 day compressive in pounds per square inches indicated by class. Concrete mixes shall meet the following requirements, unless otherwise specified:

Class A	Minimum Cement Content
	564 pounds (6.0 sacks/cu., yd.)
	Compressive strength: 3500 PSI at 28 days

5. In addition, the concrete mix shall meet the following requirements:
  - a. Entrained air range from 4 percent to 6 percent by volume according to ASTM C173 or C-231.
  - b. Slump range from 2 inches to 4 inches according to ASTM C143.
  - c. Approximately 0.2 pounds of Pozzolan 300N per sack of cement shall be used as water dispersing additive.
  - d. The water cement ratio shall not exceed 5 gallons per sack.
6. Class A concrete shall be used in all applications, unless shown otherwise, on the drawings or specified herein. A mix design shall be submitted to the City for approval before ordering the concrete.
7. Add 1 lb. of lampblack per cubic yard of concrete (at batch plant) for all Portland Cement Concrete installed within the public right-of-way, unless otherwise stated on the plans or as directed by the City.
8. Premolded Expansion Joint Material. Premolded expansion joint filler shall conform to the requirements of ASTM D994 for performed expansion joint filler (bituminous) and shall be of 1/4 inch thick to the full depth of the concrete section.

F. Performance

1. Placement of Concrete
  - a. Place concrete so that a uniform appearance of surface will be obtained and concrete will be free of all rock pockets, honeycombs and voids.
  - b. Deposit as nearly as practicable in final position.
  - c. Deposit in walls shall be made in approximately 18 inch layers, continuing at a uniform rate.
  - d. Do not deposit concrete into accumulations of water.

- e. Do not deposit or place concrete until all forms, reinforcing steel and construction joints have been inspected within the limits of the pour.
  - f. Subgrade must be moistened when the concrete is placed for floor slabs to prevent excessive loss of water from the concrete mix.
2. Vibrators, Vibrating and Spacing
- a. Employ as many vibrators and tampers as necessary to secure the specified results with a minimum of one vibrator or tamper for each 20 cubic yard of concrete placed per hour.
  - b. The following practices will be not permitted:
  - c. Pushing of concrete with vibrator.
  - d. External vibration of forms.
  - e. Allowing vibrator to vibrate against reinforcing steel.
  - f. Allowing vibrator to vibrate against contact faces of forms.
- Vibrators shall function at a minimum frequency of 3600 cycles per minute when submerged in concrete.
- g. Supplement vibrating along the surfaces of the forms and between reinforcing whenever flow is restricted.

3. Curing

Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperature, and shall be maintained with minimal moisture loss at a relatively constant temperature for the time necessary for the hydration of the cement and proper hardening of the concrete. Curing concrete shall be in accordance to Section 90-7, "Curing Concrete" of the Standard Specifications.

- a. Curing shall immediately follow the finishing operation.

Concrete shall be kept continuously moistened for 24 hours upon completion of finishing. Materials and methods shall be used as described in Section 90-7.

If the curing compound method is used the curing compound shall conform to Section 90-7.01B, "Curing Compound Method," and it shall be of pigmented curing compound conforming to the requirements of ASTM Designation C309, Type 2, Class B.

Such compounds shall be applied at a nominal rate of 1 gallon per 150 square feet, unless otherwise specified, and shall not be used on any surface against which additional concrete or other cementitious finishing materials are to be bonded, nor on surfaces that will receive paint.



b. Duration of Curing

The final curing shall continue uninterrupted until the cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of the air in contact with the concrete is above 50°F has totaled 7 days.

c. Formed Surfaces

Steel forms heated by the sun and all wood forms in contact with the concrete during the final curing period shall be kept wet. If forms are to be removed during the curing period specified above, curing materials or methods shall be employed immediately. Such curing shall be continued for the remainder of the curing period.

4. Construction Joints

Joints not shown on the drawings shall be so made and located as to least impair the strength of the structure. A pour schedule for each structure showing all constructing joints shall be submitted to the City for review.

5. Repair of Surface Defects

All tie holes and all repairable defective areas shall be patched immediately after form removal. After being cleaned and thoroughly dampened, the tie holes shall be soiled with patching mortar. All honeycombed and other defective concrete shall be removed down to sound concrete.

The area to be patched and an area of at least 6 inches wide surrounding shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing No. 30 mesh sieve shall be mixed to the consistency of thick cream and brushed into the surface.

The patching mixture shall be made of the same material and approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted, and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume.

Quantity of mixing water shall be not more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation of a trowel, without

addition of water, until it has reached the stiffest consistency that will permit placing and finishing.

After surface water has evaporated from the area to be patched, the bond coat shall be brushed into the surface. When the bond coat begins to lose the water sheen, the premixed mortar shall be applied. The mortar shall be thoroughly consolidated and struck-off to leave the patch slightly higher than the surrounding surface for at least 1 hour before being finished.

## 6. Finishes

### a. Schedules of Finishes

<u>Element</u>	<u>Finish</u>
• Walls not exposed	-Rough or boards form finish
• Slabs	-Troweled finish
• Curb, gutter, sidewalk, driveway and handicap ramp.	-Broom finish

### b. Rough or Board Form Finish

Rough or board form finish surfaces shall be true to line and plane with no specific requirements for selected facing materials. Tie holes and defects shall be patched and fins shall be rubbed down with wooden blocks. Otherwise, surfaces shall be left with the texture imparted by the forms.

### c. Troweled Finish

Where a troweled finish is specified, the surface shall be finished first with power floats, then with power trowels and finally with handtrowels. The first troweling after power floating shall be done by a power trowel, and shall produce a smooth surface that is relatively free of defects, but which may still contain some trowel marks.

Additional troweling shall be done when a ringing sound is produced as the trowel is moved over the surface.

The surface shall be thoroughly consolidated by hand troweling operations. The finished surface shall be free of any trowel marks, uniform in texture and appearance.

### d. Broom Finish

Finished sidewalk slabs shall be shaped and smoothed with a longitudinal float, with its length and transverse motion, planning-off the high places and filling in depressions. The float shall be 16 to 18 feet long.

Final finishing shall be made with a small steel trowel, the finished surface shall be broomed lightly before edging and scoring. Brooms shall be kept clean and shall only be used to lightly remove the polish.

The finished surface shall vary not more than 1/8 inch from a straight edge 10 feet long laid parallel to the curb. Sidewalks shall be marked-off in squares not to exceed 30 inches in dimension and a continuous score mark 6 inches from curb or as directed by the City. Weakened planed joint 2 inches deep for sidewalk and 3 inches deep for driveway shall be placed at 10 feet nominal intervals. Scoring and edging tools shall be clean and sharp. All scoring shall be straight and to a minimum depth of 1/8 inch.

#### G. Installation Of Dowels

Where Portland cement concrete is to be cast next to existing Portland cement concrete, the new concrete shall be doweled to the existing concrete. This applies to sidewalks, driveways, curbs and gutters, planter strips filled with concrete, sidewalk added to the back of existing walk or as directed by the City.

The dowels shall be No. 3 (min.) rebar dowels 12 inches in length. The dowels shall be placed 3 feet on center and drilled for a tight fit or epoxy in place.

### 1.5 CONCRETE TESTS AND INSPECTIONS

The City will undertake any tests he may find necessary or use his agents to undertake such tests or request a Certificate of Compliance. All tests shall meet the requirements of these project specifications and the Standard Specifications.

#### A. Related Work in Other Sections

- 1) Section 21-3, "Cast-in-place Concrete"
- 2) Section 21-5, "Reinforcing Steel"

#### B. Approval of Testing Agencies and Reports

All laboratories, agencies, etc., where testing of any material and/or equipment to be incorporated in the work is to be carried out and shall be approved by the City in writing. Documentary evidence, satisfactory

to the City that the material has passed the required inspection and testing must be furnished before the incorporation of such materials in the work, and rejected materials must be promptly removed from the premises.

#### C. Governing Specifications

It is the intent of the Specifications to define properly the kind and quality of materials to be furnished. The latest revisions of the Standard Specifications, American Association of State Highway Official (AASHO), American Concrete Institute (ACI), American Society of Testing and Materials (ASTM) or other such agency may be referred to in the Specifications.

Where such standards are referred to, said references shall be construed to mean the latest amended and/or revised version of the said Standard or Tentative Specifications. In the selection of samples and the routine testing of materials, the testing laboratory shall follow the standard procedure as outlined by the ASTM, unless otherwise set out.

#### D. Performance

##### 1. Concrete Material Tests

###### a. Cement

ASTM C150. All cement used on the project shall have been shipped from the mill not more than 3 months prior to receipt on the work site.

###### b. Fine Aggregate

Sand equivalent -- California Test 217

###### c. Coarse Aggregate

Standard tests shall be made in advance in the field or laboratory.

Los Angeles Rattler -- California Test 211

Cleanness Value -- California Test 227

###### d. Reinforcing Steel

Field inspect for section, rust, shape and dimension.

##### 2. Concrete Mix Tests

Test cylinders -- California Test 521 or ASTM C39.

The mixes shall be designed, tested and adjusted, if required, sufficiently in advance of work to permit review by the City before the first concrete is scheduled for placement.

##### 3. Concrete Tests

Concrete materials and operations will be tested and inspected as work progresses. The Contractor shall furnish samples to the City for testing as work progresses. The City of Menlo Park will be responsible for the payment to the Testing Agencies. However, if the test fails, the cost for retesting shall be the Contractor's responsibility.

#### 1.6 REINFORCING STEEL

##### A. Scope of Work

Work required under this Section consists of furnishing and placing all reinforcing steel in all reinforced concrete structures as shown on the plans.

##### B. Related Work in Other Sections

1. Section 21-2, "Concrete Form Work"
2. Section 21-3, "Cast-in-place Concrete"
3. Section 21-4, "Concrete Test and Inspection"
4. Section 52, "Reinforcement" of the Standard Specifications

##### C. Material

1. Bars Reinforcement
2. Reinforcing bars for concrete reinforcement shall be deformed, billet steel bars conforming to ASTM A615, grade 60 and rust-free, and shall be placed according to the size and spacing as shown on the plans.
3. Welded Wire Fabric (when applicable)
4. Welded wire fabric shall conform to ASTM A185 with the size as shown on the plans.

##### D. Performance

##### 1. Standard Installation

Except where specified otherwise herein or shown otherwise on the drawing, reinforcing steel shall be cleaned, fabricated, placed, tied and supported according to Section 52-1.07, "Placing" of the Standard Specifications.

Reinforcing shall not be bent or straightened in any manner that will weaken the material. All splices for deformed bars shall conform to Section 52-1.08, "Splicing" of the Standard Specifications.

##### 2. Minimum Cover

Where not shown otherwise on the plans, the minimum concrete coverage for steel reinforcement shall be as follows:

Type of Element	Minimum Cover
Cast against and exposed to soil.	3"
Exposed to soil, weather or water	2"
No. 6 bars and larger.	
No. 5 bars and smaller including wire mesh.	1-1/2"
Not exposed to soil, weather or water No. 11 bars and smaller.	3/4"

### 3. Supporting Devices

Steel reinforcement shall be accurately placed and shall be supported and secured against displacement by adequate and proper supporting and spacing devices, tie wires, etc., so that it will remain in its correct location in finished work. No supporting devices shall be used that will impede the flow of concrete.

### 4. Bar Spacing

The clear spacing center to center between parallel bars shall be not less than 2.50 times the diameter of the bar. The bundles of bars spacing shall be in accordance to Section 52-1.07, "Placing" of the Standard Specifications.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

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**SECTION 05 70 05**

**SITE METALWORK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide fencing complete, including footings and the following principal items:
  - 1. Metal Fence.

**1.2 RELATED WORK SPECIFIED ELSEWHERE**

- A. Site Concrete: Section **32 13 00**

**1.3 QUALITY ASSURANCE**

- A. Do not scale drawings for dimensions. Use only the written dimensions indicated on the Drawings, unless such be found in error. Contractor shall verify and be responsible for dimensions and conditions shown by the Drawings, and shall visit the site to inspect and verify field conditions prior to fabrication and installation. The Owner's Representative shall be notified, in writing, of discrepancies on Drawings, in field dimensions or conditions, and of changes required in construction details.
- B. Provide each type of gate as a complete unit produced by a single manufacturer, including required mounting accessories, fittings and fastenings.
- C. Details shown in the Drawings shall be followed for exterior appearance. Minor changes in interior construction will be accepted in order to conform to Contractor's shop practices or engineering requirements when, in the Owner's Representative's sole judgment, such changes do not detract materially from design concept or intent. Contractor shall circle such changes on the shop drawings.
- D. Completed work shall be structurally sound, and free from distortions, chips, breaks, holes, splits or other disfigurements considered as imperfections for the specific material.
- E. Comply with the latest publications for materials and operations of the following:
  - 1. "Code of Arc and Gas Welding in Building Construction" of American Welding Society, WS D1.0, latest edition with current supplements and addenda, is hereby made a part of this Section

and Miscellaneous Metalwork shall conform to the applicable requirements therein, except as otherwise specified herein or shown on the drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements or governing rules and regulations.

2. All work shall conform to the American Institute of Steel Construction specifications for design, erection and fabrication, and acceptable standards of good practice. Finished members shall be true to line and free from twists and bends.
3. SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".
4. Industrial Fasteners Institute "Fastener Standards Book".

#### **1.4 STRUCTURAL DESIGN AND ENGINEERING**

- A. Details in the Drawings indicate a general design approach for the fencing and gates but do not necessarily include the specific fabrication details required for the complete structural integrity of the gates, nor do they necessarily consider preferred shop practices of individual contractors. Such specific fabrication details shall be provided by the Contractor, who shall ensure that fencing and gates withstand any static, dynamic and erection loads that act upon them, including such loads associated with handling and servicing.
- B. Contractor shall furnish a complete structural design for fencing and gate, incorporating reasonable safety factors necessary to protect the Owner and Contractor against public liability including ADA /Title 24 Accessibility requirements.
- C. Contractor shall be responsible for the engineering and internal construction of gate, and shall submit shop drawings and details for review by the Owner's Representative. Shop drawings for Fence shall be designed and stamped by a licensed Engineer currently registered in the State of California.
  1. Structural design shall meet applicable local, state, and national codes, as well as testing laboratory listings, where required.

#### **1.5 SUBMITTALS per Section 01 33 00**

- A. Product Data: If requested by Owner's Representative, submit manufacturers' catalog sheets, brochures, diagrams, schedules, charts, illustrations, test results and/or other standard descriptive data.



1. Mark up each copy to identify pertinent materials, products or models.
  2. Show dimensions and clearances required.
- B. Shop Drawings:
1. Shop drawings shall be neat, well organized and clearly legible. Elevations and plan views from the Drawings may be reproduced for the sake of expedience where appropriate.
  2. Shop drawings shall be drawn to scale and not subsequently reduced to fit a drawing format.
  3. Submit elevations and plan views for gate types, including graphic layouts, complete dimensions, materials, locations of fasteners and finishes. Determine the total quantity for each gate type and note it in the shop drawings.
  4. Submit comprehensive section drawings for gate types where applicable, including sections of typical members. Show fabrication and installation details, including details for securing members to one another, to structures, and/or to site work. Show interior construction, reinforcements, anchorages, components and finishes. Reproduction of section drawings shown in the Drawings shall not be acceptable.
  5. Site Condition Verification: Where required by the Owner's Representative for specific items, Contractor shall inspect site to confirm installation conditions, then submit shop drawings and/or written documentation for approval indicating proposed mounting devices.
- C. Samples:
1. Color and Finish: Submit 3 each samples of finish and colors. Prior to submittal, Contractor shall verify that colors submitted as samples match accurately any samples or specifications provided by Owner's Representative.
    - a. Contractor to submit verification of paint manufacturer used for submittal.

## **PART 2 - MATERIALS**

### **2.1 BASIC MATERIALS AND ACCESSORIES**

- A. Steel Tubing: ASTM A500 (cold-formed), Grade A or B, welded or seamless.
- B. Steel Pipe: ASTM 53, Type E or S, unless otherwise noted.

- C. Miscellaneous Steel Plates and Structural Steel Shapes: conforming to ASTM A36-69.
  - D. Bolts: Structural grade steel, ASTM A307-68, with suitable hex nuts and washers, all galvanized.
  - E. Welding Electrodes: As permitted by AWS Code D1.0.
- 2.2 FINISHES** (except as otherwise noted on the drawings or specified):
- A. Fence and gate shall be hot-dip galvanized after fabrication.
  - B. Face Preparation of galvanized fencing: chemically clean in accordance with SSPC SP-1 taking care not to damage the galvanized surface.
  - C. Paint:
    - 1. Primer: To be epoxy primer as manufactured by Fuller, Tnemec, or approved equal; to be compatible with finish coat. Dry Film Thickness (DFT) 3.0 to 5.0 mils
    - 2. Finish Coats: External metal paint as manufactured by Fuller, Tnemec, or approved equal. DFT 2.0 to 3.0 mils. Color(s) to be as follows: Satin Finish Black.
    - 3. Total DFT: 5.0 to 8.0 mils.

### **PART 3 - EXECUTION**

#### **3.1 CONDITION OF SURFACES**

- A. Inspect all surfaces to receive site metalwork and report all defects which would interfere with this installation. Starting work implies acceptance of surfaces as satisfactory.

#### **3.2 WORKMANSHIP**

- A. Verify all measurements at job. Coordinate all metalwork with adjoining work for details of attachments, fittings, etc. Do all cutting, shearing, drilling, punching, threading, tapping, etc., required for site metalwork or for attachment of adjacent work. Drill or punch holes; do not use cutting torch. Shearing and punching shall leave true lines and surfaces.
- B. Conceal all fastenings where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Form joints exposed to weather to exclude water.
- C. Make all permanent connections in ferrous metal surfaces using welds where possible; do not use bolts or screws where they can be avoided.
- D. Provide all lugs, clips, anchors, and miscellaneous fastenings necessary for complete assembly and installation.

Set all work plumb, true, rigid and neatly trimmed out. Miter corners and angles of exposed mouldings and frames unless otherwise noted.

- E. Set all railings and similar items shown or required to be set in sleeves or cans with quick-setting, non-shrink anchor cement. Unless otherwise noted, size sleeves for approximately 1/4" clearance all around.
- F. Where items must be incorporated or built into adjacent work, deliver to trade responsible for such work in sufficient quantity than progress of work is not delayed. Be responsible for proper location of such items.

**3.3 WELDING:** Perform all welding in accordance with AWS Code D1.0. Welds shall be made only by operators experienced in performing the type of work indicated. Welds normally exposed to view in the finished work shall be uniformly made and shall be ground smooth. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter or tramp metal.

**3.4 BOLTED, SCREWED AND RIVETED CONNECTIONS:** In general, use bolts for field connections only, and then only as detailed. Provide washers under all heads and nuts bearing on wood. Draw all nuts tight and nick threads of permanent connections to prevent loosening. Use beveled washers where bearing is on sloped surface.

**3.5 MINIMUM COMPONENT SIZES:** Size of components as required to conform with Uniform Building Code.

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**SECTION 09 06 00**  
**SCHEDULE FOR FINISHES**

**PART I - GENERAL**

**1.1 DESCRIPTION**

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

**1.2 MANUFACTURERS**

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.3 SUBMITALS**

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

DESIGNER NOTE: See instructions.

1. DIGITAL COLOR PHOTOS-INTERIOR VIEWS:

Room Number and Name	Item/View to be Photographed
1.	
2.	
3.	
4.	

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

DESIGNER NOTE: Update Applicable  
Publications to correct issue at time of  
project specification preparation.

#### 1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the  
extent referenced. Publications are referenced in text by basic  
designation only.

B. MASTER PAINTING INSTITUTE: (MPI)

2001 .....Architectural Painting Specification Manual

#### 1.5 DIVISION 10 - SPECIALTIES

I. SECTION 10 13 00 / 10 14 00, EXTERIOR SIGNS

Component	Finish	Manufacturer	Mfg. Color Name/No.
B1	Paint	Matthews Paint	TBD
B2	Paint	Matthews Paint	TBD
B3	Paint	Matthews Paint	TBD

--- E N D---

**SECTION 10 13 00**  
**DIRECTORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior directories.
- B. This section also specifies exterior medical center directional signs, directories and information.

**1.2 RELATED WORK**

- A. Electrical: Related Electrical Specification Sections.
- B. Section 10 14 00, SIGNAGE/ Section 10 13 00, DIRECTORIES.
- C. Finishes, Division 09, FINISHES.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Directory panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Resident Engineer, other returned to Contractor.
  - 1. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
  - 2. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
  - 1. Showing the methods and procedures proposed for the concealed anchorage of the directory system to each surface type.
  - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Directory location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

### **1.5 DELIVERY AND STORAGE**

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver directories only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07..... Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and tubes.
- C. Federal Specifications (Fed Spec):
  - MIL-PRF-8184F..... Plastic Sheet, Acrylic, Modified.
  - MIL-P-46144C..... Plastic Sheet, Polycarbonate

### **1.7 MINIMUM SIGN REQUIREMENTS**

- A. Directional/Informational Signs:
  - 1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
  - 2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
  - 4. Mounting Location and Height: As shown.

### **1.8 COLORS AND FINISHES:**

Section 09 06 00, SCHEDULE FOR FINISHES.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.

- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

## **2.2 PRODUCTS**

- A. Aluminum:
  - 1. Sheet and Plate: ASTM B209.
  - 2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: MIL-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Electrical Directories:
  - 1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.
  - 2. Refer to Electrical Specifications Section, Division 26, ELECTRICAL, to verify line voltages for sign locations that require electrical signs.
  - 3. Quality Control: Installed electrical components and sign installations are to bear the label and certification of Underwriter's Laboratories, Inc., and are to comply with National Electrical Code as well as applicable federal, state and local codes



for installation techniques, fabrication methods and general product safety.

4. Ballast and Lighting Fixtures: See Electrical Specifications.

F. Concrete Post Footings: See Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE, Cast-in-place Concrete.

G. Steel: See Section 05 12 00, STRUCTURAL STEEL FRAMING.

## **2.3 SIGN STANDARDS**

A. Topography:

1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.

2. Arrow: See graphic standards in drawings.

3. Letter spacing: See graphic standards on drawings.

4. Letter spacing: See graphic standards on drawings.

5. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.

B. Project Colors and Finishes: See Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.4 SIGN TYPES**

A. General:

1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.

a. IN indicates a component construction based sign.

2. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.

3. EI designation indicates exterior internally illuminated sign.

4. EN designation indicates exterior non-illuminated sign.

B. Text and Graphics:

1. Illuminated Signs: Graphics are routed out and backed with 3 mm (0.0125 inch) thick minimum translucent white acrylic diffuser.

Diffuser and letter voids are to be mechanically fastened to sign face.

2. Non-illuminated Signs: Surface applied reflective white opaque vinyl graphics.

C. Illuminated Signs:

1. UL approved cabinet to be constructed from aluminum extrusion system with internal fluorescent lamps 230 mm (9 inches) on center maximum.
2. Energy saver fluorescent lamps which shall be turned on or and off by photocell.
3. Energy shut off switch shall be mounted on bottom or side away from traffic thoroughfare.
4. The sign face and changeable sign strips are to be 2 mm minimum (0.090 inch) to 3 mm (0.125 inch) thick aluminum. Aluminum faces and changeable strips shall be mounted into framed extruded cabinet face to allow for removal from top or side, so that faces can be changed without affecting extruded sign structure.
5. Changeable strip sign text modules are to be extruded aluminum sliding panels which are retained by a horizontal aluminum channel mounted behind the insert panel joints. Text module heights are 100 mm (4 inches), 150 mm (6 inches) and 200 mm (8 inches).
6. Contractor shall make the sign operable by making the necessary electrical connections to adjacent junction box located in the general area of sign. Electrical connection is to run under grade and up through base. No exposed electrical conduit runs shall be allowed. Coordinate line voltages with site electrical circuit.

D. Post and Panel Signs:

1. Sign shall be constructed of an aluminum extrusion system including the following integral features: water relief channel for proper drainage, integral flanges for attachment of additional structural supports and mounting to posts with minimum 3 mm (0.125 inch) wall thickness. Post caps to be welded or mechanically attached with concealed fasteners.
2. Reveal between the post and sign cabinet is to be extruded aluminum. This extruded connector shall be adjustable to allow for either flush, 12 mm ((0.5 inch) or 25 mm (one inch) reveal between the sign post and cabinet or tube.

3. Sign to be installed with direct burial of posts in concrete or with a base plate mounting. Any electrical connections should be run through the posts.

E. Illuminated Monument Sign - Sign Type EI-01,

1. Sign shall be an illuminated sign cabinet mounted on a masonry base with a reveal between the base and the cabinet.
2. Sign shall be constructed of an aluminum extrusion system including the following integral features: concealed hinge for lamp access, water relief channel for proper drainage, ballast bracket channel, enclosed electrical raceway with cover, internal flanges for attachment of additional structural supports and mounting to base and a frame retainer, maximum 25 mm (1 inch) face dimension, to allow for sign face removal.
3. Sign to be installed with a cast-in-place "J" bolt type mounting to masonry base.

F. Non-illuminated Post and Panel Sign - Sign Types EN-03

1. Sign shall be a non-illuminated sign cabinet mounted to extruded aluminum posts with an adjustable reveal between the posts and the cabinet.
2. Sign shall be constructed of an aluminum extrusion system including the following integral features: water relief channel for proper drainage, internal flanges for attachment of additional structural supports and mounting to posts, extruded aluminum posts, extruded aluminum reveal which is adjustable and a frame retainer (maximum 25 mm (1 inch) face dimension) to allow for sign face removal.
3. Weld sign cabinet at mitered corners and provide internal bracing as necessary to insure structural rigidity. Shop weld as much as possible. Grind smooth all exposed welds so surface is consistent with surrounding surface, and accepts paint finish in a like manner.
4. The sign faces are to be 2 mm (0.090 inch) thick aluminum. Aluminum faces shall be mounted into the framed extruded cabinet to allow for removal from the top or side, so faces can be changed without affecting extruded sign structure.

G. Non-illuminated Post and Stacking Bar Sign - Sign Type EN-04:

1. Sign shall be aluminum tubes mounted to extruded aluminum posts with an adjustable reveal between the posts and tubes.

2. Sign shall be constructed of an aluminum extrusion system including the following integral features: water relief channel for proper drainage, internal flanges for attachment of additional structural supports and mounting to posts, extruded aluminum posts, extruded aluminum reveal which is adjustable and interchangeable aluminum tube text modules to allow for individual stacking bar removal.
  3. The sign text stacking bar modules are extruded aluminum sliding tubes retained by a reveal. The aluminum tube sign text stacking modules shall be mounted to allow for removal from the top, so tubes can be changed without affecting sign structure. Stacking bar (tube) module height is 150 mm (6 inches).
- H. Non-illuminated Single Post Sign - Sign Types EN-12.01,
1. Sign shall be constructed of an extruded aluminum square post with an aluminum plate sign panel.
  2. Sign panel shall be a 3 mm (0.125 inch) aluminum plate. Panel mechanically fastens to support post with tamper resistant fasteners.
  3. Posts shall be aluminum and a minimum 3 mm (0.125 inch) wall thickness. Post caps to be welded or mechanically attached with conceal fasteners.
  4. Sign shall be installed with direct burial of post into concrete. If sign is to be installed with a base plate/"J" bolt type mounting, it is noted in the sign message schedule.
- I. Non-Illuminated Cut Out Dimensional Letters - Sign Types EN-09:
1. Cut out aluminum letters which are mill cut (vertical sides) out of 9 mm (0.375 inch), 12 mm (0.5 inch) or 19 mm (0.75 inch) plate depending on sign type.
  2. Letters to be studded and mounted with a 9 mm (.375 inch) spacers to wall surface using adhesive appropriate to the surface.
  3. Letters painted with acrylic polyurethane in specified color and finish.

## **2.4 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

- M. No signs are be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.
- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings,

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MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

templates, instructions and directions for installation of anchorage  
devices which may involve other trades.

- - - END - - -

DIRECTORIES

10 13 00 - 10

## **SECTION 10 14 00**

### **SIGNAGE**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This section specifies interior signage for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.
- B. This section also specifies exterior medical center identification signs, building identification signs, parking and traffic signs.
- C. Installation of Government furnished dedication plaque and VA seal.

##### **1.2 RELATED WORK**

- A. Electrical: Related Electrical Specification Sections.
- B. Lighted EXIT signs for egress purposes are specified under Division 26, ELECTRICAL.
- C. Section 10 13 00, DIRECTORIES and Section 10 14 00, SIGNAGE.
- D. Color Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

##### **1.3 MANUFACTURER'S QUALIFICATIONS**

- A. Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

##### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Resident Engineer, other returned to Contractor.
  - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.

### **SIGNAGE**



2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches). Show anticipated range of color and texture.
3. Sample of typeface, arrow and symbols in a typical full size layout.

C. Manufacturer's Literature:

1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.

D. Samples: Sign location plan, showing location, type and total number of signs required.

E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

F. Full size layout patterns for dimensional letters.

#### 1.5 DELIVERY AND STORAGE

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

#### 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  1. B209-07 Aluminum and Aluminum-Alloy Sheet and Plate
  2. B221-06 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and tubes.

C. Federal Specifications (Fed Spec):

1. MIL-PRF-8184F Plastic Sheet, Acrylic, Modified.
2. MIL-P-46144C Plastic Sheet, Polycarbonate

**1.7 MINIMUM SIGN REQUIREMENTS**

A. Permanent Rooms and Spaces:

1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

B. Overhead Signs:

1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
4. Mounting Location and Height: As shown.

**1.8 COLORS AND FINISHES:**

A. Section 09 06 00, SCHEDULE FOR FINISHES.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

### **2.2 PRODUCTS**

- A. Aluminum:
  - 1. Sheet and Plate: ASTM B209.
  - 2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.
- C. Polycarbonate: Mil-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Electrical Signs:
  - 1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.

2. Refer to Electrical Specifications Section, Division 26, ELECTRICAL, to verify line voltages for sign locations that require electrical signs.
3. Quality Control: Installed electrical components and sign installations are to bear the label and certification of Underwriter's Laboratories, Inc., and are to comply with National Electrical Code as well as applicable federal, state and local codes for installation techniques, fabrication methods and general product safety.
4. Ballast and Lighting Fixtures: See Electrical Specifications.

F. Concrete Post Footings: See Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE, Cast-in-place Concrete.

G. Steel: See Section 05 12 00, STRUCTURAL STEEL FRAMING.

## **2.3 SIGN STANDARDS**

A. Topography:

1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
2. Arrow: See graphic standards in drawings.
3. Letter spacing: See graphic standards on drawings.
4. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.

B. Project Colors and Finishes: See Section 09 06 00, SCHEDULE FOR FINISHES.

## **2.4 SIGN TYPES**

A. General:

1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
  - a. IN indicates a component construction based sign.
2. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which

identify a particular group of signs. An additional number identifies a specific type of sign within that family.

3. EI designation indicates exterior internally illuminated sign.
4. EN designation indicates exterior non-illuminated sign.

B. Interchangeable Component System:

1. Sign Type Families: 03, 04, 05, 06, 07, 08, 09 10, 11 12, 13, 14, 15, 16 and 17.
2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.
  - a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
  - b. Component Sign System is comprised of the following primary components:
    - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
    - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
    - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
    - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
    - 5) Joiners and Accent Joiners connect separate Rail Backs together.
    - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
  - c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
  - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
  - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12

SIGNAGE

inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.

3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
  - a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
  - b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.
  - c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
  - a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
  - b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
  - a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
  - b. Cleanable without use of special chemicals or cleaning solutions.
  - c. Copy Insert Materials.
    - 1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
    - 2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.

- 3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.
- 4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
- 5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.
- 6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
  - a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.
  - b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
- 7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
- 8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
- 9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
- 10) Typography
  - a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
  - b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with

SIGNAGE

subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.

- c) Integral Tactile Copy Inserts - phenolic photo polymer etched with mm (.0937 inches) raised copy.
- d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

C. Sign Type Family 01, 02.01 thru 02.05, 08, 09 and 20:

- 1. All text and graphics are to be first surface silk-screened.
- 2. IN-01.12 & IN-01.13: Refer to Sign Type 03 specification for tactile and Braille portion of sign.
- 3. IN-02.4: All text and graphics are to be first surface vinyl letters.
- 4. IN-01.1: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

D. Sign Type Families 03:

- 1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
- 2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
- 3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
- 4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
- 5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).

E. Sign Type Family 04 and 11:

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1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-04: When a Type IN-04 is to be mounted under a Type IN03, a connecting Accent Joiner is to be used to create a singular integrated sign.
- F. Sign Type 05:
1. Text if added to Copy Insert module to be first surface applied vinyl letters.
- G. Sign Type Family 06 and 07:
1. All text and graphics are to be first surface applied vinyl letters except for under sliding tile.
  2. Protect text, which is covered by sliding tile, so tile does not wear away letters.
- H. Sign Type Family 10:
1. Pocket depth is to be 0.3 mm (.0150 inches).
- I. Sign Type Family 12 and 13:
1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-12: Provide felt, cork or similar material on bottom of desk mounting bracket to protect counter surfaces.
- J. Sign Type Family 14, 15, and 16:
1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-14.06: When added to top of IN-14.01, IN-14.04, or IN-14.05 a connecting Accent Joiner is to be used to create a singular integrated sign.
  3. Ceiling mounted signs required mounting hardware on the sign that allows for sign disconnection, removal and reinstallation and reconnection.
- K. Sign Type Family 17:
1. All text and graphics are to be first surface applied vinyl letters.
  2. IN-17: Directory constructed using elements of the Component System.
- L. Sign Type Family 18:

1. All text and graphics are to be first surface applied stylus cut vinyl letters.
2. Provide in specified typeface, color and spacing, with each message or message group on a single quick release backing sheet.

M. Sign Type Family 19:

1. Dimensional letters are mill or laser cut acrylic in the size and thickness noted in the drawings.
2. Draft of letters is perpendicular to letters face.
3. All corners such as where a letter stem and bar intersect are to be square so the letter form is accurately reproduced.
4. Paint letters with acrylic polyurethane in specified color and finish.

N. Sign Type Family (See Specialty Signs Section) 21:

1. IN-21.01: 57 mm (2.25 inches) polished aluminum tube mounted to weighted 356 mm (14 inches) diameter polished aluminum base. Sign bracket to hold a 6 mm (.25 inches) sign plaque.
2. IN-21.02: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted polished 57 mm (2.25 inches) aluminum tubular base. Rail Back mechanically connected to vertical supports with Copy Panel attached to front and back.
3. IN-21.03 & 21.04: IN-21.02: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted polished 57 mm (2.25 inches) aluminum tubular base. Rail Back mechanically connected to vertical supports with hinged locking glass door. Black felt covered changeable letter board or tan vinyl impregnated cork tack surface as background within case.

O. Sign Type Family 22:

1. IN-22.01: Extruded aluminum clip anodized black containing rollers to pinch and release paper. End caps are black plastic.
2. IN-22.02: Patient Information holder constructed of 18 gauge formed sheet metal painted in specified color. Polished aluminum connecting rods and buttons. Button covers for mounting screws are to permanently attach and securely conceal screws.

P. Temporary Interior Signs:

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1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole. Ties are steel wire mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
  - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
  - b. Replace any missing damaged or illegible signs.

## **2.5 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.

- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and

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sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.

- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

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**SECTION 10 75 00**  
**FLAGPOLES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Relocation of existing flag pole into new concrete base.

**1.2 RELATED WORK**

- A. Excavation and backfill: Section 31 20 00, EARTH MOVING.
- B. Concrete for ground set flagpole: Section 03 30 00, CAST-IN-PLACE CONCRETE.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Concrete base for flagpole.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A167-99 (R2009).....Stainless and Heat-resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - B209-07.....Aluminum and Aluminum Alloy-Sheet and Plate
  - B241/B241M-10.....Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Concrete and steel reinforcement: see Section 03 30 00, CAST IN PLACE CONCRETE.
- B. Stainless Steel: ASTM A167, Class 302 or 304.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Set flagpoles in concrete base. Provide galvanized, corrugated steel sleeve or tube of length shown welded to steel base plates for installation in concrete.
- B. Wrap top of sleeve with two layers of asphalt felt for distance of 600 mm (2 feet) down.
- C. Fill space between pole and metal sleeve to within two inches of top with fine dry sand and fill balance of space with waterproof compound as shown.

**3.2 LIGHTNING ROD**

Weld lightning ground rod of 19 mm (3/4-inch) diameter galvanized steel to base plate at bottom of sleeve or tube, and to steel support plate at grade.

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**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on drawings.
- C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the utility's system shall conform to the utility's requirements. Coordinate fuses, circuit breakers and relays with the utility's system, and obtain utility approval for sizes and settings of these devices.
- D. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies,



lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

**B. Definitions:**

1. Listed; Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product which:
  - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
  - c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

**1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.5 APPLICABLE PUBLICATIONS**

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

**1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

#### **1.7 EQUIPMENT REQUIREMENTS**

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

#### **1.8 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
  2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  3. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  5. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

### **1.9 WORK PERFORMANCE**

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
  - 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Resident Engineer and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
  - 4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Resident Engineer.
- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.

- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers (starters), fused and unfused safety switches, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Nameplates for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Nameplates for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 1/2 inch [12mm] high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### 1.12 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  - 1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  - 3. Submit each section separately.
- E. The submittals shall include the following:
  - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
  - 2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and/or attached to the equipment.
  - 3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  - 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL  
REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation instructions.
  - e. Safety precautions for operation and maintenance.
  - f. Diagrams and illustrations.
  - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
  - 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
  - 2. Each type of conduit coupling, bushing and termination fitting.
  - 3. Conduit hangers, clamps and supports.
  - 4. Duct sealing compound.
  - 5. Each type of receptacle, toggle switch, occupancy sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

#### **1.15 ACCEPTANCE CHECKS AND TESTS**

The contractor shall furnish the instruments, materials and labor for field tests.

#### **1.16 TRAINING**

- A. Training shall be provided in accordance with Article 1.25, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

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**SECTION 26 05 21**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of low-voltage conductors and cables in manholes and ducts.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- 1. Manufacturer's Literature and Data: Showing each cable type and rating.
- 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the Engineer of Record:
  - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

## 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
  - D2301-04.....Standard Specification for Vinyl Chloride  
Plastic Pressure-Sensitive Electrical Insulating  
Tape
- C. National Fire Protection Association (NFPA):
  - 70-08.....National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
  - WC 70-09.....Power Cables Rated 2000 Volts or Less for the  
Distribution of Electrical Energy
- E. Underwriters Laboratories, Inc. (UL):
  - 44-05.....Thermoset-Insulated Wires and Cables
  - 83-08.....Thermoplastic-Insulated Wires and Cables
  - 467-071.....Electrical Grounding and Bonding Equipment
  - 486A-486B-03.....Wire Connectors
  - 486C-04.....Splicing Wire Connectors
  - 486D-05.....Sealed Wire Connector Systems
  - 486E-94.....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors
  - 493-07.....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable
  - 514B-04.....Conduit, Tubing, and Cable Fittings
  - 1479-03.....Fire Tests of Through-Penetration Fire Stops

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.
- B. Single Conductor:
  - 1. Shall be annealed copper.
  - 2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
  - 3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- a. Lighting circuit "switch legs" and 3-way switch "traveling wires" shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC.

Coordinate color coding in the field with the Engineer of Record.

2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified above.
  - c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

## 2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.
- B. Aboveground Circuits (No. 10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.

C. Aboveground Circuits (No. 8 AWG and larger):

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

D. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190° F [90° C], with integral insulation.

## **2.3 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

## **2.4 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.

- D. Wires of different systems (e.g., 120 V, 277 V) shall not be installed in the same conduit or junction box system.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- G. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
  - 2. Use nonmetallic ropes for pulling feeders.
  - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineer of Record.
  - 4. All cables in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- I. No more than three single-phase branch circuits shall be installed in any one conduit.

### **3.2 INSTALLATION IN MANHOLES**

- A. Install and support cables in manholes on the steel racks with porcelain or equivalent insulators. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

### **3.3 SPLICE INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque values.
- C. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

### **3.4 FEEDER IDENTIFICATION**

- A. In each interior pull-box and junction box, install metal tags on all circuit cables and wires to clearly designate their circuit

identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

- B. In each manhole and handhole, provide tags of the embossed brass type, showing the circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.5 EXISTING WIRING**

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

### **3.6 CONTROL AND SIGNAL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

### **3.7 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

### **3.8 DIRECT BURIAL CABLE INSTALLATION**

- A. Tops of the cables:
  - 1. Below the finished grade: Minimum 24 in [600 mm] unless greater depth is shown.
  - 2. Below road and other pavement surfaces: In conduit as specified, minimum 30 in [750 mm] unless greater depth is shown.
  - 3. Do not install cables under railroad tracks.
- B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on plans, but not less

than 2 in [50 mm] trade size with bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.

- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.
- D. Cut the trenches neatly and uniformly:
  - 1. Excavating and backfilling is specified in Section 31 20 00, EARTH MOVING.
  - 2. Place a 3 in [75 mm] layer of sand in the trenches before installing the cables.
  - 3. Place a 3 in [75 mm] layer of sand over the installed cables.
  - 4. Install continuous horizontal, 1 in x 8 in [25 mm x 200 mm] preservative impregnated wood planking 3 in [75 mm] above the cables before backfilling.
- E. Provide horizontal slack in the cables for contraction during cold weather.
- F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
- G. Connections and terminations shall be listed submersible-type designed for the cables being installed.
- H. Warning tape shall be continuously placed 12 in [300 mm] above the buried cables.

### **3.9 ACCEPTANCE CHECKS AND TESTS**

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

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**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- C. Section 26 13 00, MEDIUM-VOLTAGE SWITCHGEAR: Medium voltage distribution switchgear.
- D. Section 26 13 13, GENERATOR PARALLELING CONTROLS: Generator paralleling controls.
- E. Section 26 18 41, MEDIUM-VOLTAGE SWITCHES: Medium voltage switches.
- F. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.
- G. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low voltage switchgear.
- H. Section 26 24 11, DISTRIBUTION SWITCHBOARDS: Low voltage distribution switchboards.
- I. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- J. Section 26 24 19, MOTOR CONTROL CENTERS: Low voltage motor control centers.
- K. Section 26 24 21, MOTOR CONTROL PANELBOARDS: Low voltage motor control panelboards.
- L. Section 26 32 13, ENGINE-GENERATORS: Engine-generators.
- M. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Automatic transfer switches.



N. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Requirements for lightning protection.

### 1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

### 1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present enough information to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Engineer of Record:
  - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
  - 2. Certification by the contractor that the complete installation has been properly installed and tested.

### 1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

- A. American Society for Testing and Materials (ASTM):
  - B1-07.....Standard Specification for Hard-Drawn Copper Wire
  - B3-07.....Standard Specification for Soft or Annealed Copper Wire
  - B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity,  
Ground Impedance, and Earth Surface Potentials  
of a Ground System

C2-07.....National Electrical Safety Code

C. National Fire Protection Association (NFPA):

70-08.....National Electrical Code (NEC)

99-2005.....Health Care Facilities

D. Underwriters Laboratories, Inc. (UL):

44-05 .....Thermoset-Insulated Wires and Cables

83-08 .....Thermoplastic-Insulated Wires and Cables

467-07 .....Grounding and Bonding Equipment

486A-486B-03 .....Wire Connectors

## **PART 2 - PRODUCTS**

### **2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm<sup>2</sup>] and larger shall be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

### **2.2 GROUND RODS**

- A. Steel or copper clad steel, 0.75 in [19 mm] diameter by 10 ft [30 M] long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance, as shown on the drawings.

### **2.3 CONCRETE ENCASED ELECTRODE**

Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

### **2.4 MEDIUM VOLTAGE SPLICES AND TERMINATIONS**

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

### **2.5 GROUND CONNECTIONS**

- A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

**2.6 EQUIPMENT RACK AND CABINET GROUND BARS**

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

**2.7 GROUND TERMINAL BLOCKS**

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
  1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

**3.2 INACCESSIBLE GROUNDING CONNECTIONS**

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

**3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building steel, and supplemental or made electrodes. Provide jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
  2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers and Panelboards, Engine-Generators, and Automatic Transfer Switches:
1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
  2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
  3. Provide ground bars, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
  4. Connect metallic conduits that terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

### **3.5 RACEWAY**

- A. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
  3. Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
  4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect

- bushings with a bare grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
- D. Wireway Systems:
1. Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm<sup>2</sup>] bonding jumper at all intermediate metallic enclosures and across all section junctions.
  2. Install insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].
  3. Use insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
  4. Use insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].
- E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
- H. Raised Floors: Provide bonding of all raised floor components.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG [16 mm<sup>2</sup>]. These conductors shall be installed in rigid metal conduit.

### **3.7 CORROSION INHIBITORS**

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

### **3.8 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping at the outlets directly to the room or patient ground bus.

### **3.9 LIGHTNING PROTECTION SYSTEM**

Bond the lightning protection system to the electrical grounding electrode system.

### **3.10 ELECTRICAL ROOM GROUNDING**

Building Earth Ground Busbars: Provide ground busbar and mounting hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

### **3.11 EXTERIOR LIGHT POLES**

Provide 20 ft [6.1 M] of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

### **3.12 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance

measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the Engineer of Record prior to backfilling. The contractor shall notify the Engineer of record 24 hours before the connections are ready for inspection.

### **3.12 GROUND ROD INSTALLATION**

- A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 24 in [609 mm] below final grade.
- B. For indoor installations, leave 4 in [100 mm] of rod exposed.
- C. Where permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- D. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

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**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.
- B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.
- C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- H. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.
- I. Section 31 20 00, EARTH MOVING: Bedding of conduits.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:



- A. Manufacturer's Literature and Data: Showing each cable type and rating.  
The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of panels and pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.
- C. Certifications:
  - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Engineer of Record:
    - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
    - b. Certification by the contractor that the material has been properly installed.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
  - C80.1-05.....Electrical Rigid Steel Conduit
  - C80.3-05.....Steel Electrical Metal Tubing
  - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
  - 70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05.....Flexible Metal Conduit
  - 5-04.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-093.....Liquid-Tight Flexible Steel Conduit
  - 467-07.....Grounding and Bonding Equipment
  - 514A-04.....Metallic Outlet Boxes
  - 514B-04.....Conduit, Tubing, and Cable Fittings
  - 514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-05.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit

- 797-07.....Electrical Metallic Tubing
- 1242-06.....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
  - TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and  
Conduit
  - TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
  - FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

- A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
  - 1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
  - 2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
  - 3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
  - 4. Flexible galvanized steel conduit: Shall conform to UL 1.
  - 5. Liquid-tight flexible metal conduit: Shall conform to UL 360.
  - 6. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
  - 7. Surface metal raceway: Shall conform to UL 5.
- C. Conduit Fittings:
  - 1. Rigid steel and IMC conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
    - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
    - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting.

Bushings made entirely of metal or nonmetallic material are not permitted.

- e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
3. Electrical metallic tubing fittings:
- a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
  - d. Indent-type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp-type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Direct burial plastic conduit fittings:
- Fittings shall meet the requirements of UL 514C and NEMA TC3.
7. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.

8. Expansion and deflection couplings:

- a. Conform to UL 467 and UL 514B.
- b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
- c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
- d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

1. UL-50 and UL-514A.
2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Engineer of Record prior to drilling through structural elements.

2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the Engineer of record as required by limited working space.

- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, as shown, and as specified herein.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.
- C. Install conduit as follows:
  1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
  2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
  4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
  7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
  8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  9. Conduit installations under fume and vent hoods are prohibited.
  10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made

- up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
  12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:
1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
  2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Engineer of Record.

### **3.3 CONCEALED WORK INSTALLATION**

- A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
  2. Align and run conduit in direct lines.
  3. Install conduit through concrete beams only:
    - a. Where shown on the structural drawings.
    - b. As approved by the Engineer of Record prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
  4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
    - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
    - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
    - c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
  5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground

continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the same system is prohibited.
2. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
5. Tightening setscrews with pliers is prohibited.

**3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

**3.5 DIRECT BURIAL INSTALLATION**

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

### **3.6 HAZARDOUS LOCATIONS**

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

### **3.7 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

### **3.8 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

### **3.9 EXPANSION JOINTS**

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and



deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.

- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 in [375 mm] of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

### **3.10 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
    - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- E. Hollow Masonry: Toggle bolts.
- F. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

- J. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### **3.11 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- G. On all branch circuit junction box covers, identify the circuits with black marker.

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**SECTION 26 05 41**  
**UNDERGROUND ELECTRICAL CONSTRUCTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of precast manholes and pullboxes with ducts to form a complete underground raceway system.
- B. "Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

**1.2 RELATED WORK**

- A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings and boxes for raceway systems.
- E. Section 31 20 00, EARTH MOVING: Trenching, backfill and compaction.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Coordinate layout and installation of ducts, manholes, pullboxes, and pull-boxes with final arrangement of other utilities, site grading, and surface features, as determined in the field.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include manholes, pullboxes, duct materials, and hardware. Submit plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories and details.

3. Proposed deviations from details on the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes or pullboxes at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit four copies to the Engineer of Record for approval prior to construction.

C. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the Engineer of record:

1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
2. Certification by the contractor that the materials have been properly installed, connected, and tested.

#### **1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):

Building Code Requirements for Structural Concrete

318/318M-05.....Building Code Requirements for Structural  
Concrete & Commentary

SP-66-04.....ACI Detailing Manual

C. American National Standards Institute (ANSI):

77-07.....Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):

C478-09.....Standard Specification for Precast Reinforced  
Concrete Manhole Sections

C858-09.....Underground Precast Concrete Utility Structures

C990-09.....Standard Specification for Joints for Concrete  
Pipe, Manholes and Precast Box Sections Using  
Preformed Flexible Joint Sealants.

E. Institute of Electrical and Electronic Engineers (IEEE):

C2-07 .....National Electrical Safety Code

F. National Electrical Manufacturers Association (NEMA):

TC 2-03.....Electrical Polyvinyl Chloride (PVC) Tubing And  
Conduit

- TC 3-2004.....PVC Fittings for Use With Rigid PVC Conduit And  
Tubing
- TC 6 & 8 2003.....PVC Plastic Utilities Duct For Underground  
Installations
- TC 9-2004.....Fittings For PVC Plastic Utilities Duct For  
Underground Installation
- G. National Fire Protection Association (NFPA):
  - 70-08.....National Electrical Code (NEC)
- H. Underwriters Laboratories, Inc. (UL):
  - 6-07.....Electrical Rigid Metal Conduit-Steel
  - 467-07.....Grounding and Bonding Equipment
  - 651-05.....Schedule 40 and 80 Rigid PVC Conduit and  
Fittings
  - 651A-00.....Type EB and A Rigid PVC Conduit and HDPE  
Conduit
  - 651B-07.....Continuous Length HDPE Conduit
- I. U.S. General Services Administration (GSA):
  - A-A-60005-1998.....Frames, Covers, Gratings, Steps, Sump and Catch  
Basin, Manhole

## 1.6 STORAGE

Lift and support pre-cast concrete structures only at designated  
lifting or supporting points.

## PART 2 - PRODUCTS

### 2.2 PULLBOXES

- A. General: Size as indicated on drawings. Provide pullboxes with  
weatherproof, non-skid covers with recessed hook eyes, secured with  
corrosion- and tamper-resistant hardware. Cover material shall be  
identical to pullbox material. Covers shall have molded lettering,  
ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the  
requirements of ANSI/SCTE 77 //Tier 5// //Tier 8// //Tier 15//  
//Tier 22// loading. Provide pulling irons, 0.875 in [22 mm] diameter  
galvanized steel bar with exposed triangular-shaped opening.
- D. Concrete Pullboxes: Shall be monolithically-poured reinforced concrete.

### 2.3. DUCTS

- A. Number and sizes shall be as shown on drawings.
- B. Ducts (concrete-encased):
  - 1. Plastic Duct:

- b. Duct shall be suitable for use with 194° F [90° C] rated conductors.
- 2. Conduit Spacers: Prefabricated plastic.
- C. Ducts (direct-burial):
  - 1. Plastic duct:
    - a. NEMA TC2 and TC3
    - b. UL 651, 651A, and 651B, Schedule 40 PVC or HDPE.
    - c. Duct shall be suitable for use with 167° F [75° C] rated conductors.
  - 2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid steel, threaded type, half-lapped with 10 mil PVC tape.

## **2.4 GROUNDING**

- A. Rods: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Ground Wire: Stranded bare copper 6 AWG [16 mm<sup>2</sup>] minimum.

## **2.5 WARNING TAPE**

Standard 4-mil polyethylene 3 in [76 mm] wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

## **2.6 PULL ROPE FOR SPARE DUCTS**

Plastic with 200 lb [890 N] minimum tensile strength.

# **PART 3 - EXECUTION**

## **3.1 MANHOLE AND PULLBOX INSTALLATION**

- A. Assembly and installation shall follow the printed instructions and recommendations of the manufacturer. Install manholes and pullboxes level and plumb.
  - 1. Units shall be installed on a 12 in [300 mm] level bed of 90% compacted granular fill, well-graded from the 1 in [25 mm] sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
  - 2. Seal duct terminations so they are watertight.
- B. Access: Ensure the top of frames and covers are flush with finished grade.
- C. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 4 in [100 mm] above the manhole floor.

D. Grounding in Manholes:

1. Install a No. 3/0 AWG [95 mm<sup>2</sup>] bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
2. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
3. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG [16 mm<sup>2</sup>] bare copper jumper.

**3.2 TRENCHING**

- A. Refer to //Section 31 20 00, EARTH MOVING for trenching, backfilling, and compaction.
- B. Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
- D. Cut the trenches neatly and uniformly.
- E. For Concrete-Encased Ducts:
  1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 4 ft [1.2 M] intervals to establish the grade and route of the duct bank.
  2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
  3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
  4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.
- F. Conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place. Conduits shall be heavy wall rigid steel.

### 3.3 DUCT INSTALLATION

#### A. General Requirements:

1. Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.
2. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 4 in [100 mm] in 100 ft [30 M].
3. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] outside the building foundation. Tops of conduits below building slab shall be minimum 24 in [610 mm] below bottom of slab.
4. Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] away from the edge of slab.
5. Install insulated grounding bushings on the terminations.
6. Radius for turns of direction shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter. Use manufactured long sweep bends.
7. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3 in [75 mm] above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 5 ft [1.5 M]. Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during pouring of concrete. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 12 in [300 mm] from other utility systems, such as water, sewer, and chilled water.
10. Clearances between individual ducts:
  - a. For like services, not less than 3 in [75 mm].
  - b. For power and signal services, not less than 6 in [150 mm].
11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.



12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Seal conduits, including spare conduits, at building entrances and at outdoor equipment terminations with a suitable compound to prevent entrance of moisture and gases.

B. Concrete-Encased Ducts and Conduits:

1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
2. Duct lines shall consist of single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
3. Tops of concrete-encased ducts shall be:
  - a. Not less than 24 in [600 mm] and not less than shown on the drawings, below finished grade.
  - b. Not less than 30 in [750 mm] and not less than shown on the drawings, below roads and other paved surfaces.
  - c. Conduits crossing under grade slab construction joints shall be installed a minimum of 4 ft [1.2 M] below slab.
4. Extend the concrete envelope encasing the ducts not less than 3 in [75 mm] beyond the outside walls of the outer ducts and conduits.
5. Within 10 ft [3 M] of building manhole and pullbox wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts, conduits, and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, conduits, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Conduit joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 in [150 mm] vertically.

9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 0.75 in [19 mm] reinforcing rod dowels extending 18 in [450 mm] into concrete on both sides of joint near corners of envelope.
  10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by Engineer OF Record.
  11. Duct Bank Markers:
    - a. Duct bank markers, where required and shown on plans, shall be located at the ends of duct banks except at manholes or pullboxes at approximately every 200 ft [60 M] along the duct run and at each change in direction of the duct run. Markers shall be placed 2 ft [0.6 M] to the right of the duct bank, facing the longitudinal axis of the run in the direction of the electrical load.
    - b. The letter "D" with two arrows shall be impressed or cast on top of the marker. One arrow shall be located below the letter and shall point toward the ducts. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the ducts. The letter and arrow adjacent to it shall each be approximately 2 in [75 mm] long. The letter and arrows shall be V-shaped, and shall have a width of stroke at least 0.75 in [6 mm] at the top and a depth of 0.25 in [6 mm].
    - c. In paved areas, the top of the duct markers shall be flush with the finished surface of the paving.
    - d. Where the duct bank changes direction, the arrow located adjacent to the letter shall be cast or impressed with an angle in the arrow equivalent to the angular change of the duct bank.
- C. Direct-Burial Duct and Conduits:
1. Install direct-burial ducts and conduits only where shown on the drawings. Provide direct-burial ducts only for low-voltage systems.
  2. Join and terminate ducts and conduits with fittings recommended by the conduit manufacturer.
  3. Tops of ducts and conduits shall be:
    - a. Not less than 24 in [600 mm] and not less than shown on the drawings, below finished grade.

- b. Not less than 30 in [750 mm] and not less than shown on the drawings, below roads and other paved surfaces.
- 4. Do not kink the ducts or conduits. Compaction shall not deform the ducts.
- D. Concrete-Encased Duct and Conduit Identification: Place continuous strip of warning tape approximately 12 in [300 mm] above ducts or conduits before backfilling trenches. Warning tape shall be preprinted with proper identification.
- E. Spare Ducts and Conduits: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
- F. Duct and Conduit Cleaning:
  - 1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct. The mandrel shall be not less than 12 in [3600 mm] long, and shall have a diameter not less than 0.5 in [13 mm] less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
  - 2. Mandrel pulls shall be witnessed by the Engineer of Record.
- G. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.
- H. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 12 in [300 mm] in each direction. Perimeter of the duct bank opening in the underground structure shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.
- I. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening

to form a key or flared surface, providing a positive connection with the duct bank envelope.

- J. Connections to Existing Ducts: Where connections to existing duct banks are indicated, excavate around the duct banks as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.
- K. Partially-Completed Duct Banks: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 ft [0.6 M] back into the envelope and a minimum of 2 ft [0.6 M] beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 in [75 mm] from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 12 in [300 mm] apart. Restrain reinforcing assembly from moving during pouring of concrete.

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**SECTION 26 09 23**  
**LIGHTING CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation and connection of the lighting controls.

**1.2 RELATED WORK**

- A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Interface of lighting controls with HVAC control systems.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 24 26 16, PANELBOARDS: panelboard enclosure and interior bussing used for lighting control panels.
- F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting control, submit the following information.
  - 1. Manufacturer's catalog data.
  - 2. Wiring schematic and connection diagram.
  - 3. Installation details.
- C. Manuals:
  - 1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.

2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
  - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Green Seal (GS):  
GC-12.....Occupancy Sensors
- C. Illuminating Engineering Society of North America (IESNA):  
IESNA LM-48.....Guide for Calibration of Photoelectric Control Devices
- D. National Electrical Manufacturer's Association (NEMA)  
C136.10.....American National Standard for Roadway Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing  
ICS-1.....Standard for Industrial Control and Systems General Requirements  
ICS-2.....Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment  
ICS-6.....Standard for Industrial Controls and Systems Enclosures
- E. Underwriters Laboratories, Inc. (UL):  
20.....Standard for General-Use Snap Switches  
773.....Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting  
773A .....Nonindustrial Photoelectric Switches for Lighting Control  
98.....Enclosed and Dead-Front Switches

917.....Clock Operated Switches

## **PART 2 - PRODUCTS**

### **2.1 ELECTRONIC TIME SWITCHES**

- A. Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST.
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Astronomical Clock: Capable of switching a load on at sunset and off at sunrise, and automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise.  
Additionally, it shall be programmable to a fixed on/off weekly schedule.
  - 4. Battery Backup: For schedules and time clock.

### **2.2 ELECTROMECHANICAL-DIAL TIME SWITCHES**

- A. Electromechanical-dial time switches; complying with UL 917.
  - 1. Contact Configuration: SPST.
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Wound-spring reserve carryover mechanism to keep time during power failures.

### **2.3 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Solid state, with SPST dry contacts rated for 1800 VA tungsten or 1000 VA inductive, complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc [16.14 to 108 lx], with adjustable turn-on and turn-off levels.
  - 2. Time Delay: 15-second minimum.
  - 3. Surge Protection: Metal-oxide varistor.
  - 4. Mounting: Twist lock, with base-and-stem mounting or stem-and-swivel mounting accessories as required.

### **2.4 TIMER SWITCHES**

- A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
  - 1. Compatibility: Compatible with all ballasts.
  - 2. Warning: Audible warning to sound during the last minute of "on" operation.
  - 3. Time-out: Adjustable from 5 minutes to 12 hours.
  - 4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

## **2.6 SKYLIGHT PHOTOELECTRIC SENSORS**

- A. Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight; with separate relay unit.
  - 1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 2. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
  - 3. Monitoring Range: 1000 to 10,000 fc [10,800 to 108,000 lx], with an adjustment for turn-on and turn-off levels.
  - 4. Time Delay: Adjustable from 5 to 300 seconds, with deadband adjustment.
  - 5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

## **2.7 INDOOR OCCUPANCY SENSORS**

- A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
  - 2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
  - 7. Manual/automatic selector switch.
  - 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc [21.5 to 2152 lx]; keep lighting off when selected lighting level is present.
  - 9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.



B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch [150mm] minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. [232 sq. cm], and detect a person of average size and weight moving not less than 12 inches [305 mm] in either a horizontal or a vertical manner at an approximate speed of 12 inches/s [305 mm/s].
3. Detection Coverage: as scheduled on drawings.

## **2.8 OUTDOOR MOTION SENSOR (PIR)**

A. Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C).

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a 1 to 15 minute adjustable time delay for turning lights off.
2. Mounting:
  - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
  - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
3. Bypass Switch: Override the on function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc [11 to 215 lx]; keep lighting off during daylight hours.

B. Detector Sensitivity: Detect occurrences of 6-inch [150mm] minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. [232 sq. cm].

C. Detection Coverage: as scheduled on drawings.

D. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

## **2.9 LIGHTING CONTROL PANEL - RELAY TYPE**

- A. Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Controller communication protocol shall be compatible with the building automation system specified in SECTION 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.
- B. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.
- C. Directory: Identifies each relay as to load controlled.
- D. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-V ac for tungsten filaments and 20 A, 277-V ac for ballasts, 50,000 cycles at rated

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION:**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Aim outdoor photocell switch according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle photocell turn-on.
- E. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.
- F. Label time switches and contactors with a unique designation.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations.
- B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.
- C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

E. Program lighting control panels per schedule on drawings.

### **3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

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**SECTION 26 56 00**  
**EXTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of exterior luminaires, poles, and supports.

**1.2 RELATED WORK**

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- D. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.
- H. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, lamps, and accessories.

- C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the Engineer of Record. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement lamps, ballasts, and parts.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Engineer of Record:
  - 1. Certification by the manufacturer that the materials are in accordance with the drawings and specifications.
  - 2. Certification by the contractor that the complete installation has been properly installed and tested.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Aluminum Association Inc. (AA):  
AAH35.1-06.....Alloy and Temper Designation Systems for  
Aluminum
- C. American Association of State Highway and Transportation Officials  
(AASHTO):  
LTS-5-09 .....Structural Supports for Highway Signs,  
Luminaires and Traffic Signals
- D. American Concrete Institute (ACI):  
318-05 .....Building Code Requirements for Structural  
Concrete
- E. American National Standards Institute (ANSI):  
C81.61-09 .....Electrical Lamp Bases - Specifications for  
Bases (Caps) for Electric Lamps
- F. American Society for Testing and Materials (ASTM):  
A123/A123M-09 .....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products  
A153/A153M-09.....Zinc Coating (Hot-Dip) on Iron and Steel  
Hardware  
B108-03a-08 .....Aluminum-Alloy Permanent Mold Castings  
C1089-06 .....Spun Cast Prestressed Concrete Poles
- G. Federal Aviation Administration (FAA):

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.

DVA Project No.: 640A0-12-204FCA

795 Willow Road, Menlo Park, CA

AC 70/7460-IK-07.....Obstruction Lighting and Marking

AC 150/5345-43F-06.....Obstruction Lighting Equipment

H. Illuminating Engineering Society of North America (IESNA)

HB-9-00.....Lighting Handbook

RP-8-05.....Roadway Lighting

RP-20-98.....Lighting for Parking Facilities

RP-33-99.....Lighting for Exterior Environments

LM-5-96.....Photometric Measurements of Area and Sports  
Lighting Installations

LM-50-99.....Photometric Measurements of Roadway Lighting  
Installations

LM-52-99.....Photometric Measurements of Roadway Sign  
Installations

LM-64-01.....Photometric Measurements of Parking Areas

LM-72-97.....Directional Positioning of Photometric Data

LM-79-08.....Approved Method for the Electrical and  
Photometric Measurements of Solid-State Lighting  
Products

LM-80-08.....Approved Method for Measuring Lumen Maintenance  
of LED Light Sources

I. National Electrical Manufacturers Association (NEMA):

C78.41-06.....Electric Lamps - Guidelines for Low-Pressure  
Sodium Lamps

C78.42-07 .....Electric Lamps - Guidelines for High-Pressure  
Sodium Lamps

C78.43-07 .....Electric Lamps - Single-Ended Metal-Halide  
Lamps

C78.1381-98.....Electric Lamps - 70-Watt M85 Double-Ended  
Metal-Halide Lamps

C82.4-02 .....Ballasts for High-Intensity-Discharge and Low-  
Pressure Sodium Lamps (Multiple-Supply Type)

C136.3-05 .....For Roadway and Area Lighting Equipment -  
Luminaire Attachments

C136.17-05 .....Roadway and Area Lighting Equipment - Enclosed  
Side-Mounted Luminaires for Horizontal-Burning  
High-Intensity-Discharge Lamps - Mechanical  
Interchangeability of Refractors

EXTERIOR LIGHTING

26 56 00 - 3

795 Willow Road, Menlo Park, CA

ICS 2-00 (R2005) .....Controllers, Contactors and Overload Relays  
Rated 600 Volts

ICS 6-93 (R2006) .....Enclosures

J. National Fire Protection Association (NFPA):

70-08 .....National Electrical Code (NEC)

K. Underwriters Laboratories, Inc. (UL):

496-08 .....Lampholders

773-95.....Plug-In, Locking Type Photocontrols for Use  
with Area Lighting

773A-06 .....Nonindustrial Photoelectric Switches for  
Lighting Control

1029-94.....High-Intensity-Discharge Lamp Ballasts

1598-08 .....Luminaires

8750-08.....Light Emitting Diode (LED) Light Sources for  
Use in Lighting Products

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 12 in [305 mm] above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS AND EQUIPMENT**

Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

#### **2.2 POLES**

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of 100 mph, with an additional 30% gust factor, supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.
3. Poles shall be embedded type designed for use with underground supply conductors. Poles shall have handhole having a minimum clear

- opening of 2.5 x 5 in [65 x 125 mm]. Handhole covers shall be secured by stainless steel captive screws.
4. Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.
  5. Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
  6. Hardware and Accessories: All necessary hardware and specified accessories shall be the product of the pole manufacturer.
  7. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

**B. Types:**

1. Aluminum: Provide round aluminum poles manufactured of corrosion-resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4. Poles shall be seamless extruded or spun seamless type.

**2.3 FOUNDATIONS FOR POLES**

- A. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.
- C. Place concrete in spirally-wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 0.25 in [6 mm] radius.
- E. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- F. Prior to concrete pour, install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

**2.4 LUMINAIRES**

- A. Per UL 1598 and NEMA C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.



- B. Light distribution pattern types shall be as shown on the drawings.
- C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.
- F. Pre-wire internal components to terminal strips at the factory.
- G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.
- J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

## **2.5 LAMPS**

- A. Install the proper lamps in every luminaire installed.
- B. Lamps shall be general-service, outdoor lighting types.
- C. High-Pressure Sodium (HPS) Lamps: NEMA C78.42, CRI 21 (minimum), wattage as indicated. Lamps shall have minimum average rated life of 24,000 hours.
- D. Low-Pressure Sodium (LPS) Lamps: NEMA C78.43.
- E. Metal-Halide Lamps: NEMA C78.43 or NEMA C78.1381.
- //F. LED sources shall meet the following requirements:
  - 1. Operating temperature rating shall be between -40° F [-40° C] and 120° F [50° C].
  - 2. Correlated Color Temperature (CCT): 2700K.
  - 3. Color Rendering Index (CRI): ≥ 65.
  - 4. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High

Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).//

G. Mercury vapor lamps shall not be used.

## **2.6 HIGH INTENSITY DISCHARGE BALLASTS**

- A. Per NEMA C82.4 and UL 1029. Ballasts shall be //encapsulated// single-lamp, copper-wound, constant-wattage autotransformer type, designed to operate on the voltage system to which they are connected, and capable of open-circuit operation without reducing lamp life.
- B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.
- C. Ballast shall have an allowable line voltage variations of  $\pm 10\%$ , with a maximum 20% lamp wattage regulation spread.
- D. Power factor shall be not less than 90%.
- E. Ballast shall have a minimum starting temperature of  $-22^{\circ}\text{ F } [-30^{\circ}\text{ C}]$ , and a normal ambient operating temperature of  $104^{\circ}\text{ F } [40^{\circ}\text{ C}]$ .
- F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

## **2.7 METAL HALIDE CORE AND COIL BALLASTS**

- A. Shall be pulse start, linear reactor type for 277 volt luminaires and constant-wattage autotransformer (CWA) type for other voltage luminaires (if not otherwise specified).
- B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.
- C. Power factor shall be not less than 90%.
- D. Ballast shall have an allowable line voltage variations of  $\pm 5\%$  for linear reactor type and  $\pm 10\%$  for CWA, with a maximum 20% lamp wattage regulation spread.
- E. Ballast shall have a minimum starting temperature of  $-40^{\circ}\text{ F } [-40^{\circ}\text{ C}]$ .
- F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

## **2.8 METAL HALIDE ELECTRONIC BALLASTS**

- A. Ballast shall be low-frequency electronic type, and shall operate pulse start and ceramic metal halide lamps at a frequency of 90 to 200 Hz square wave.

- B. Ballast shall be labeled Type '1' outdoor, suitable for recessed use, Class 'P'.
- C. Ballast shall have auto-resetting thermal protector to shut off ballast when operating temperatures reach unacceptable levels.
- D. Ballast shall have an end of lamp life detection and shut-down circuit.
- E. Lamp current crest factor shall be 1.5 or less.
- F. Ballasts shall comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
- G. Ballast shall have a minimum ballast factor of 1.0.
- H. Input current THD shall not exceed 20% for the primary lamp.
- I. Ballasts shall have ANSI C62.41, category 'A' transient protection.
- J. Ballasts shall have power factor greater than 90%.
- K. Ballast shall have a Class 'A' sound rating.

## **2.9 LED DRIVERS**

- A. LED drivers shall meet the following requirements:
  - 1. Drivers shall have a minimum efficiency of 85%.
  - 2. Starting Temperature: -40° F [-40° C].
  - 3. Input Voltage: 120 to 480 (±10%) V.
  - 4. Power Supplies: Class I or II output.
  - 5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
  - 6. Power Factor (PF): ≥ 0.90.
  - 7. Total Harmonic Distortion (THD): ≤ 20%.
  - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
  - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Pole Foundations:
  - 1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to

- prevent pressure between conductor, jacket, or sheath, and the end of conduit.
2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
  3. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
  4. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 0.375 in [9 mm] inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.
- C. Install lamps in each luminaire.
- D. Adjust luminaires that require field adjustment or aiming.

### **3.2 GROUNDING**

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

### **3.3 ACCEPTANCE CHECKS AND TESTS**

Verify operation after installing luminaires and energizing circuits.

### **//3.4 WATER TANKS AND COOLING TOWERS**

Mount the luminaires at the extreme top of tank and tower. //

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**SECTION 31 20 00**  
**EARTHWORK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK:**

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:

1. Site preparation.
2. Excavation.
3. Underpinning.
4. Filling and backfilling.
5. Grading.
6. Soil Disposal.
7. Clean Up.

**1.2 DEFINITIONS:**

A. Unsuitable Materials:

1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D1557.
2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from reference borings and design requirements, excavate to acceptable strata subject to Contracting Officer's Representative's approval.

B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.

C. Trench Earthwork: Trenchwork required for utility lines.

- D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D6938.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Contracting Officer's Representative. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the Contracting Officer's Representative based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.
- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.

- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- R. Contaminated soils: Soil that contains contaminants as defined and determined by the Contracting Officer's Representative or the Government's testing agency.

### **1.3 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
- F. Site preparation: Section 31 23 19, DEWATERING, and Section 02 41 00, DEMOLITION.
- H. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

### **1.4 CLASSIFICATION OF EXCAVATION:**

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

### **1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:**

- A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL

REQUIREMENTS. The measurement will include authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

#### 1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
  - C. Furnish to Contracting Officer's Representative:
    - 1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
    - 2. Soil samples.
      - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
      - b. Laboratory compaction curve in accordance with ASTM D1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
      - c. Test reports for compliance with ASTM D2940 requirements for subbase material.
      - d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
      - e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.
    - 3. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material.
- Notification of encountering rock in the project. Advance notice on



the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

#### 1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
  - T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
  - C33-03.....Concrete Aggregate
  - D448-08.....Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  - D698-07e1.....Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft<sup>3</sup> (600 kN m/m<sup>3</sup>))
  - D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
  - D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
  - D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2700 kN m/m<sup>3</sup>))
  - D2167-08.....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
  - D2487-11.....Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
  - D2940-09.....Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
  - D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

## D. Society of Automotive Engineers (SAE):

J732-07.....Specification Definitions - Loaders

J1179-08.....Hydraulic Excavator and Backhoe Digging Forces

**PART 2 - PRODUCTS****2.1 MATERIALS:**

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m<sup>3</sup> (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75-µm (No. 200) sieve.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- F. Granular Fill:
  - 1. Under concrete slab, - granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C 33 with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers (No. 200) sieve.
  - 2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D2940.

- G. Buried Warning and Identification Tape: Polyethylene plastic with metallic core warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red: Electric  
 Yellow: Gas, Oil, Dangerous Materials  
 Orange: Telephone and Other Communications  
 Blue: Water Systems  
 Green: Sewer Systems  
 White: Steam Systems

- H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.
- I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m (3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.
- J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION:**

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.

- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by Contracting Officer's Representative. Remove materials from Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Contracting Officer's Representative. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m<sup>3</sup> (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be

removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.

F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.

1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
2. Locations of existing and proposed elevations indicated on plans are from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate. Contractor is responsible to notify Contracting Officer's Representative of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify Contracting Officer's Representative of any differences between existing or constructed grades, as compared to those shown on the plans.
3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.
4. Finish grading is specified in Section 32 90 00, PLANTING.

G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

### **3.2 EXCAVATION:**

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Contracting Officer's

Representative, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor. The Contractor shall submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheet piling shall be removed as excavations are backfilled, in a manner to prevent caving.
2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Contracting Officer's Representative.
3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall provide a concrete fill support under disturbed foundations, as directed by Contracting Officer's Representative, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Contracting Officer's Representative.
5. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer's Representative of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer's Representative at any time throughout the contract duration.

- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Contracting Officer's Representative. Approval by the Contracting Officer's Representative is also required before placement of the permanent work on all subgrades.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Contracting Officer's Representative.
- D. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
  2. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade with six passes of a 13.6 meter tons (15 ton), pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Contracting Officer's Representative a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer's Representative. Rutting or pumping of material shall be undercut as directed by the Contracting Officer's Representative and replaced with select material. Maintain subgrade until succeeding operation has been accomplished.
- E. Building Earthwork:
1. Excavation shall be accomplished as required by drawings and specifications.
  2. Excavate foundation excavations to solid undisturbed subgrade.
  3. Remove loose or soft materials to a solid bottom.

4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.
6. Slope grades to direct water away from excavations and to prevent ponding.
7. Capillary water barrier (granular fill) under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.
8. Ensure that footing subgrades have been inspected and approved by the Contracting Officer's Representative prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer's Representative. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

G. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
  - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
  - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
  - c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
  - d. Length of open trench in advance of piping laying shall not be greater than is authorized by Contracting Officer's Representative.
  - e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade.
  - f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall



remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

- g. Bedding shall be of the type and thickness shown on the plans. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
  - 1) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
- 2. Sanitary and storm sewer trenches:
  - a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
  - b. Bed bottom quadrant of pipe on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
    - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
    - 2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm

(12 inches) above top of pipe. Place and tamp fill material by hand.

- c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
- d. Use granular fill for bedding where rock or rocky materials are excavated.
- e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade.
- f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
- g. Bedding shall be of the type and thickness shown on the plans. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
  - 1) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
- H. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and

other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Contracting Officer's Representative as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the Contracting Officer's Representative, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
  - 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
  - 2) Walks: Plus or minus 25 mm (1 inch).
  - 3) Pavements: Plus or minus 13 mm (1 inch).
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

**3.3 FILLING AND BACKFILLING:**

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use

unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Contracting Officer's Representative.

- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Contracting Officer's Representative. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill

- a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D1557 Method A, 95 percent.
- b. Curbs, curbs and gutters, ASTM D1557 Method A, 95 percent.
- c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D1557 Method A, 95 percent.
- d. Landscaped areas, top 400 mm (16 inches), ASTM D1557 Method A, 85 percent.

- e. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D1557 Method A, 90 percent.
- 2. Natural Ground (Cut or Existing)
  - a. Under building slabs, steps and paved areas, top 150 mm (6 inches), ASTM D1557 Method A, 95 percent.
  - b. Curbs, curbs and gutters, top 150 mm (6 inches), ASTM D1557 Method A, 95 percent.
  - c. Under sidewalks, top 150 mm (6 inches), ASTM D698 D1557 Method A, 95 percent.
- D. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.
- E. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Contracting Officer's Representative sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

### **3.4 GRADING:**

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points

where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to Contracting Officer's Representative at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

### **3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the Contracting Officer's Representative from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

**3.6 CLEAN UP:**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center.

----- E N D -----

**SECTION 31 20 00.01**  
**EARTHWORK - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies earthwork operations within the City of Menlo Park right of way.

**1.2 GENERAL**

The requirements indicated in the Plans or elsewhere in the Contract Documents, or the direction of the City, or the recommendations of a Soils Report for the site if there is one, shall take precedence over Section 19 of the Standard Specifications.

**1.3 PRESERVATION OF LIFE AND PROPERTY**

The following is added to Section 19-1.02 of the Standard Specifications:

Utility companies' equipment or facilities not indicated on the Plans as being moved or removed by the Contractor are to be moved by the companies, but they shall be protected from damage by the Contractor. See project specifications regarding Dust Control and Traffic Control.

**1.4 GRADE TOLERANCES**

Section 19-1.03C of the Standard Specifications is revised as follows:  
"...the grading plane at any point shall be not more than 0.05-foot above or below the grade established by the City."

**1.5 REMOVAL AND DISPOSAL OF BURIED MAN-MADE OBJECTS**

Section 19-1.04 of the Standard Specifications is adopted without revision.

**1.6 DISPOSITION OF EXCAVATION SPOILS**

Material removed for excavation, but not replaced as fill, shall become the property of the Contractor and shall be removed from the site and properly disposed of.

**1.7 CLEAN-UP AND RESTORATION OF SURROUNDINGS**

As excavation, backfill and grading operations proceed, and immediately upon completion, the Contractor shall remove and clean-up accumulated deposits of rock, soil and dust from the vicinity of the work. Stabilized construction entrances shall be refreshed before further construction work proceeds. Fences, walls, irrigation systems or other equipment or facilities, and adjacent paved surfaces that were damaged



during the work shall be restored or replaced before further construction work proceeds, unless otherwise directed by the City.

#### **1.8 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)**

No grading or excavation work may commence unless the Contractor and their subcontractors have complied with the City's stormwater pollution protection permit requirements, and the State Water Resources Control Board permit requirements noted in Section 015729.01, TEMPORARY ENVIRONMENTAL CONTROLS - OFFSITE.

Exposed soils, such as on-site stockpiles, embankments, excavations into existing slopes, backfill in place, and all disturbed surfaces on the surrounding site, shall be protected from erosion, and all necessary measures shall be taken to prevent off-site migration of material by wind or water run-off. See Section 015723.01, TEMPORARY STORM WATER POLLUTION CONTROL - OFFSITE, and Section 015729.01, TEMPORARY ENVIRONMENTAL CONTROLS - OFFSITE.

#### **1.9 ROADWAY EXCAVATION**

Section 19-2 of the Standard Specifications is revised as follows:

##### **1.10 GENERAL**

This section includes shoulder excavation, as well as making subgrade for sidewalk, bicycle paths, walkways, and parking areas if included in the Project. It also includes preparation of subgrade where existing streets are widened or extended, but it shall exclude reconstruction of subgrade where existing streets are being repaired during street repair or resurfacing projects, which is covered in Section 39. Excavation and/or fill for foundations is covered in Section 19-3, and excavation and/or fill for linear utility lines is covered in Section 19-4.

##### **1.11 UNSUITABLE MATERIALS**

The following is added to Section 19-2.02 of the Standard Specifications:

Unsuitable material also includes contaminated soils (see the subsection on Contaminated Soil Management in Sec. 013500.01 of the project specifications).

##### **1.12 BLASTING**

Blasting is not allowed within the City without the explicit written permission of the City under conditions prescribed by him.

##### **1.13 SLIDES AND SLIPOUTS**

Section 19-2.04 of the Standard Specifications is adopted without revision.

**1.14 SLOPES**

Section 19-2.05 of the Standard Specifications is entirely replaced with the following:

Unless directed otherwise by the Plans, or elsewhere in these project specifications, or by the City, or in a Soils Report prepared for the subject site by a licensed Geologist or Geotechnical City, no temporary slopes shall be left unsupported at angles steeper than 2:1 (H:V). Cut or fill slopes shall be constructed in conformance with the lines and grades established by the City. When completed, the average plane of slopes shall conform to the slopes indicated on the Plans and no point on the completed slopes shall vary above or below the designated slopes by more than 0.2-foot measured at right angles to the slope. Flowlines shall be graded to drain and shall not vary more than 0.1-foot from the grade line established by the City.

Areas that are not to be paved shall be cleared of loose rocks and roots; unless directed otherwise in the Plans or elsewhere in these project specifications or by the City, rocks larger than 2" in largest diameter and roots larger than 1" in diameter shall be removed.

The tops of cut or fill slopes and the ends of excavations shall be gently rounded.

**1.15 SURPLUS MATERIAL**

Section 19-2.06 of the Standard Specifications is revised as follows: Where the Plans require the existing surface of the site to be lowered, it shall be done concurrently with fill or backfill operations to minimize the off-haul or import of material.

**1.16 SELECTED MATERIAL**

Section 19-2.07 of the Standard Specifications is adopted without revision.

**1.17 TRENCH EXCAVATION & BACKFILL**

Section 19-4 of the Standard Specifications is entirely replaced with the following:

**1.18 EXCAVATION**

No trenches shall be left open and uncovered when workers are not present unless they are completely surrounded by locked fencing. When trenches are excavated in public street areas, work must comply with an approved Traffic Control Plan as described in Section 015526.01, TRAFFIC CONTROL - OFFSITE.

**1.19 COMPACTION**

Section 19-5.01 of the Standard Specifications is entirely replaced with the following:

All embankment and backfill material shall be compacted as it is placed so that the material will not settle or slump over time. This section shall apply to Structure Backfill as well as any other fill, and in any conflicts between this section and Section 19-3 the requirements in this section take precedence.

**1.20 GENERAL**

The following is added to Section 19-5.02 of the Standard Specifications:

When a compaction wheel on a backhoe or excavator is used for Trench Backfill operations, or when heavy wheeled-compactor equipment is used during grading or embankment placement, deeper lifts of fill may be approved by the City on a case-by-case basis.

**1.21 RELATIVE COMPACTION (95%)**

Section 19-5.03 of the Standard Specifications is entirely replaced with the following:

Unless directed otherwise by the Plans, or elsewhere in these project specifications, or by the City, or in a Soils Report prepared for the subject site by a licensed Geologist or Geotechnical City, all embankment or backfill under roadway pavements, or bearing structures shall be compacted to at least 95% of the relative dry density of the material, at a moisture content at or slightly above optimal.

**1.22 RELATIVE COMPACTION (90%)**

Section 19-5.04 of the Standard Specifications is adopted without revision.

**1.23 FOUNDATION PREPARATION**

Section 19-5.05 of the Standard Specifications is entirely replaced with the following:

Before placement of embankment the existing basement material shall be scarified to a depth of 8", moisture-conditioned and re-compacted to the density of the fill to be placed upon it.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 31 23 19**  
**DEWATERING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

**1.2 SUMMARY:**

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
  - 1. Implementation of the Erosion and Sedimentation Control Plan.
  - 2. Dewater excavations, including seepage and precipitation.
- B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

**1.3 REQUIREMENT:**

- A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 300 mm (1 foot) below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.
- B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 300 mm (1 foot) below prevailing excavation surface.
- C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
- D. Maintain stability of sides and bottom of excavation.
- E. Construction operations are performed in the dry.
- F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
  - 1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase

and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

2. Erosion is controlled.
3. Flooding of excavations or damage to structures does not occur.
4. Surface water drains away from excavations.
5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

#### **1.4 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- D. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.
- F. Excavation, backfilling, site grade and utilities: Section 31 20 00, EARTHWORK.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Drawings and Design Data:
  1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.
  2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
  3. Include a written report outlining control procedures to be adopted if dewatering problem arises.
  4. Capacities of pumps, prime movers, and standby equipment.
  5. Design calculations proving adequacy of system and selected equipment. The dewatering system shall be designed using accepted and professional methods of design and engineering consistent with the

- best modern practice. The dewatering system shall include the deep wells, wellpoints, and other equipment, appurtenances, and related earthwork necessary to perform the function.
6. Detailed description of dewatering procedure and maintenance method.
  7. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.
- C. Inspection Reports.
  - D. All required permits.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION:**

- A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.
- B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 300 mm (1 foot) below prevailing excavation surface at all times.

### **3.2 OPERATION:**

- A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

### **3.3 WATER DISPOSAL:**

- A. Dispose of water removed from the excavations in such a manner as:
  1. Will not endanger portions of work under construction or completed.
  2. Will cause no inconvenience to Government or to others working near site.
  3. Will comply with the stipulations of required permits for disposal of water.

4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

**B. Excavation Dewatering:**

1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.**

**3.4 STANDBY EQUIPMENT:**

Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain dewatering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

**3.5 CORRECTIVE ACTION:**

If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure or damages to work in place resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

**3.6 DAMAGES:**

Immediately repair damages to adjacent facilities caused by dewatering operations.

**3.7 REMOVAL:**

Insure compliance with all conditions of regulating permits and provide such information to the Contracting Officer's Representative. Obtain written approval from Contracting Officer's Representative before discontinuing operation of dewatering system.

----- E N D -----



**SECTION 31 23 23.33**  
**FLOWABLE FILL**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

- A. Flowable fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers. Flowable fill is sometimes referred to as controlled density fill (CDF), controlled low strength material (CLSM), lean concrete slurry, and unshrinkable fill.
- B. Flowable fill materials will be used as only as a structural fill replacement on VA projects. The materials and mix design for the flowable fill should be designed to produce a comparable compressive strength to the surrounding soil after hardening, making excavation at a later time possible Contracting Officer's Representative.

**1.2 DESCRIPTION:**

Furnish and place flowable fill in a fluid condition, that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans or as directed by the Contracting Officer's Representative, verbally or in writing. This section specifies flowable fill for use as structural fill to remain excavatable using hand tools.

**1.3 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Earthwork, excavation and backfill and compaction requirements: Section 31 20 00, EARTHWORK.

**1.4 DEFINITIONS:**

- A. Flowable fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious

content to reduce strength development for possible future removal. Unless specifically approved otherwise, by the Contracting Officer's Representative, flowable fill shall be designed as a permanent material, not designed for future removal. Design strength for this permanent type flowable fill shall be a compressive strength of 2.1 MPa (300 psi) minimum at 28 days. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.

- B. Excavatable Flowable fill - flowable fill designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Flowable fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications. The mix design should state the sources and proportions of each of the flowable fill constituents. The coefficient of permeability of flowable fill shall be that of uniform fine sand,  $4.0 \times 10^{-1}$  cm/sec (0.16 in/sec) or as indicated to provide a backfill material with permeability equal to or greater than that of the surrounding soil.

##### **1. Test and Performance - Submit the following data:**

- a. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C 39 at 28 days after placement.
- b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

- c. Flowable fill shall have a unit weight of 1900 - 2300 kg/m<sup>3</sup> (115 - 145 lb/feet<sup>3</sup>) measured at the point of placement after a 60 minute ready-mix truck ride.
- C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.
- D. Manufacturer's Certificates: Provide Contracting Officer's Representative with a certification that the materials incorporated in the flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.

#### 1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - D4832-10.....Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
  - C618-12.....Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)
  - C403/C403M-08.....Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
  - C150/C150M-11.....Standard Specification for Portland Cement
  - C33/C33M-11a.....Standard Specification for Concrete Aggregates
  - C94/C94M-12.....Standard Specification for Ready-Mixed Concrete
  - C494/C494M-11.....Standard Specification for Chemical Admixtures for Concrete
  - C685/C685M-11.....Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
  - C940-10a.....Standard Specification for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced - Aggregate Concrete in the Laboratory
  - D5971.....Sampling Freshly Mixed Controlled Low Strength Material

D6103.....Flow Consistency of Controlled Low Strength  
Material

D6023.....Unit Weight, Yield, Cement Content and Air  
Content (Gravimetric) of Controlled Low Strength  
Material

C. American Concrete Institute (ACI):

SP-150-94.....Controlled Low-Strength Materials

#### **1.7 QUALITY ASSURANCE:**

- A. Manufacturer: Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.
- B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, "Controlled Low Strength Materials."
- C. Pre-Approval Procedures: The use of flowable fill during any part of the project shall be restricted to those incidences where, due to field conditions, the Contractor has made the Contracting Officer's Representative aware of the conditions for which he recommends the use of the flowable, and the Contracting Officer's Representative has confirmed those conditions and approved the use of the flowable fill, in advance. During the submittal process, the contractor shall prepare and submit various flowable fill mix designs corresponding to required conditions or if the contractor desires to use flowable fill due to economics. Approval for the strength of the flowable fill shall be obtained from the Contracting Officer's Representative when the contractor desires, or is required, to use flowable fill at specific location(s) within the project. Prior to commencement of field operations the contractor shall establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- D. Sampling and Acceptance: Flowable fill shall be samples and testing in the field in conformance with either ASTM C 94 or C 685. Samples for tests shall be taken for every 115 cubic meters (150 cubic yards) of material, or fraction thereof, for each day's placement. Tests shall include temperature reading and four compressive strength cylinders. Compressive strength sampling and testing shall conform to ASTM D 4832 with one specimen tested at 7 days, two at 28 days, and one held for each batch of four specimens. Sampling and testing shall be performed

by a qualified, independent commercial testing laboratory. Test results should be submitted within 48 hours of completion of testing.

#### **1.8 DELIVERY, STORAGE, AND HANDLING:**

Deliver and handle all products and equipment required, in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

#### **1.9 PROJECT CONDITIONS:**

Perform installation of flowable fill only when approved by the Contracting Officer's Representative, and when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS:**

- A. Provide flowable fill containing, at a minimum, cementitious materials and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option, and following approval by the Contracting Officer's Representative. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the Contracting Officer's Representative.
- B. Portland Cement: ASTM C150, Type 2. // Meeting Caltrans Standard Specifications.
- C. Mixing Water: Meeting Caltrans Standard Specifications for use as mix-water for cast-in-place concrete.
- D. Air-Entraining Admixture: ASTM C260.
- E. Chemical Admixtures: ASTM C494.
- F. Aggregate: ASTM C33.

#### **2.2 FLOWABLE FILL MIXTURE:**

- A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
- B. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C39 at 28 days after placement.
- C. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall

be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

- D. Flowable fill shall have a unit weight of 1900 - 2300 kg/m<sup>3</sup> (115 - 145 lbs/feet<sup>3</sup>) measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m<sup>3</sup> (150 lbs/cy).
- E. Flowable fill shall have an in-place yield of a maximum of 110% of design yield for removable types at 1 year.
- F. Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION:**

Examine conditions of substrates and other conditions under which work is to be performed and notify Contracting Officer's Representative, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

#### **3.2 APPLICATION OF FLOWABLE FILL:**

Secure tanks, pipes and other members to be encased in flowable fill. Insure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the flowable fill. Replacement or protection of metallic objects is subject to the approval of the Contracting Officer's Representative.

#### **3.3 PROTECTION AND CURING:**

Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Contracting Officer's Representative.

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**SECTION 32 05 23**  
**CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:
- B. Curb, gutter, and wheel stops.
- C. Pedestrian Pavement: Walks, lawn mower strips, crossings, wheelchair curb ramps, terraces, and steps.
- D. Vehicular Pavement.

**1.2 RELATED WORK**

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 00, EARTHWORK.
- C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.
- D. Metal Components of Steps (Nosing and Railing): Section 05 50 00, METAL FABRICATIONS.

**1.3 DESIGN REQUIREMENTS**

Design all elements with the latest published version of applicable codes.

**1.4 WEATHER LIMITATIONS**

Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN-PLACE CONCRETE.

**1.5 SELECT SUBBASE MATERIAL JOB-MIX**

The Contractor shall retain and reimburse a testing laboratory to design a select subbase material mixture and submit a job-mix formula to the Contracting Officer's Representative, in writing, for approval. The formula shall include the source of materials, gradation, plasticity index, liquid limit, and laboratory compaction curves indicating maximum density at optimum moisture.

**1.6 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
  - 1. Expansion joint filler
  - 2. Hot poured sealing compound
  - 3. Reinforcement
  - 4. Curing materials
- C. Data and Test Reports:
  - 1. Select subbase material:
    - a. Job-mix formula.
    - b. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
  - 2. Aggregate Base:
    - a. Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by the Caltrans Standard Specifications.

#### 1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - M031MM031-07-UL.....Deformed and Plain Carbon-Steel Bars for  
Concrete Reinforcement (ASTM A615/A615M-09)
  - M055MM055-09-UL.....Steel Welded Wire Reinforcement, Plain, for  
Concrete (ASTM A185)
  - M147-65-UL.....Materials for Aggregate and Soil-Aggregate  
Subbase, Base and Surface Courses (R 2004)
  - M148-05-UL.....Liquid Membrane-Forming Compounds for Curing  
Concrete (ASTM C309)
  - M171-05-UL.....Sheet Materials for Curing Concrete (ASTM C171)
  - M182-05-UL.....Burlap Cloth Made from Jute or Kenaf and Cotton  
Mats
  - M213-01-UL.....Preformed Expansion Joint Fillers for Concrete  
Paving and Structural Construction  
(Non-extruding and Resilient Bituminous Type)  
(ASTM D1751)
  - M233-86-UL.....Boiled Linseed Oil Mixer for Treatment of  
Portland Cement Concrete



T099-09-UL.....Moisture-Density Relations of Soils Using a 2.5  
kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop  
T180-09-UL.....Moisture-Density Relations of Soils Using a 4.54  
kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

C. American Society for Testing and Materials (ASTM):

C94/C94M-09.....Ready-Mixed Concrete

C143/C143M-09.....Slump of Hydraulic Cement Concrete

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

Concrete shall be Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with cement and water factors for 3,000 psi minimum 28-day compressive strength and air-entrainment per Table I, with the following exceptions:

<u>TYPE</u>	<u>MAXIMUM SLUMP*</u>
Curb & Gutter	75 mm (3")
Pedestrian Pavement	75 mm (3")
Vehicular Pavement	50 mm (2") (Machine Finished) 100 mm (4") (Hand Finished)
Equipment Pad	75 to 100 mm (3" to 4")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

### **2.2 REINFORCEMENT**

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. Welded wire-fabric shall conform to AASHTO M55.
- C. Dowels shall be plain steel bars conforming to AASHTO M31. Tie bars shall be deformed steel bars conforming to AASHTO M31.

### **2.3 AGGREGATE BASE**

- A. Aggregate base shall conform to the requirements of Section 26-1.02B of the Caltrans Standard Specifications, Class 2 Aggregate Base, 3/4" maximum grading. Where the term "Engineer" or "Commission" is referenced in the Caltrans Standard Specifications, it shall mean the VA Contracting Officer's Representative.

### **2.4 FORMS**

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.

- B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

## **2.5 CONCRETE CURING MATERIALS**

- A. Concrete curing materials shall conform to one of the following:
  - 1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
  - 2. Impervious Sheeting conforming to AASHTO M171.
  - 3. Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 1 and shall be free of paraffin or petroleum.

## **2.6 EXPANSION JOINT FILLERS**

- A. Material shall conform to AASHTO M213.

# **PART 3 - EXECUTION**

## **3.1 SUBGRADE PENETRATION**

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTHWORK.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.
- C. Watering, spreading, and compacting of aggregate base shall be done in conformance with Sections 26-1.03 of the Caltrans Standard Specifications.

## **3.2 SETTING FORMS**

- A. Base Support:
  - 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
  - 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
  - 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
  - 2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.

3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
  4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
  5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.
1. Make necessary corrections to forms immediately before placing concrete.
  2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

### **3.3 EQUIPMENT**

- A. The Contracting Officer's Representative shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

### **3.4 PLACING REINFORCEMENT**

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the Contracting Officer's Representative shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

### **3.5 PLACING CONCRETE - GENERAL**

- A. Obtain approval of the Contracting Officer's Representative before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Contracting Officer's Representative before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.

- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

### **3.6 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS**

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

### **3.7 PLACING CONCRETE FOR VEHICULAR PAVEMENT**

- A. Deposit concrete into the forms as close as possible to its final position.
- B. Place concrete rapidly and continuously between construction joints.
- C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.
- D. Finish the surface to the elevation and crown as shown.
- E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the Contracting Officer's Representative.

### **3.8 CONCRETE FINISHING - GENERAL**

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
  - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.

2. Maintain finishing equipment and tools in a clean and approved condition.

### **3.9 CONCRETE FINISHING CURB AND GUTTER**

- A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 6mm (1/4 inch) or as otherwise detailed.
- B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
- C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
- D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.
- E. Except at grade changes or curves, finished surfaces shall not vary more than 3 mm (1/8 inch) for gutter and 6 mm (1/4 inch) for top and face of curb, when tested with a 3000 mm (10 foot) straightedge.
- F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.
- G. Correct any depressions which will not drain.
- H. Visible surfaces and edges of finished curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

### **3.10 CONCRETE FINISHING PEDESTRIAN PAVEMENT**

- A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces:
  1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
  2. Brooming shall be transverse to the line of traffic.
  3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
  4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
  5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.

6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

### **3.11 CONCRETE FINISHING FOR VEHICULAR PAVEMENT**

- A. Accomplish longitudinal floating with a longitudinal float not less than 3000 mm (10 feet) long and 150 mm (6 inches) wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.
- B. After the longitudinal floating is completed, but while the concrete is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 1500 mm (5 feet) in length, and straightedges, 3000 mm (10 feet) in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.
- C. Test the surface for trueness with a 3000 mm (10 foot) straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.
- D. The finished surface of the pavement shall not vary more than 6 mm (1/4 inch) in both longitudinal and transverse directions when tested with a 3000 mm (10 foot) straightedge.
- E. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
- F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 450 mm (18 inches) wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in character and width, and not more than 3 mm (1/8 inch) in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.
- G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

**3.12 CONCRETE FINISHING EQUIPMENT PADS**

- A. After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.
- B. Carefully finish all slab edges with an edger having a radius as shown in the Drawings.
- C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 3 mm (1/8 inch) when tested with a 3000 mm (10 foot) straightedge.
- D. Correct irregularities exceeding the above.

**3.13 JOINTS - GENERAL**

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.

**3.14 CONTRACTION JOINTS**

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.
- B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb and gutter.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.
- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

**3.15 EXPANSION JOINTS**

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.
- E. Form expansion joints as follows:

1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
2. Using joint filler of the type, thickness, and width as shown.
3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

### **3.16 CONSTRUCTION JOINTS**

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.
- B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- C. Use a butt-type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.
- D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

### **3.17 FORM REMOVAL**

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

### **3.18 CURING OF CONCRETE**

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Contracting Officer's Representative.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray



of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.

**D. Liquid Membrane Curing:**

1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 m<sup>2</sup>/L (200 square feet per gallon) for both coats.
2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

**3.19 CLEANING**

**A. After completion of the curing period:**

1. Remove the curing material (other than liquid membrane).
2. Sweep the concrete clean.
3. After removal of all foreign matter from the joints, seal joints as herein specified.
4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

**3.20 PROTECTION**

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Contracting Officer's Representative, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Contracting Officer's Representative.

**3.21 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.

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**SECTION 32 11 00.01**  
**BASE COURSES - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies installation of aggregate base within the city of Menlo Park right of way.

**1.2 GENERAL:**

- A. Aggregate base within the city of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, Section 26, Aggregate Base, as modified below.

**1.3 CLASS 2 AGGREGATE BASE:**

The following is added to Section 26-1.01 of the Standard Specifications:

Unless otherwise directed in the plans, or elsewhere in the special provisions, Class 2 shall be presumed to be used.

**1.4 MATERIALS**

Aggregate base shall be produced from commercial quality aggregates consisting of broken stone; crushed gravel, natural, clean, rough-surfaced gravel and sand; or a combination thereof.

The grading of the material shall conform to the 3/4" maximum, specified in Section 26-1.02a, "Class 2 Aggregate Base" of the Standard Specifications dated May 2006.

Recycled Class 2 aggregate base material may be used in this project as approved by the City.

A certificate of compliance with Caltrans specifications must be submitted to the City for approval prior to placing any imported aggregate base.

**1.5 PLACEMENT**

Aggregate base shall be thoroughly moisture conditioned and compacted to 95% in accordance with California test method No. 231, based on the documentation provided by the quarry.

The cross-section of the finished base shall be free from ridges or valleys, and shall be within 0.03 of a foot (three-eighths of an inch) of the theoretical Section of any point on the cross-section.

Aggregate base shall not be placed until the City has approved the

condition of the underlying subgrade.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

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**SECTION 32 12 16**  
**ASPHALT PAVING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

**1.2 RELATED WORK**

- A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTHWORK.
- C. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

**1.3 INSPECTION OF PLANT AND EQUIPMENT**

The Contracting Officer's Representative shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

**1.4 ALIGNMENT AND GRADE CONTROL**

The Contractor's Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
  - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by Caltrans Standard Specifications.
  - 2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by Caltrans Standard Specifications.
  - 3. Job-mix formula.

C. Certifications:

1. Asphalt tack coat material certificate of conformance to Caltrans Standard Specifications.
2. Asphalt cement certificate of conformance to Caltrans Standard Specifications.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the Caltrans Standard Specifications.

D. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

A. Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the Caltrans Standard Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA Contracting Officer's Representative.

**2.2 AGGREGATES**

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined. Conform to Caltrans Standard Specifications, section 26-1.02, Class 2, ¾" maximum aggregate size.
- B. Aggregates for asphaltic concrete paving: in conformance with Caltrans Standard Specifications, section 39-1.02E.

**2.3 ASPHALTS**

- A. Comply with provisions of Asphalt Institute Specification SS2:
  1. Asphalt cement: Penetration grade 50/60
  2. Tack coat: Uniformly emulsified, grade SS-1H

**2.4 SEALER**

- A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.
- B. Where conflicts arise between this specification and the requirements in the latest version of the Caltrans Standard Specifications, the Caltrans Standard Specifications shall control.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the Caltrans Standard Specifications for the type of material specified.

### **3.2 MIXING ASPHALTIC CONCRETE MATERIALS**

- A. Provide hot plant-mixed asphaltic concrete paving materials.
  - 1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
  - 2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

### **3.3 SUBGRADE**

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Contracting Officer's Representative or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

### **3.4 BASE COURSES**

- A. Base
  - 1. Spread and compact to the thickness shown on the drawings.
  - 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
  - 3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
- B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").
- C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).
- D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

### **3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING**

- A. Remove all loose materials from the compacted base.

- B. Apply the specified tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Contracting Officer's Representative.
- C. Receipt of asphaltic concrete materials:
  - 1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).
  - 2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.
- D. Spreading:
  - 1. Spread material in a manner that requires the least handling.
  - 2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.
- E. Rolling:
  - 1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
  - 2. Roll in at least two directions until no roller marks are visible.
  - 3. Finished paving smoothness tolerance:
    - a. No depressions which will retain standing water.
    - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

### **3.6 APPLICATION OF SEAL COAT**

- A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- B. Apply one coat of the specified sealer.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

### **3.7 PROTECTION**

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

### **3.8 FINAL CLEAN-UP**

Remove all debris, rubbish, and excess material from the work area.

- - - E N D - - -

**SECTION 32 12 16.01**  
**ASPHALT PAVING - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies installation of asphalt within the City of Menlo Park right of way.

**1.2 GENERAL**

When work is being paid for on the basis of quantity of material installed, it shall be the responsibility of the Contractor to confirm that accurate delivery records have been given to the City on a timely basis. A Contractor's representative shall check with the City's inspector at the conclusion of every day that such work is done and verify that complete and accurate delivery records have been presented. Payment will be based on records kept by the City's inspector, and the burden will be on the Contractor to resolve to the City's satisfaction any discrepancies.

**1.3 MATERIALS**

Asphalt concrete shall be produced from commercial quality asphalt and aggregates. The Contractor shall submit laboratory analyses of the aggregates and the binder, as well as any admixtures proposed to be included in the mix, for the City's approval prior to delivering any material to the project. In addition, the Contractor shall submit a certificate of compliance with the Standard Specifications for the mix design and the components.

**1.4 A.C. TYPE**

Unless otherwise directed in the plans or elsewhere in the project specifications, asphalt concrete installed in the City of Menlo Park shall be type A as described in Section 39 of the 2006 Caltrans Standard Specifications.

**1.5 AGGREGATE GRADING**

Unless otherwise directed in the plans or elsewhere in the project specifications or at the specific direction of the City, the aggregate grading shall be 1/2 inch Maximum, Medium per Section 39-2.02 of the Standard Specifications for any single-lift placement of hot mix asphalt and for the top course of any multiple-lift placement. The lower courses of multiple-lift placements shall be 3/4 inch Maximum,



Medium.

#### **1.6 ASPHALT BINDER**

Unless otherwise directed in the plans or elsewhere in the project specifications, or at the specific direction of the City, paving asphalt shall be viscosity grade PG 64-10. The amount of asphalt binder to be mixed with the aggregate shall be approximately 6% by weight of the dry aggregate.

#### **1.7 RECLAIMED ASPHALT PAVEMENT**

If called for in the plans or elsewhere in the project specifications, reclaimed asphalt pavement (RAP) may be used in lieu of virgin aggregate, in a quantity not to exceed 15% of the total weight of the dry aggregate prior to mixing with asphalt binder. RAP shall conform with the 06-05-09 revision to Section 39 of the Standard Specifications.

#### **1.8 RUBBERIZED HOT MIX ASPHALT**

[this Section is not used in this project]

#### **1.9 STORING, PROPORTIONING AND MIXING MATERIALS**

Asphalt concrete shall be prepared in accordance with Section 39-3 of the Standard Specifications, and shall be delivered to the jobsite ready to place.

#### **1.10 SURFACE PREPARATION**

#### **1.11 PROTECTION OF SURROUNDINGS**

In addition to the provisions in Section 024100.01, DEMOLITION, particular care must be taken by the Contractor to prevent staining of adjacent surfaces by oils, emulsions, or asphaltic materials, including the street surfaces beyond the limits of the work.

#### **1.12 SUBGRADE AND BASE PREPARATION**

This section applies whenever large roots are cut out from beneath pavement, requiring removal of base and subgrade material. See Section 024100.01 of these project specifications for requirements pertaining to root pruning.

Roots and surrounding soil must be removed to a minimum depth of twelve inches (12") below finished grade of the aggregate base. Unless otherwise specified in the plans or elsewhere in the project specifications, or as directed by the City, presume 4" of aggregate base at parking strips and walkways or 6" of aggregate base within the street. The remainder of the backfill may be clean, native material free of toxic contamination and generally free of organic matter,

moisture conditioned and compacted to approximately 95% of relative compaction for soils typical of the area (no laboratory testing will be necessary).

Unless otherwise directed in the plans or elsewhere in the project specifications, or at the specific direction of the City, existing base rock that is removed shall be replaced with imported material per Section 26 of these project specifications.

If the full section of base rock is being replaced, the subgrade shall be compacted to 95% minimum relative to soils typically found in the area (laboratory analysis will not be necessary). Subgrade soils that are excessively soft or moist must be brought to the immediate attention of the City.

Wherever unsuitable subgrade soils are encountered, the City shall direct the removal of soil and replacement with compacted aggregate base to whatever depth he deems necessary.

Where subgrade and base reconstruction is to be followed by wedge-grind or full-width milling, the asphalt concrete plug shall be held down to approximately the level that the surrounding surface will be milled to.

#### **1.13 PAINT BINDER (TACK COAT)**

Paint binder or tack coat shall conform to Section 94, "Asphaltic Emulsions" of the Standard Specifications. Unless otherwise directed in the plans or elsewhere in the project specifications, or at the specific direction of the City, one of the slow-setting grades, per Section 94 would be acceptable, but one of the medium- or rapid-setting grades would be preferred. Paving asphalt shall not be used without prior written approval of the City. The Contractor shall submit for the City's approval a copy of the manufacturers' application instructions for the tack coat material prior to applying it.

The Contractor shall apply a tack coat to all solid vertical surfaces that new hot mix asphalt will be placed against, including all cuts made in existing paving as well as all Portland cement concrete gutters and curbs. The surfaces to receive tack coat shall be dry and shall be brushed clean of soil or loose material. A thorough covering shall be applied, to provide a watertight seal at the joint; the hot mix asphalt shall not be placed until the City has approved the tack coat application.

A tack coat of asphalt emulsion paint binder shall also be applied over all existing asphalt concrete being overlaid with new hot mix asphalt,

including cold-milled surfaces and original surfaces. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

It shall be the Contractor's sole responsibility to prevent the tack coat paint binder from being tracked onto adjacent surfaces by vehicle tires or by personnel walking.

Frames and covers for manholes, vaults, valves, monuments, clean-outs, etc. Shall be effectively masked prior to application of tack-coat to prevent them from being coated.

Hot mix asphalt shall not be placed until the tack coat emulsion has "broken".

Unless otherwise directed by the City, prime coat shall not be required on baserock.

#### **1.14 LEVELING COURSE**

Unless otherwise directed in the plans or elsewhere in the project specifications, or at the specific direction of the City, a leveling course of new hot mix asphalt shall not be installed.

If a leveling course is provided, the surface over which it is placed shall be carefully cleared and swept beforehand and shall receive a full tack coat to the extent of the coverage by the leveling course. The City shall direct the Contractor as to where to place a leveling course.

#### **1.15 SPREADING AND COMPACTING EQUIPMENT**

Sections 39-5.01 and 39-5.02 of the Standard Specifications are revised as follows:

A paving machine used on relatively narrow streets with a widely-rounded crown shall be capable of "breaking" the screed to approximate the profile of the street.

A pneumatic-tired roller shall not be required, but would be allowed at the Contractor's option.

A 12 ton roller shall not be required if a vibratory roller capable of providing similar compactive effort is used.

All trucks used for delivery of hot mix asphalt shall be capable of backing up; no double-trailer bottom-dumps are permitted without the prior written approval of the City.

Where the existing pavement is extended to new concrete gutters, similar to city standard detail st-1, the plug may be placed by hand and compacted by portable "jumping-jack" or vibra-plate compactors, as

long as 95% compaction is achieved in lifts no deeper than 2" compacted thickness. The final lift must be rolled smooth.

#### **1.16 SPREADING AND COMPACTING, GENERAL**

The following is added to Section 39-6.01 of the Standard Specifications:

On streets receiving an asphalt concrete overlay, a single lift of hot mix asphalt shall be placed over the existing pavement after the surface has been prepared as specified in the plans or elsewhere in the project specifications, or as directed by the City, for that particular street. Preparation will consist of some combination of cold-milling, clearing and sweeping, crack-sealing, and fabric, although not all of these may be required in each situation.

Unless otherwise directed in the plans or elsewhere in the project specifications, or at the specific direction of the City, the nominal depth of new hot mix asphalt concrete overlay shall be two inches after compaction.

The finished surface shall be approximately 1/4" above adjacent concrete gutters.

Where new pavement is required to conform to surrounding surfaces, resulting in a finished surface that is concave (cupped) upward rather than planar or curved downward, material may be hand-placed by shovels and rakes, provided that the required compacted thickness is achieved, and it must be rolled in multiple passes side-by-side following the curve so that the full area of the new surface is compacted to 95%. A worker shall be dedicated to directing the trucking and dumping whenever placement is done using wind rows.

Wind rows shall not extend across intersections where cross-traffic is permitted.

Placement of hot mix asphalt must stop in sufficient time to allow proper compaction and cooling before opening the street to traffic by the required time; the guidelines for traffic control plans (see Section 12 of these project specifications) indicate the standard times by which work must cease. Other times might be imposed in specific locations, which might be noted in the plans, elsewhere in these project specifications, or in a written directive from the City.

If rubberized hot mix asphalt is specified to be used, the delivery and placement procedures differ from what is contained in Section 39 of the 2006 Standard Specifications. The procedural updates adopted by

Caltrans (particularly the 06-05-09 update) must be followed.

#### **1.17 SPREADING**

The following is added to Section 39-6.02 of the Standard Specifications:

Prior to spreading hot mix asphalt overlay, asphalt emulsion tack coat binder, conforming with Section 39-4 of the Standard Specifications as modified herein, is required to be spread on existing asphalt concrete surfaces.

HMA shall not be placed over aggregate base until the City has approved the condition of the base.

#### **1.18 COMPACTING**

The following is added to Section 39-6.03 of the Standard Specifications:

Hot mix asphalt shall be compacted to 95% relative to the maximum listed in the laboratory analysis for the approved mix design.

On hills, at the direction of the City, the breakdown compaction may be initiated by smaller rollers to establish a shell of compacted material at the surface, provided that the heavy breakdown rolling follows before the material has cooled below 150 degrees Fahrenheit.

#### **1.19 MISCELLANEOUS**

The following is added to Section 39-7.01 of the Standard Specifications:

#### **1.20 FAILURE TO ACHIEVE REQUIRED COMPACTION**

If any portion of hot mix asphalt concrete paving fails to reach the required compaction, the City may require replacement of the full depth of new material.

#### **1.21 FAILURE TO MAINTAIN REQUIRED GRADES OR SMOOTHNESS TOLERANCES**

Low areas of new pavement shall be removed entirely and repaved. High areas shall be smooth-ground to the specified grade and cross-section with a diamond blade type pavement grinder and the ground surface shall be fog sealed.

If, in the opinion of the City, any finished surface of new hot mix asphalt installation is unacceptably coarse, the Contractor may, at the City discretion, be allowed to overcoat the unacceptable portion at his own expense with a seal coat or slurry seal, per Section 37 of the Standard Specifications, as an alternate to removing and replacing the new hot mix asphalt.

**1.22 EXPOSING UTILITY MANHOLE, VALVE AND MONUMENT COVERS**

Note: See also Section 024100.01 of the project specifications.

While the hot mix asphalt is being placed, it must be scraped-off the covers of sanitary sewer manholes, electrical or communications vault covers and utility valves before it has been compacted. Prior to leaving the worksite at the conclusion of the day, enough material must be chipped-away to allow the covers to be removed if required in an emergency before they are raised to finished grade.

**1.23 RESTORATION OF PAVEMENT MARKINGS AND MARKERS**

Note: see also Section 321723.01 of the project specifications.

Prior to reopening a traffic lane after hot mix asphalt or seal coat has been applied, temporary markings ("floppies" or tape) shall be installed where stripes and stop bars had been located (stop bars shall be marked with tape). These shall be restored on a daily basis as they become dislodged, until the striping layout lines are in place.

The City shall be notified when the striping layout lines are to be installed so they may be inspected; they must be approved prior to application of the permanent markings and markers. The Contractor shall schedule the permanent application to follow the application of layout lines by no more than three working days.

The Contractor shall schedule the installation of pavement markings and markers after all other work has been completed.

Markings on cross-streets that intersect streets that have been resurfaced in the project shall be re-coated to a distance of 50' beyond the limit of work.

**PART 2 - MATERIALS (NOT USED)****PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 32 12 36.01**  
**BITUMINOUS SEALS - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies bituminous seals within the City of Menlo Park right of way.

**1.2 GENERAL:**

- A. Installation of bituminous seals within the City of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, section 37, Bituminous Seals, as modified below.

**1.3 SLURRY SEAL**

The following is added to Section 37-2.01 of the Standard Specifications:

If the Plans or these project specifications call for a resurfacing that consists of an emulsion slurry in conjunction with the application of additional aggregate or rock chips, as described in Section 37-3 or 37-4 below, the composition of the emulsion component of that system shall be governed by this section.

**1.4 MATERIALS**

The second sentence of Section 37-2.02A is revised to read as follows:

"The grade of asphaltic emulsion shall be at the option of the Contractor if not specified in the plans or elsewhere in these project specifications.

Section 37-2.02C is revised as follows:

Aggregate shall conform to the requirements for Type I.

**1.5 MIX DESIGN**

In addition to the requirements in Section 37-2.03 of the Standard Specifications, the Contractor shall submit laboratory analyses of the aggregates and the emulsion, as well as any admixtures proposed to be included in the mix. In addition, the Contractor shall provide a Certificate of Compliance with the Standard Specifications for the mix design and the components.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

**SECTION 32 13 00.01**  
**RIGID PAVING - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies vehicular concrete within the City of Menlo Park right of way.

**1.2 GENERAL:**

- A. Installation of vehicular concrete within the City of Menlo Park right of way shall conform to the following:
  - 1. 2006 edition of the Caltrans **Standard Specifications**:
    - a. Section 40: Portland Cement Concrete Pavement
    - b. Section 90: Portland Cement Concrete
  - 2. City of Menlo Park Standard Detail G-3
- B. Unless otherwise directed on the Plans or elsewhere in these project specifications or by the City, vehicular concrete shall be Class 2 per Section 90-1.01 of the Standard Specifications.
- C. For sidewalks or other non-structural Portland cement concrete surfaces, driveways, curbs and/or gutters, V-ditches or other non-structural work, refer to Section 73 of the Standard Specifications as modified in section 321600.01 in these project specifications.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----



**SECTION 32 16 00.01**  
**CURBS, GUTTERS, SIDEWALKS - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies the installation of curbs, gutters, and sidewalks within the City of Menlo Park right of way.

**1.2 GENERAL**

Section 73-1.01 of the Standard Specifications is revised as follows:

- A. Portland Cement Concrete for curbs, gutters and sidewalks shall be minimum Class 2 per Section 90-1.01 of the Standard Specifications.
- B. The coarse aggregate grading shall comply with the specifications for 1" x No.4 or ½" x No. 4 in Section 90-3.02 of the Standard Specifications; the combined grading shall meet the limits for 1" Max. or ½" Max. in Section 90-3.04.
- C. No admixtures shall be allowed without the written approval of the City, except that all Portland cement concrete for curbs, gutters, sidewalks and driveway approaches shall contain one pound of lampblack per cubic yard.
- D. Concrete work shall be done in accordance with the General Concrete Notes available on the City's website.
- E. The Contractor shall submit laboratory analyses of the aggregates and the cement, as well as any admixtures proposed to be included in the mix, for the City's approval prior to placing any concrete. In addition, the Contractor shall submit a Certificate of Compliance with the Standard Specifications for the mix design and the components.

**1.3 SUBGRADE PREPARATION**

Section 73-1.02 of the Standard Specifications is entirely replaced with the following:

**A. General**

Subgrade shall be moisture-conditioned as necessary and compacted to approximately 95% relative to soils common to the area; no laboratory testing shall be required. Immediately prior to placing concrete, the forms and base shall be watered.

## B. Subgrade Reconstruction

Whenever large roots are cut out from beneath flatwork, requiring removal of base and subgrade material, see section 024100.01 of these project specifications for requirements pertaining to root pruning. Roots and surrounding soil must be removed to a minimum depth of twelve inches (12") below finished grade of the aggregate base. Unless otherwise specified in the Plans or elsewhere in the project specifications, or as directed by the City, presume 4" of aggregate base at sidewalks, driveways or side gutters, or 6" beneath valley gutters and spandrel aprons. The remainder of the backfill may be clean, native material free of toxic contamination and generally free of organic matter, moisture conditioned and compacted to approximately 95% of relative compaction for soils typical of the area (no laboratory testing will be necessary).

Subgrade soils that are excessively soft or moist must be brought to the immediate attention of the City. Wherever unsuitable subgrade soils are encountered, the City shall direct the removal of soil and replacement with compacted aggregate base to whatever depth he deems necessary.

### 1.4 EXISTING GUTTERS, CURBS AND SIDEWALKS

Section 73-1.03 of the Standard Specifications is entirely replaced with the following:

- Where broken sidewalk, curb or gutter is to be replaced, the damaged portion shall be removed as far as the nearest score line or expansion joint.
- Existing curbs, gutters and sidewalks shall be saw-cut through their full depth along existing score lines. If the existing concrete is too thick for through-cutting to be practicable, it must be cut as deeply as possible and then removed the rest of the way by chipping carefully. The Contractor shall be required to replace, at his own cost, any concrete damaged beyond the lines established in the Contract Documents.
- Where existing sidewalks are required to be retrofitted with new curb ramps, the sidewalk, curb and gutter shall be entirely removed and replaced as far as the first score line or expansion joint past the limits of the required ramps unless otherwise directed in the Plans or elsewhere in these project specifications, or by the City.

- See Section 024100.01 of the project specifications for additional requirements pertaining to concrete removal.

#### **1.5 GUTTERS, CURBS AND MONOLITHIC CURB-AND-GUTTER**

The following is added to Section 73-1.05 of the Standard Specifications:

##### **A. Expansion Joints**

If expansion joints are called for in the Plans or elsewhere in the project specifications, or at the direction of the City, the compressive material used shall be elastic and resistant to decomposition. The Contractor shall submit a sample of the expansion joint material for the City's approval prior to installing it.

##### **B. New or Replacement Gutters In Existing Streets**

Where Portland cement gutters are installed in existing asphalt concrete streets, the existing pavement shall be saw-cut at least 12" from the line of the finished gutter lip in order to provide room for forming the face of the gutter pan. This trench, which is to be excavated to the depth of the gutter pan (and any over-excavation necessary for aggregate base), and must be filled to within 2" of the surface with a lean Portland cement slurry mix ("Controlled Density Fill"). Alternately, if approved by the City, the face of the gutter pan could be formed with 2" high boards that would allow the trench to be filled to the bottom of the form board with concrete when the gutter is poured. In either case, the remaining 2" shall be plugged with new, compacted hot mix asphalt per Section 39 of the Standard Specifications as modified in these project specifications.

#### **1.6 SIDEWALKS AND RAMPS**

The following is added to Section 73-1.06 of the Standard Specifications:

All curb ramps at crosswalks shall have a detectable warning surface (DWS) installed in conformance with City Standards and the latest Caltrans Standard Details A88A and A88B. The DWS shall be U/V resistant polymer composite panels of truncated domes colored Federal yellow #33538. The Contractor shall submit manufacturer's documentation of the material and configuration of the proposed panels for the City's approval prior to delivering them to the site. Panels shall be embedded in the concrete of the ramps per the manufacturer's instructions; no surface-applied matting systems (i.e. glued and screwed) style of DWS shall be allowed without the written permission of the City. Where

multiple panels or portions of panels are placed side-by-side, the pattern of domes shall be continuous across any joints.

Ramps at locations where existing physical constraints do not allow for conventional configurations shall be worked-out by the Contractor to the satisfaction of the City.

Where existing conditions require additional portions of sidewalk to be added or replaced adjacent to new ramps, as transitions, the details shall be determined on a case-by-case basis to the satisfaction of the City.

Where sidewalk is contiguous with curb, it shall be poured monolithically with the curb (and gutter, if applicable) unless otherwise directed in the Plans or elsewhere in these project specifications, or at the direction of the City.

Expansion joints shall be placed approximately 20' on center.

Curing may be done as described in Section 90-7.01A of the Standard Specifications, or by using non-pigmented curing compound of type D or E as described in Section 90-7.01B

See Section 024100.01 of these project specifications for additional requirements pertaining to disturbance of private improvements.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 32 17 23**  
**PAVEMENT MARKINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This work shall consist of furnishing and applying paint and reflective glass beads on pavement surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings, in accordance with the details as shown or as prescribed by the Contracting Officer's Representative. Conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, published by the U.S. Department of Transportation, Federal Highway Administration, for details not shown.

**1.2 SUBMITTALS**

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.

B. Paint.

C. Reflective Glass Beads

**1.3 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

TT-B-1325C.....Beads (Glass Spheres); Retro-Reflective

TT-P-1952D.....Paint, Traffic Black, and Airfield Marking,  
Waterborne

C. Master Painters Institute (MPI):

Approved Product List - 2010

D. Caltrans: State Standard Specifications, Section 84, Traffic Stripes and Pavement Markings

**PART 2 - PRODUCTS**

**2.1 PAINT**

Paint for marking pavement (parking lot and zone marking) shall conform to MPI No. 97, color as shown. Paint for obliterating existing markings shall conform to Fed. Spec. TT-P-1952D. Paint shall be in containers of at least 18 L (5 gallons). A certificate shall accompany each batch of paint stating compliance with the applicable publication.

## **2.2 REFLECTIVE GLASS BEADS**

Beads shall conform to Fed. Spec. TT-B-1325C, Type I, Gradation A. When used in regions of high humidity, coat beads with silicone or other suitable waterproofing material to assure free flow. Furnish the glass beads in containers suitable for handling and strong enough to prevent loss during shipment. A certificate shall accompany each batch of beads stating compliance with this section.

## **2.3 PAINT APPLICATOR**

Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as shown. Provide pneumatic spray guns for hand application of paint in areas where a mobile paint applicator cannot be used. If the equipment does not have a glass bead dispenser, use a separate piece of equipment.

Adjust and synchronize the equipment with the paint applicator so that the reflective beads are distributed uniformly on the paint lines within ten seconds without any waste. An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.

## **2.4 SANDBLASTING EQUIPMENT**

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall furnish not less than 0.08 m<sup>3</sup>/s (150 cfm) of air at a pressure of not less than 625 kPa (90 psi) at each nozzle used.

# **PART 3 - EXECUTION**

## **3.1 SURFACE PREPARATION**

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Thoroughly clean all surfaces to be marked before application of paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by the Contracting Officer's Representative. The application of paint conforming to Fed. Spec. TT-P-1952D is an option to removal of

existing paint markings on asphalt pavement. Apply the black paint in as many coats as necessary to completely obliterate the existing markings. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint. Pavement marking shall follow as closely as practicable after the surface has been cleaned and dried, but do not begin any marking until the Contracting Officer's Representative has inspected the surface and gives permission to proceed. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals. The Contractor is responsible to preserve and apply marking in conformance with the established control points.

### **3.2 APPLICATION**

Apply uniformly painted and reflective pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and established control points. The length and width of lines shall conform within a tolerance of plus or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in the case of skip markings. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 10°C (50°F) and less than 35°C (95°F). Apply the paint at a wet film thickness of 0.4 mm (0.015 inch). Disperse reflective glass beads evenly on the wet paint at a rate of 720 g/L (6 pounds per gallon) of paint. Apply paint in one coat. At the direction of the Contracting Officer's Representative, markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the marking, discontinue paint operations until cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, faulty distribution of beads, smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved

method to remove marking so that the surface to which the marking was applied will not be damaged.

### **3.3 PROTECTION**

Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Government.

### **3.4 DETAIL PAVEMENT MARKING**

Use Detail Pavement Markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at crosswalks, at parking bays, and at such other locations as shown. Show the International Handicapped Symbol at indicated parking spaces. Color shall be as shown. Apply paint for the symbol using a suitable template that will provide a pavement marking with true, sharp edges and ends. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

### **3.5 TEMPORARY PAVEMENT MARKING**

When shown or directed by the Contracting Officer's Representative, apply Temporary Pavement Markings of the color(s), width(s) and length(s) shown or directed. After the temporary marking has served its purpose and when so ordered by the Contracting Officer's Representative, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that the surface to which the marking was applied will not be damaged. As an option, an approved preformed pressure sensitive, reflective, adhesive tape type of temporary pavement marking of the required color(s), width(s) and length(s) may be furnished and used in lieu of temporary painted and reflective marking. The Contractor shall be fully responsible for the continued durability and effectiveness of such marking during the period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted and reflective markings at no additional cost to the Government.

### **3.6 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the Station.



- - - E N D - - -

**SECTION 32 17 23.01**  
**SIGNING AND STRIPING - OFFSITE**

**PART 1 - GENERAL**

**1.1 INTRODUCTION:**

This section specifies signing and striping within the city of Menlo Park right of way.

**1.2 GENERAL:**

- A. Signing and striping within the City of Menlo Park right of way shall conform to the 2006 edition of the Caltrans Standard Specifications, Section 56, Signs, and Section 84, Traffic Stripes and Pavement Markings, as modified below.

**1.3 ROADSIDE SIGNS**

A. Description

The following is added to Section 56-2.01 of the Standard Specifications:

B. Materials

1. Metal Posts - The following is added to Section 56-2.02A of the Standard Specifications:

Unless otherwise directed on the Plans or elsewhere in these project specifications or by the City, roadsides signs mounted on steel poles shall comply with the requirements shown on City of Menlo Park Standard Detail ST-12.

2. Wood Posts - Section 56-2.02B of the Standard Specifications is revised as follows:

Wood posts shall only be made of redwood.

3. Metal Panels - Section 56-2.02C of the Standard Specifications is entirely replaced with the following:

Aluminum sheet panels shall be 0.080 anodized on both sides.

4. Sign Panel Fastening Hardware - Section 56-2.02D of the Standard Specifications is revised as follows:

Brackets for top-mounting signs on metal posts shall comply with the requirements shown on City Standard Detail ST-12.

5. Signs - The City will provide the Contractor with the signs needed for the project.

**1.4 EXISTING SIGNAGE REMOVAL**

As identified on the plans, or as directed by the City, the Contractor shall remove the existing City sign, pole and foundation and deliver the salvaged sign and mounting hardware to the City.

Those existing free-standing City signs located within the proposed work that have not been specifically identified for removal shall be carefully removed from the ground for re-use. The used pole and foundation becomes the property of the Contractor to dispose of as identified in these specifications.

**1.5 SIGN PANEL INSTALLATION**

The following is added to Section 56-2.03 of the Standard Specifications:

The street name sign detail shall comply with City Standard Detail ST-13 except that Note 4 shall be revised to say: "Sign sheeting shall be reflective City grade (Scotchlite) white copy on reflective City grade (Scotchlite) "Mesa Brown" background.

**1.6 STRIPING**

The Contractor shall provide all materials, equipment, and labor necessary to furnish and place all traffic stripes and pavement markings, which may include but is not necessarily limited to, removal of any existing striping, legends, and pavement markers; repair of damaged pavement; placement of pavement markers; placement of both thermoplastic and painted striping and marking; and all other appurtenant work, complete in place, as shown on the Drawings and as specified herein.

A. Contractor Submittals - Certificates of Compliance: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. Materials

1. General: Unless otherwise noted on the Drawings, all permanent traffic stripes and pavement markings shall be thermoplastic and/or pavement markers.

2. Thermoplastic: Thermoplastic for traffic stripes and pavement markings shall conform to Section 84-2, "Thermoplastic Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.

3. Paint: Paint for traffic stripes and pavement markings shall conform to Section 84-3, "Painted Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.
4. Pavement markers: Pavement markers shall conform to Section 85, "Pavement Markers," of the Caltrans Standard Specifications and as specified herein. Fire Hydrant markers shall be two-way, reflective blue markers.

**1.7 ADHESIVE**

Adhesive shall be the hot melt bituminous type conforming to Section 85, "Pavement Markers," of the Caltrans Standard Specifications.

**1.8 EXECUTION**

**A. GENERAL**

1. Centerline and lane lines shall be re-established the same day as they are removed by the use of temporary reflective markers placed at 24-foot maximum spacing.
2. Stop bars, crosswalks, advanced school crossing legends and arrows, shall be re-established the same day as they are removed using paint or traffic tape and shall match the width, size, and color as the removed markings unless otherwise shown on the Drawings.

**B. REMOVE EXISTING TRAFFIC STRIPES AND PAVEMENT MARKINGS**

1. All removed traffic stripes and pavement markings and excess material shall become the property of the Contractor and shall be disposed of in a legal and proper manner. Removal and disposal of existing traffic markings and excess material shall conform to Section 15, "Existing Highway Facilities," of the Caltrans Standard Specifications and as specified herein.
2. The Contractor shall conduct his work so as not to damage existing pavement and public improvements to remain. Any resultant damage determined to be excessive by the City shall be repaired in kind by the Contractor at its sole expense.
3. Damage to the pavement resulting from removal of pavement markers shall be considered as any depression more than 1/4-inch deep and shall be repaired by the Contractor by filling the depression with hot melt bituminous adhesive to the satisfaction of the City.
4. Where blast cleaning is used for the removal of traffic stripes and pavement markings or objectionable material, the residue including dust shall be removed immediately after contact between the sand and

- the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation.
5. Where removal of traffic stripes and pavement markings is done by grinding or sandblasting methods, the effected pavement surface shall be completely covered by applying asphaltic emulsion conforming to Section 94 of Caltrans Standard Specifications.
  6. All reference markings made by the Contractor shall be done with spray chalk.
  7. All temporary traffic stripes and pavement markings shall be removed by the Contractor on the same day as placement of the permanent striping and markings.

C. TRAFFIC STRIPES AND PAVEMENT MARKINGS INSTALLATION

Placement of all traffic stripes and pavement markings shall be in conformance with Section 84, "Traffic Stripes and Pavement Markings," and Section 85, "Pavement Markers" of the Caltrans Standard Specifications, referenced Plans of the Caltrans Standard Plans, as shown on the Drawings and as specified herein.

All layouts must be inspected and approved by the City prior to permanent placement of the traffic stripes and pavement markings. The Contractor shall notify the City no later than 48 hours prior to the start of the scheduled placement.

Any overlap, dripping, or tracking of fresh thermoplastic or paint onto unmarked surfacing shall be removed to the satisfaction of the City. Thermoplastic and paint shall be placed as close as possible to existing utility structure and monument frames and covers without covering them.

The Contractor shall protect all fresh thermoplastic and paint and shall repair or replace all damage to traffic stripes and pavement markings caused by his failure to do so at its own expense.

All traffic stripes and pavement markings, new or existing, within or adjacent to the work limits which become defaced or damaged during the Contractor's operations shall be replaced by the Contractor at its expense concurrently with other traffic marking operations in the immediate area. The City shall be the sole judge as to which stripes or legends are defaced or damaged.

Fire hydrant markers shall be installed at all fire hydrant locations as shown on the Drawings.

Glass beads to be applied to the surface of the molten thermoplastic material shall conform to the requirements of the State Specifications, 8010-11E-22 (Type II).

All paved areas to receive thermoplastic material shall be mechanically wire brushed to remove all dirt and contaminants. Thermoplastic material shall be applied only to dry pavement surfaces and only when the pavement surface temperature is above 50°F.

The thermoplastic material shall be applied by either spray or extrusion methods in a single uniform layer; stencils shall be used when applying thermoplastic material for pavement markings. The pavement surface to receive the thermoplastic material shall be completely coated by the material and the void of the pavement surface shall be filled. Unless, otherwise specified, the thermoplastic material for traffic stripes shall be applied at a minimum thickness of 0.060 inch. Thermoplastic material for markings shall be applied at a thickness of 0.100 to 0.150 inch. Glass beads shall be applied immediately to the surfaces of the molten thermoplastic material at a rate of not less than 8 pounds per 100 square feet.

Placement of pavement markers shall be done in accordance to Section 85-1.06, "Placement" of the Standard Specifications and shall be of the type, details and color shown on the plans. Pavement markers shall be cemented to the pavement with hot melt bituminous adhesive or rapid set type epoxy adhesive. Newly installed markers shall be protected from all traffic for at least 3 hours. The ambient temperature shall be 55°F or above and pavement is dry.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 32 31 13**  
**CHAIN LINK FENCES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This work consists of all labor, materials, and equipment necessary for furnishing and installing chain link fence and accessories in conformance with the lines, grades, and details as shown.

**1.2 RELATED WORK**

- A. Grounding of fencing for enclosures of electrical equipment and for lightning protection as shown: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Temporary Construction Fence: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Finish Grading: Section 31 20 00, EARTHWORK, and Section 32 90 00, PLANTING.

**1.3 MANUFACTURER'S QUALIFICATIONS**

Fence and accessories shall be products of manufacturers' regularly engaged in manufacturing items of type specified.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, furnish the following:
  - 1. Manufacturer's Literature and Data: Chain link fencing, privacy slats, and all accessories.
  - 2. Manufacturer's Certificates: Zinc-coating complies with specifications.
- B. Shop Drawings for chain link fences.
- C. Certification that fence alignment meets requirements of contract documents.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A121-07.....Metallic Coated Carbon Steel Barbed Wire
  - A392-07.....Zinc-Coated Steel Chain-Link Fence Fabric
  - A817-07.....Metal-Coated Steel Wire for Chain-Link Fence Fabric and Marcellled Tension Wire





## **2.7 ACCESSORIES**

- A. Accessories as necessary caps, rail and brace ends, wire ties or clips, braces and tension bands, tension bars, truss rods, and miscellaneous accessories conforming to ASTM F626.

## **2.8 CONCRETE**

ASTM C94/C94M, using 19 mm (3/4 inch) maximum-size aggregate, and having minimum compressive strength of 25 mPa (3000 psig) at 28 days. Non-shrinking grout shall consist of one part Portland cement to three parts clean, well-graded sand, non-shrinking grout additive and the minimum amount of water to produce a workable mix.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install fence by properly trained crew, on previously prepared surfaces, to line and grade as shown. Install fence in accordance with ASTM F567 and with the manufacturer's printed installation instructions, except as modified herein or as shown. Maintain all equipment, tools, and machinery while on the project in sufficient quantities and capacities for proper installation of posts, chain links and accessories.
- B. A Registered Professional Land Surveyor or Registered Civil Engineer specified in Section 01 00 00, GENERAL REQUIREMENTS, shall stake out and certify the fence alignment to meet the requirements as shown.

SPEC WRITER NOTE: Use Paragraph 3.2 and 3.3 for fencing set in individual concrete footings. Use Paragraph 3.5 for fencing set in concrete slabs, walls, curbs, or similar structure.

### **3.2 EXCAVATION**

Excavation for concrete-embedded items shall be of the dimensions shown, except in bedrock. If bedrock is encountered before reaching the required depth, continue the excavation to the depth shown or 450 mm (18 inches) into the bedrock, whichever is less, and provide a minimum of 50 mm (2 inches) larger diameter than the outside diameter of the post. Clear loose material from post holes. Grade area around finished concrete footings as shown and dispose of excess earth as directed by the Resident Engineer.

### **3.3 POST SETTING**

Install posts plumb and in alignment. Set post in concrete footings of dimensions as shown. Thoroughly compact concrete so as it to be free of

voids and finished in a slope or dome to divert water running down the post away from the footing. Straight runs between braced posts shall not exceed 150 m (500 feet). Cure concrete a minimum of 72 hours before any further work is done on the posts.

### **3.5 POST CAPS**

Fit all exposed ends of post with caps. Provide caps that fit snugly and are weathertight. Where top rail is used, provide caps to accommodate the top rail. Install post caps as recommended by the manufacturer and as shown.

### **3.6 SUPPORTING ARMS**

Design supporting arms, when required, to be weathertight. Where top rail is used, provide arms to accommodate the top rail. Install supporting arms as recommended by the manufacturer and as shown.

### **3.7 TOP RAILS AND BOTTOM RAILS**

Install rails before installing chain link fabric. Provide suitable means for securing rail ends to terminal and intermediate post. Top rails shall pass through intermediate post supporting arms or caps as shown. The rails shall have expansion couplings (rail sleeves) spaced as recommended by the manufacturer. Where fence is located on top of a wall, install expansion couplings over expansion joints in wall.

### **3.8 TOP AND BOTTOM TENSION WIRE**

Install and pull taut tension wire before installing the chain-link fabric.

### **3.9 ACCESSORIES**

Supply accessories (posts braces, tension bands, tension bars, truss rods, and miscellaneous accessories), as required and recommended by the manufacturer, to accommodate the installation of a complete fence, with fabric that is taut and attached properly to posts, rails, and tension wire.

### **3.10 FABRIC**

Pull fabric taut and secured with wire ties or clips to the top rail, bottom rail, and tension wire close to both sides of each post and at intervals of not more than 600 mm (24 inches) on centers. Secure fabric to posts using stretcher bars and ties or clips.

### **3.11 REPAIR OF GALVANIZED SURFACES**

Use galvanized repair compound, stick form, or other method, where galvanized surfaces need field or shop repair. Repair surfaces in accordance with the manufacturer's printed directions.

**3.12 FINAL CLEAN-UP**

Remove all debris, rubbish and excess material from the station.

- - - E N D - - -

**SECTION 32 84 00**  
**PLANTING IRRIGATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. An automatically-controlled irrigation system, complete, including controller, piping, , drip emitters, sprinkler heads, valves, controls, control wiring, fittings, electrical connections and necessary accessories.

**1.2 RELATED WORK**

- A. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- D. Protection of Materials and Equipment:
  - 1. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION
  - 2. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- E. Division 26, ELECTRICAL.
- F. Section 32 90 00, PLANTING
- G. Sustainable design requirements and procedures including submittal requirements: Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS.
- H. Procedures and requirements for managing and disposing construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

**1.3 QUALITY ASSURANCE**

- A. Criteria:
  - 1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
  - 2. There is a permanent service organization, maintained or trained by the manufacturer, which will render satisfactory service within eight hours of receipt of notification that service is requested.
  - 3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
- B. Products Criteria:

1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  - a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
  - b. Components are compatible with each other and with the total assembly for the intended service.
3. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

C. System Requirements:

1. Full and complete coverage is required. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout required to achieve full coverage of irrigated areas without overthrow on roadways, sidewalks, window wells, or buildings and to protect trees from close high spray velocity.
2. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.
3. Locations of remote control valves is schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.
4. Irrigation lines and control wire shall run through designated utility lanes or beside roadways where most appropriate.
5. Connect new pipe systems to existing mains where shown and specified. Disconnect and abandon existing irrigation system to be abandoned.
6. Connect existing and new RCV wires to new controllers where shown and as specified as accepted by COR.

- D. Maintenance and Operating Instructions: Prior to final acceptance, verbal instructions, for a period of not less than 8 hours, shall be

provided to the operating personnel. Provide two additional years of software support for one hour each month. Provide manuals as specified in Section 01 00 00, GENERAL REQUIREMENTS.

- E. Follow manufacturer's instructions for installation.
- F. Manufacturer of Control Systems to certify Control System is complete, including all related components, and totally operational. Submit certificate to COR.
- G. As-Built Record Drawings: Maintain a complete set of as-built drawings which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment. Valves shall be shown with dimensions to reference points.
- H. Controller Chart:
  - 1. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
  - 2. Provide one controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
  - 3. Chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved prior to final inspection of the irrigation system.

#### **1.4 SUBMITTALS**

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data:
  - 1. Piping.
  - 2. Jointing materials.
  - 3. Valves.
  - 4. Frames and covers.
  - 5. Strainers.
  - 6. Pressure gages.
  - 7. Automatic control equipment.
  - 8. Sprinkler heads.

- 9. Drip Emitters
- 10. Quick couplers.
- 11. Valve boxes.
- C. Complete detailed layout shop drawings covering design of system showing pipe sizes and lengths; fittings, locations, types and sizes of sprinkler heads; controls; valves; location and mounting details of electrical control equipment; complete wiring diagram showing routes and wire sizes; wiring details and source of current and connections to existing services. Do not start work before final shop drawing approval.
- D. Name and address of a permanent service organization maintained or trained by the manufacturers that will render satisfactory service within eight hours of receipt of notification that service is requested.
- E. Reproducible "as-built" drawings.
- F. After "as-built" drawings have been approved, submit print of controller chart.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - 1. A-A-60005 Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole
- C. American National Standard Institute (ANSI):
  - 1. B40.100-05 Gauges-Pressure Indicating Dial Type-Elastic Element
- D. American Society of Sanitary Engineers (ASSE):
  - 1. 1013-2009 Reduced Pressure Principle Backflow Preventers
- E. American Society for Testing and Materials (ASTM):
  - 1. B61-08 Steam or Valve Bronze Castings
  - 2. B62-09 Composition Bronze or Ounce Metal Castings
  - 3. D1785-06 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120
  - 4. D2241-05 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
  - 5. D2464-06 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

6. D2466-06 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
  7. D2564-04 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
  8. D2855-96(R2002) Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
  9. F477-08 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F. American Water Works Association (AWWA):
1. C110 A21.10-08 Ductile-Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch for Water
  2. C111 A21.11-06 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  3. C115 A21.15-05 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
  4. C151 A21.51-09 Ductile-Iron Pipe, Centrifugally Cast, for Water  
C153 A21.53-00
  5. C504-06 Rubber Seated Butterfly Valves
  6. C600-05 Installation of Ductile-Iron Water Mains and Their Appurtenances
  7. C900-07 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4in. Through 12in.
- G. Manufacturers Standardization Society (MSS):
1. SP-70-06 Gray Iron Gate Valves, Flanged and Thread Ends
- H. References, Codes and Standards:
1. AB 325 and 1881 State of California Model Water Efficient Landscape Ordinance, California Code of Regulations Title 23.
  2. California Environmental Quality Act (CEQA)
  3. Water Use Classification of Landscape Species (WUCOLS).
  4. American Society of Irrigation Consultants (ASIC) Design Guidelines.
  5. California Landscape Standards, California Landscape Contractors Association, (CLCA) Sacramento, California.
  6. CAL-OSHA, title 8, Subchapter 4-Construction Safety Orders and Subchapter 7-General Industry Safety Orders.
  7. California Electric Code.
  8. California Plumbing Code (UPC) published by the Association of Western Plumbing Officials.
  9. NFPA 24, Section 10.4, Depth of Cover.



10. Underwriters Laboratories (UL): Electrical wiring, controls, motors and devices, UL listed and so labeled.
11. American Society of Testing Materials (ASTM)

## **PART 2 - PRODUCTS**

### **2.1 PIPING**

- A. Irrigation Mains: Polyvinyl Chloride, ASTM D2241, PVC 1120, SDR 21, solvent welded. Solvent welded and manufactured from purple colored PVC material and shall be printed on two sides with the words "Caution-Reclaimed Water" every 24 inches along pipe.
- B. Irrigation Laterals: Polyvinyl Chloride, ASTM D2241, PVC 1120, SDR 21, solvent welded. Solvent welded and manufactured from purple colored PVC material and shall be printed on two sides with the words "Caution-Reclaimed Water" every 24 inches along pipe.
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- D. Above Grade and in Concrete Pit: AWWA C115, flanged joints and fittings working pressure 1025 kPa (150 psi).
- E. Fittings:
  1. Irrigation Mains (Ductile Iron and PVC Pipe): Ductile Iron, AWWA C110.
  2. Irrigation Laterals: PVC, schedule 40, solvent welded socket type, ASTM D2466.
  3. Threaded Pipe: PVC, schedule 80, ASTM D2464.
  4. Swing Joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 1375 kPa (200 psig) working pressure.
- F. Jointing Materials:
  1. Irrigation Laterals: Solvent cement, ASTM D2564.

### **2.2 VALVES (EXCEPT REMOTE CONTROL VALVES)**

- A. Underground Shut-Off Valves: Provide One of the Following:
  1. Gate valves 50 mm (2 inches) and larger: Iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 1025 kPa (150 psi) minimum working pressure. AWWA C504.
  2. Butterfly valves 80 mm (3 inches) and larger: cast iron body with stainless steel shaft, ductile iron valve disc and resilient rubber coated, 1025 kPa (150 psi) minimum pressure. AWWA C504.

3. Ball valves (for isolation valves 1-1/2" and smaller): Full-port ball valves with bronze body, PTFE seats, and 90 degree on/off handle. Ball valves to have NPT female end connections.

B. Operations:

1. Underground: furnish valves with 50 mm (2 inch) nut for T-Handle socket wrench operation.
2. Above ground and in pits: MSS SP-70, with handwheels.
3. All butterfly valves 150 mm (6 inches) and above shall have enclosed gear drive operators.
4. Ends of valves shall accommodate the type of pipe installed.

C. Check: Swing.

1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 850 kPa (125 pound) WSP.
2. One hundred mm (4 inches) and larger: Iron body, bronze trim, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG.

- D. Pressure Reducing Valve: Cast steel body with renewable seats, with stainless steel trim. Flow passages and all parts designed to withstand high velocity applications, flange connected.

### 2.3 VALVE BOX

- A. Gate and Butterfly Valve: Valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 Mpa (4000 psi). Box shall be of such length to be adapted to depth of cover required over pipe at valve location. Mark box cover to differentiate between lawn irrigation system and domestic water supply system and set flush with finished grade. Provide 2 "T" handle socket wrenches of 15 mm (5/8 inch) round stock with sufficient length to extend 600 mm (2 feet) above top of deepest valve box cover.
- B. Remote Control Valves: When in pavement, valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 MPa (4000 psi). In planter areas, valve boxes shall be HDPE structural foam Type A, Class III, green in color. Box shall be minimum 475 mm (19 inches) long by 350 mm (14 inches) deep with key-lockable hinged cast iron cover.
1. After installation, label boxes with two 80 mm (3 inch) size stencils designated controller and circuit numbers with permanent white epoxy paint. Numbers shall be placed at center of valve cover and shall face nearest main road or service road.

2. Furnish 2 750 mm (30 inch) long valve adjustment keys.

- C. Drip zone Lateral Flush Cap Assembly: Round reinforced plastic valve box and lid constructed from HDPE. Opening at top of access box to be 14.5 cm (5-3/4") diameter, minimum. Height of access box to be 23cm (9-1/16"), minimum. Lid to have lift-hole for opening.
- D. Emitter Access Boxes: Round plastic boxes with lid constructed of UV resistant thermoplastic material, tan in color. Top diameter to be 13 cm (5") minimum. Height of box to be 26 cm (10-1/4"), minimum.

#### **2.4 STRAINERS**

- A. Basket or "Y" type with brass strainer basket. Body smaller than 70 mm (2-1/2 inch) shall be brass or bronze; 70 mm (2-1/2 inch) and larger shall be cast iron or semi-steel. Strainer cover to be furnished with blow-off connection and shut-off valve to accommodate 20 mm (3/4 inch) diameter hose connection.

#### **2.5 PRESSURE GAUGES:**

- A. ANSI B40 .100, 114 mm (4-1/2 inch) diameter, all metal case, bottom connected. Dial shall be either dead black or white lacquered throughout. Provide shut-off cocks. Maximum graduations of 10 kPa (2 psi).

#### **2.6 Flow Meter**

- A. Housing to be a Sch 80 polyvinyl chloride tee or bronze tee.
- B. Have a pulsing output which operates at 9VDC and a pulse rate which is proportional to the GPM.
- C. Fully compatible with the internal interface at each field controller.
- D. Powered by the controller.
- E. Replaceable metering insert.
- F. Output wire shall be underground 14 AWG feeder wire.
- G. Flow meter data can be accurately read by the controller up to 2,000 feet.
- H. By the same manufacturer as the irrigation controller.
- I. Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism.

#### **2.7 Moisture Sensors:**

- A. Solid-state tensiometer type.
- B. Include data transmission circuitry which sends moisture level readings back to the irrigation controller using valve field wires.
- C. Entire unit encased in epoxy.
- D. Require no calibration for the life of the sensor.

- E. Unaffected by temperature, salinity or changes in pH.
- F. Accurately transmit moisture levels up to 3000 ft. across 14 AWG wire.

**2.8 ET Measurement Device:**

- A. Powered by the field controller.
- B. Measures ET directly in 0.01" increments and sends pulses directly to field controller.
- C. Fully compatible with the internal interface at the field controller.
- D. Mounted inside a stainless steel, vandal-resistant enclosure specifically designed for the device.

**2.9 Rain Measurement Device:**

- A. Accurately measures rainfall in 0.01" increments by means of a tipping and emptying device mounted below the center of the collection dish.
- B. Fully compatible with the internal interface at the field controller.
- C. Operate between 32 deg F and 125 deg F
- D. Be constructed of anodized aluminum.
- E. The controller shall provide the following programming parameters for rain.
  - 1. Stop Irrigation after x.xx inches.
  - 2. Maximum Rain in One Hour is x.xx inches.
  - 3. Maximum Rain in 24 Hours is x.xx inches.
  - 4. Let Rain only build up to x.xx inches.
  - 5. C

**2.10 AUTOMATIC CONTROL EQUIPMENT—INDEPENDENT ELECTRIC CONTROLLERS**

- A. Refer to Drawings.
- B. Overall Control Concept. The electric automatic control system shall consist of one or more independent controllers which operate individual remote control valves in accordance with timing schedules programmed into the independent units. The number of units and location of the installations are shown on the drawings. The system shall have two-way, central Internet management with remote programming; monitoring and real-time notification of field alerts anywhere Internet access can be obtained. Whether data shall be collected from over 40,000 government regulated and privately owned weather stations across the US to combine with local wind, temperature, solar radiation and humidity variables to model a virtual on-site weather station.
- C. The Control System consists of an Independent controller, Flow Meter, master valve and all accessories necessary to operate the irrigation

system. All of these components and software shall be a standard package

D. Independent controller shall have the following characteristics:

1. Each controller shall be programmed automatically, daily over the Internet, based upon an ET micro zone representing approximately one square kilometer that is associated with the controllers exact longitude and latitude coordinates.
2. Station base watering time shall be developed by user selection of various sprinkler, soil, slope, and plant factors. Controller will develop watering station from the input factors. The controller will automatically decide whether to irrigate or not based upon the current day's ET and the depletion of each station independent of one another
3. The stations shall allow for a rapid programming of a block of stations with the same watering time.
4. The controller shall have four programs with seven independent water day patterns and schedules. Each program has to start times with up to 20 cycles, with one water window per program. A second start time shall be available for high ET requirements in "auto mode" only.
5. The controller shall have independent station watering and watering day adjustment from -50% to +25% in 5% increments. Able to communicate with normally closed wired or wireless rain and rain/freeze switches, flow sensors and normally open or normally closed master valves.
6. Continuous flow monitoring and alert notification at the individual station and mainline levels. Preview mode that displays flow data and irrigation schedules for each station.
7. Report menu providing accumulated totals of flow usage and station runtime on a daily, weekly and monthly basis. Valve wire diagnostic circuit that identifies field wiring issues such as valve shorts or valve no-connects.
8. The ability to extend watering to following days when water window maximum has been reached. Coordinate a minimum of two flow monitors and master valves.
9. The controller shall be UL and C-UL approved.
10. Daily up dated ET irrigation schedules with an eight week go forward schedule for observing schedules for low-water use or

other deep-rooted plant materials The controller shall have direct compatibility with hand-held remotes by simply connecting to a 32 pin connector.

11. The controller shall monitor the flow rate and be furnished with the following features: main line break flow detection, unscheduled flow detection, station upper limit flow detection, programmable flow check delay from one (1) to six (6) minutes, monitor and display measured flow in GPM, automatic flow learn mode for setting individual station limits or manual entry or semi-automatic monitor/set mode, global percentage adjust to automatically factor upper flow limits for stations, automatic station advancement for station overflow, audible and visual alert for all flow violations, intelligent upper-limit processing for concurrent station operation, automatic closure of normally open master valve on main line breaks or unscheduled overflow.
12. The controller shall be furnished with a feature for tracking water consumption in gallons to pinpoint specific water savings and conservation efforts. The controller shall be furnished with the following:
  - a. Programmable master valve either normally open or normally closed.
  - b. Programmable pump.
  - c. Programmable stacking or no stacking.
  - d. Programmable timer delay.
  - e. Programmable security code.
  - f. Programmable alarm to either enable or disable an audible alarm in the event of a flow violation.
  - g. Programmable flow check delay to set up a delay after any station changes, from one (1) minute to six (6) minutes, during which time no flow limits are checked.
  - h. View and clear accumulated gallons.

**2.11 HAND-HELD REMOTE: provide one hand-held remote compatible with controllers.**

**2.12 CONTROLLER ENCLOSURE PAD**

- A. The controller enclosure mounting pad assembly shall consist of a reinforced plastic support base, a 3/16 inch thick 5052 H 32 Marine grade aluminum mounting pad and stainless steel fastening brackets.

**2.13 REMOTE CONTROL VALVES:**

- A. Each sprinkler section shall be automatically operated by a remote control valve installed underground and operated by a 24-volt AC electric solenoid. Valves shall be of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation. Install valves with union on one side to allow for easy removal. Valves shall have a minimum of 1025 kPa (150 psi) working pressure.
- B. Valve body shall be cast-iron with brass bonnet, trim and renewable seat and have two inlet tappings (furnished with one plugged) to allow installation as either a straight or angle pattern valve.
- C. Valves shall be diaphragm type designed to operate in water containing sand and debris, without the use of scrubbers or filters. To ensure this, the flush rod shall be tapered to vary the size of the port opening as the diaphragm raises and lowers, thus allowing trapped material to escape. Rod to be finished with a serrated surface to help scrub trapped material out. A The effective diaphragm working area/valve seating opening ratio must be a minimum of 3 to 1. Valves shall be completely serviceable from the top without removing valve body from the system. Furnish 2 750 mm (30 inch) long adjustment keys. Valves to operate at no more than 50 kPa (7 psi) pressure loss at manufacturers maximum recommended flow rate.

**2.14 SPRINKLER HEADS**

- A. Shall be of make, type and performance as indicated on drawings. The entire internal assembly including filter screen, to be capable of removal from the top without removing the sprinkler case from the riser.
- B. Rotator Pop-up Sprinklers:
- C. Rotator to have multi-trajectory rotating stream delivery system. Body shall be pressure compensating at 40 psi and constructed of corrosion and UV resistant heavy-duty ABS. Body to have factory installed drain check valve capable of checking up to 14 feet in elevation change. Nozzles are shall have fully adjustable arcs and radius reduction up to 25%. Nozzle distances shall reign from 8 to 30 feet with corner, side strips and corner side strips. Precipitation rate to be low below 0.5 in./hr. at head-to-head coverage. Shrub Spray Heads: Bodies to have an internal flow regulation in the pop-up stems at 30 PSI. The pop-up stem to have a shutoff device restricting

water loss by 99% if the nozzle is removed or damaged. The body shall include a check valve to prevent low head drainage up to 10 feet in elevation change. The nozzles shall have a precipitation rate of 1 in./hr. or less. The nozzles to include a wide variety of arcs including 60°, 120°, 150°, 210°, 240°, side strip, left and right corner strips. The nozzles shall be match precipitation rate within each size and with other sizes. The nozzles shall be capable of achieving a minimum of 70% DU at standard head-to-head spacing. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated comolded wiper seal for cleaning debris from the pop-up stem. Drip Emitters: Drip emitters shall be of the pressure compensating, permanently assembled type with 1.25cm (½") FPT inlet. Emitters shall be capable of providing 1gpm at inlet pressures between 15 and 50 psi.

- D. Emitter drip line tubing shall have pre-emergent impregnated into the emitter during the molding process to prevent root growth inside of emitter. Emitters to be spaced evenly 18 inches apart inside of tubing. Each emitter to be 1 gallon per hour.

#### **2.15 QUICK COUPLERS**

- A. Shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.
- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Furnish 2 hose swivels and operating keys for each size coupler to the COR.

#### **2.16 LOW VOLTAGE CONTROL VALVE WIRE**

- A. Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than No. 14.



**2.17 SPLICING MATERIALS: EPOXY WATERPROOF SEALING PACKET. LOW VOLTAGE CONTROLLER CABLE**

- A. Multi-strand cable, Underwriters Laboratories Inc. approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer's recommendations.

**2.18 SLEEVE MATERIAL**

- A. PVC-1120-5DR 17, Schedule 40.

**2.19 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, **detectable** purple with black letters and imprinted with "CAUTION BURIED IRRIGATION WATER LINE BELOW".
- B. TRACER WIRES
  - 1. No. 14, Green, Type TW plastic-coated copper tracer wire shall be installed with non-metallic irrigation main lines.

**PART 3 - EXECUTION**

**3.1 PIPE LAYING - GENERAL**

- A. Do not lay pipe on unstable material, in wet trench or when, in the opinion of COR, trench or weather conditions are unsuitable for the work.
- B. Allow a minimum of 80 mm (3 inches) between parallel pipes in the same trench.
- C. Hold pipe securely in place while joint is being made.
- D. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- E. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- F. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- G. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.

- H. Minimum cover over water mains shall be 750 mm (30 inches). Control valves shall never be less than 80 mm (3 inches) below finished grade. Cover laterals to minimum depth of 600mm (24 inches).
- I. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the warranty period.
- J. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- K. Warning tape shall be continuously placed 300 mm (12 inches) above sprinkler system water mains and laterals.

### **3.2 LAYING PLASTIC PIPE**

- A. Shall be snaked in trench at least 1 meter to 100 meters (1 foot per 100 feet) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints
  - 1. Solvent Welded Socket Type: ASTM D2855.
  - 2. Threaded Type: Apply liquid teflon thread lubricant of teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to one half additional full turn.

### **3.3 INSTALLATION OF SPRINKLERS AND QUICK COUPLERS**

- A. Install sprinkler heads and quick couplers at ground surface as detailed.
- B. Place part-circle sprinkler heads no more than 150 mm (6 inches) from edge, of and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation.
- C. Install all shrub sprays, sprinklers and quick couplers on swing joints as detailed on plans.
- D. Shrub heads shall be pop-up types and set (1 foot) from edge of curb or pavement and walls except as otherwise shown.

### **3.4 INSTALLATION OF CONTROL WIRING**

- A. Wiring from master controllers to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.

- B. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.
- C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
- D. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
- E. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

### **3.5 TRACER WIRE INSTALLATION**

- A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.
- B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a Dymo-Tape type plastic label with designation "Tracer Wire."
- C. Record locations of tracer wires and their terminations on project record documents.

### **3.6 SETTING OF VALVES**

- A. No valves shall be set under roads, pavement or walks.
- B. Clean interior of valves of foreign matter before installation.
- C. Where pressure control valves are installed adjacent to remote control valve, they shall be housed in the same valve box.
- D. Set valve box cover flush with finished grade.

### **3.7 SLEEVING**

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeving to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 300 mm (12 inches) beyond edges of paving or construction.

- C. Bed sleeves with a minimum of 100 mm (4 inches) of sand backfill above top of pipe.

### **3.8 TEST AND FLUSHING**

- A. Pressure Test: Pressure test lines before joint areas are backfilled. Backfill a minimum of 300 mm (12 inches) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 1025 kPa (150 psi) for two hours. Maximum loss shall be 3 L/25 mm pipe diameter/300 m (0.8 gallons/inch pipe diameter/1000-feet). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
- B. Flushing: After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.
- C. Operation Test: Upon completion of the final adjustment of the sprinkler heads to permanent level at ground surface, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate the entire installation to demonstrate the complete and successful operation of all equipment.

### **3.9 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

- - - E N D - - -

**SECTION 32 90 00**

**PLANTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This work consists of furnishing and installing all planting materials required for landscaping hereinafter specified in locations as shown.

**1.2 TESTING LABORATORY SERVICES**

- A. Materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

**1.3 EQUIPMENT**

- A. Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

**1.4 RELATED WORK**

- A. Section 32 84 00, PLANTING IRRIGATION.
- B. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Sustainable design requirements and procedures including submittal requirements: Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS.
- D. Procedures and requirements for managing and disposing construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

**1.5 SUBMITTALS**

- A. Product Data: Manufacturer's current catalog cuts and specifications of the following:
  - 1. Fertilizers
  - 2. Tree Tie and Stake
  - 3. Tree Root Barrier
  - 4. Iron Sulfate
  - 5. Filter Fabric
  - 6. Erosion Control Netting
  - 7. Perforated Drain Pipe
- B. Samples: Submit following samples along with certificates of compliance / analytical data from approved laboratory for degree of compliance.  
  
Plants: Submit typical sample of each variety or entire quantity to site for approval by Resident Engineer.

**PLANTING**

1. Organic Mulch: Submit 1-pint sample with list of ingredients.
  2. Organic (Soil) Amendment: Submit 1-pint sample with Technical Data Sheet and STA certification.
  3. Permeable Backfill (Filter Rock): Submit 1-pint sample.
  4. Imported Planting Soil: Submit 1-pint sample
  5. Submit 1 quart sample of composted organic amendment along with composter's Compost Technical Data Sheet and STA certification to soil and plant laboratory for analytical packages as specified in Part 2 - Products below. Upon approval of the Laboratory's recommendations by the Resident Engineer, the recommendations in the report shall become a part of the Specifications.
- C. Delivery Receipts
1. Provide delivery receipts for quantities of organic soil amendments delivered to the site.
- D. Topsoil Analysis (Soil Management) Report
1. After approval of rough grading and topsoil placement, obtain minimum of four representative one quart samples of topsoil taken from accepted site locations at depth of 4" to 6" below finish grade and submit to an accredited Soils Laboratory for evaluation of physical and chemical properties of soil including all major nutrients; pH, salinity, boron, sodium, micronutrients, copper, zinc, manganese and iron; and infiltration rate, soil texture and organic content, along with a summary describing the degree of compliance with the specified requirements. The report shall also include recommendations for modification of the soil for agricultural suitability.
  2. Upon request by Owner, submit documentation verifying implementation of soil analysis report recommendations to the local agency with Certificate of Completion as required by the State of California Model Water Ordinance
- E. Subsoil Analysis
1. Besides the above required soil samples, take one representative sample of any subgrade soil that is to receive a layer of imported planting soil over it. The laboratory report shall include the subgrade soil's total combined silt and clay content for determining the total desirable combined silt and clay

content of the final imported planting soil cover specified herein.

F. Imported Planting Soil Analysis

1. See Imported Planting Soil Analysis requirements elsewhere in this specification for comparison to existing soil analysis.

G. Approval of Laboratory Report

1. Upon approval of the Laboratory's report by the Resident Engineer, the recommendations in the report shall become a part of the Specifications and the quantities of soil amendment, fertilizer and other additives shall be adjusted to conform with the report at no additional cost to the owner. Request Testing Laboratory to send one copy of test results directly to Resident Engineer. Note that there is a minimum quantity of organic amendment specified elsewhere in this specification section.

**1.6 PROJECT/SITE CONDITIONS**

- A. Site Visit: At beginning of work, visit and walk the site with the Resident Engineer to clarify scope of work and understand existing project/site conditions.
- B. Protection of Plants from Deer: Contractor shall be responsible for protection of all planting from deer.

**1.7 WARRANTY AND REPLACEMENT**

- A. Pre-Emergence Weed Killer: Warrant the work against weed growth for a period of four (4) months after application.
- B. Warrant all plants and planting to be in a healthy, thriving condition until the end of the maintenance period, and deciduous trees beyond that time until active growth is evident.
- C. Replace all dead plants and plants not in a vigorous condition immediately upon discovery and as directed by the Resident Engineer at Contractor's expense. Install replacement plants before the final acceptance at the size specified.
- D. Warrant all plant material for a period of one year after final acceptance of the maintenance period against plant materials with defects at the time of installation.
- E. Warrant plant installation and maintenance by Contractor against defects for a period of one year.
- F. Samples: Submit the following samples for approval before work is

started:

Inert Mulch	2 quarts of each type to be used.
Organic Mulch	2 quarts of each type to be used.

G. Certificates of Conformance or Compliance: Before delivery, notarized certificates attesting that the following materials meet the requirements specified shall be submitted to the Resident Engineer for approval:

1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).
2. Fertilizers.
3. Membranes

H. Manufacturer's Literature and Data:

1. Erosion control materials
2. Pre-emergent herbicide
3. Filter Fabric

I. Soil laboratory testing results and any soil amendment recommendations from the Contractor.

#### **1.8 DELIVERY AND STORAGE**

A. Delivery:

1. Notify the Resident Engineer of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant material from the job site immediately.
2. Protect plants during delivery to prevent damage to root balls or desiccation of leaves. Protect trees during transport by tying in the branches and covering all exposed branches.
3. Deliver fertilizer to the site in the original, unopened containers bearing the manufacturer's warranted chemical



analysis, name, trade name or trademark, and in conformance to state and federal law.

4. During delivery: Protect seed from contamination.

B. Storage:

1. Keep fertilizer in dry storage away from contaminants.

2. Store plants not installed on the day of arrival at the site as follows:

a. Shade and protect plants from the wind when stored outside

C. Keep plants in a moist condition until planted.

#### **1.9 LIME TREATMENT OF SUBSOIL**

A. Refer to PART 3 -EXECUTION for mitigation of any lime treatment of soils.

#### **1.10 PLANTING INSTALLATION CONDITIONS**

A. Perform planting operations after the irrigation system is installed, tested, and approved.

B. No work shall be done when the ground is too wet or in an otherwise unsuitable condition for planting. Special conditions may exist that warrants a variance. Submit a written request to the Resident Engineer stating the special conditions and proposal variance.

#### **1.11 PLANT ESTABLISHMENT PERIOD**

A. The Establishment Period for plants shall begin immediately after installation, with the approval of the Resident Engineer, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Plant Establishment Period the Contractor shall:

1. Water all plants to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 25 mm (1 inch) of absorbed water per week either through natural rainfall or augmented by periodic watering. Apply water at a moderate rate so as not to displace the mulch or flood the plants.

2. Prune plants and replace mulch as required.

3. Replace and restore stakes, guy wires, and eroded plant saucers as required.

4. In plant beds and saucers, remove grass, weeds, and other undesired vegetation, including the root growth, before they

reach a height of 75 mm (3 inches).

5. Spray with approved insecticides and fungicides to control pests and ensure plant survival in a healthy growing condition, as directed by the Resident Engineer.
6. Remove plants that die during this period and replace each plant with one of the same size and species.

**1.12 PLANT WARRANTY**

- A. All work shall be in accordance with the terms of the Paragraph, "Warranty" of FAR clause 52.246-21, including the following supplements:

1. A One Year Plant Warranty will begin on the date that the Government accepts the project or phase for beneficial use and occupancy. The Contractor shall have completed, located, and installed all plants according to the plans and specifications. All plants are expected to be living and in a healthy condition at the time of final inspection.
2. The Contractor will replace any dead plant material immediately. A one year warranty for the plants that was replaced, will begin on the day the work is completed.
3. Replacement of relocated plants, that the Contractor did not supply, is not required unless they die from improper handling and care during transplanting. Loss through Contractor negligence requires replacement in kind and size.
4. The Government will reinspect all plants at the end of the One Year Warranty. The Contractor will replace any dead, missing, or defective plant material immediately. The Warranty will end on the date of this inspection provided the Contractor has complied with the work required by this specification. The Contractor shall also comply with the following requirements:
  - a. Replace dead, missing or defective plant material prior to final inspection.
  - b. Mulch and weed plant beds and saucers. Just prior to this inspection, treat these areas to a second application of approved pre-emergent herbicide.
  - c. From plants having been installed for one year, remove stakes, guy wires and any required tree wrappings.

d. Complete remedial measures directed by the Resident Engineer to ensure plant survival.

e. Repair damage caused while making plant replacements.

**1.13 APPLICABLE PUBLICATIONS**

- A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Ordinances and Regulations: All local, municipal and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the herein listed codes, regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard than is required by the above mentioned codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations
- C. American National Standards Institute (ANSI) Publications:
1. Z60.1-04 Nursery Stock
  2. Z133.1-06 Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush- Safety Requirements
- D. Hortus Third, A Concise Dictionary of Plants Cultivated in the U.S. and Canada.
- E. Contractor shall be familiar with and follow the State of California Model Water Ordinance, California Code of Regulations, Title 23 Waters, Division 2, Department of Water Resources, Chapter 2.7. Also, the Contractor is responsible to follow all local water ordinances and the Soil Management/Analysis Report with verifying implementation.
- F. American Society for Testing and Materials (ASTM) Publications:
1. C136-06 Sieve Analysis of Fine and Coarse Aggregates
- G. Turfgrass Producers International:
1. Turfgrass Sodding.
- H. U. S. Department of Agriculture Federal Seed Act.

1. Rules and Regulations
  - I. American Wood Protection Association (AWPA):
    1. C2-02 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
  - J. "Sunset Western Garden Book," Lane Publishing Co., Menlo Park, California; current edition.
  - K. Alameda Countywide Clean Water Program (ACCWP) or member agency having jurisdiction over the project work
  - L. US Composting Council Compost analysis Program (CAP)
  - M. Test Methods for the Evaluation of Composting and Compost (TMECC)
  - N. International Society of Arboriculture, Guide for Plant Appraisal, latest version.
  - O. United States Composting Council (USCC) Seal of Testing Assurance (STA) program.
  - P. TMECC: Refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC)
  - Q. References to "Caltrans Standard Specifications" shall mean the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.
  - R. Manufacturer's recommendations

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. All plant material shall conform to the varieties specified or shown in the plant list and be true to botanical name as listed in Hortus Third.

### **2.2 PLANTS**

- A. Plants shall be nursery grown in containers and in accordance with ANSI Z60.1, except as otherwise stated in the specifications or shown on the plans. Where the drawings or specifications are in conflict with ANSI Z60.1, the drawings and specification shall prevail.
- B. Plant the variety, quantity and size indicated. The total quantity tabulated on the drawings are considered approximate and furnished for convenience only. Contractor shall perform his/her own plant quantity calculations and shall provide all plants shown on the Drawings.

- C. Tag plants of the type or name indicated and in accordance with the standard practice recommended by the American Association of Nurserymen.
- D. Install healthy, shapely and well rooted plants with no evidence of having been root-bound, restricted or deformed.
- E. Take precautions to ensure that the plants will arrive at the site in proper condition for successful growth. Protect plants in transit from windburn and sunburn. Protect and maintain plants on site by proper storage and watering.
- F. Substitutions will not be permitted, except as follows:
  - 1. If proof is submitted to the Resident Engineer that any plant specified is not obtainable, a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price.
  - 2. Substantiate and submit proof of plant availability in writing to the Resident Engineer within 10 days after the effective date of Notice to Proceed.
- G. Tree Form: Trees shall have a symmetrical form as typical for the species/cultivar and growth form.
  - 1. Central Leader for Single Trunk Trees: Trees shall have a single, relatively straight central leader and tapered trunk, free of co dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the central leader should not have been headed; however, in cases where the original leader has been remove, an upright branch at least  $\frac{1}{2}$  the diameter of the original leader just below the pruning point shall be present.
  - 2. Potential Main Branches: Braches shall be evenly distributed radially around and appropriately spaced vertically along the trunk, forming a generally symmetrical crown typical for the species.
  - 3. Headed temporary branches should be distributed around and along the trunk as noted above and shall be no greater than  $\frac{3}{8}$ " diameter, and no greater than  $\frac{1}{2}$  diameter of the trunk at point of attachment.
- H. Tree Trunk
  - 1. Trunk diameter and taper shall be sufficient so that the tree

will remain vertical without the support of a nursery stake.

2. 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.
3. Tree trunk diameter at 6" above the soil surface shall be within the diameter range shown for each container size below, except where shown otherwise:

Container	Trunk Diameter in inches	Soil level from Container
<u>Top</u>		
5 gallon	0.5" to 0.75"	1.25 to 2"
15 gallon	0.75" to 1.0"	1.75 to 2.75"
24" Box	1.5" to 2. 5"	2.25 to 3"

4. Tree trunks shall be undamaged and uncut with all old abrasions and cuts completely callused over. Do not prune plants prior to delivery.

I. Tree Roots

1. Trunk root collar (root crown) and large roots shall be free of circling and/or kinked roots. Contractor may be required to remove soil near the root collar in order to verify that circling and/or kinked roots are not present.
2. The tree shall be well rooted in the container. When the trunk is lifted the trunk and root system shall move as one and the rootball shall remain intact.
3. The top-most roots or root collar shall be within 1" above or below the soil surface. The soil level in the container shall be within the limits shown in above table.
4. The rootball periphery shall be free of large circling and bottom-matted roots.
5. On grafted or budded trees, there shall be no suckers from the root stock.

J. Shrubs

1. Each shrub must stand upright without support.

2. All container shrubs shall be free of girdling roots, defined as those roots greater than 1/8" diameter circling the periphery of the rootball. The top of the rootball shall be free of "Knees" (roots) protruding above the soil, and the bottom shall be free of matted roots.

K. Measure trees and shrubs with branches in normal position. Height and spread dimensions indicated refer to the main body of the plant, and not from branch tip to tip.

L. Make substitutions only when a plant (or its alternates as specified) is not obtainable and the Resident Engineer authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics with an equitable adjustment of the contract price.

### 2.3 FERTILIZERS

A. Commercial fertilizer, pelleted or granular form, conform to the requirements of Chapter 7, Article 2, of the Agricultural Code of the State of California for fertilizing materials as follows:

1. Type A:

6% Nitrogen, 20% Phosphorus Acid and 20% Potash, (6-20-20).

2. Type B:

21 gram planting tablets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Agriform or 10gm BestPacks packets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Best Fertilizer Co.

3. Type C:

Complete fertilizer 21% Nitrogen, 7% Phosphoric Acid and 14% Potash (21-7-14).

4. If commercial fertilizer having this analysis is not obtainable, other similar commercial fertilizer may be used providing it meets the approval of the Resident Engineer.

B. Maintenance Fertilizer: Type C

### 2.4 ORGANIC AMENDMENT FOR IN SITU SOILS (ON-GRADE):

A. Ground Redwood or Ground Fir Bark with the following properties:

<u>Percent Passing</u>	<u>Sieve Designation</u>
100	9.51 mm 3/8"
50-60	6.35 mm 1/4"

20-40 4.76 mm      No. 4  
0-20 2.38 mm      No. 8 8 mesh

Redwood Sawdust

Dry bulk density, lbs. per cu. yd., 260-280  
Nitrogen stabilized - dry weight basis, min. 0.4%  
Salinity (ECe): 4.0 maximum  
Organic Content: 90% minimum  
Reaction (pH): 4.0 minimum

Ground Fir and/or Pine Bark

Dry bulk density, lbs. per cu. yd., Min. 350  
Nitrogen stabilized - dry weight basis, min. 0.5%  
Salinity (ECe): 4.0 maximum  
Organic Content: 90% minimum  
Reaction (pH): 4.0 minimum

- B. Submit sample along with analytical data from an approved laboratory for degree of compliance to the Resident Engineer within two weeks after award of Contract.

**2.5 COMPOSTED YARD WASTE AMENDMENT:**

- A. The above Ground Redwood or Ground Fir Bark or Ground Pine Bark (ORGANIC AMENDMENT FOR IN SITU SOILS) is the specified organic amendment material required. Acceptance of Composted Yard Waste Amendment in lieu of the above specified ORGANIC AMENDMENT FOR IN SITU SOILS (ON-GRADE) material will be considered if the in situ planting soil salinity and soil structure is favorable for the inclusion of recycled yard waste organic matter, as approved by the Resident Engineer. It is the Contractor's responsibility to secure test samples of both the planting soil and the proposed composted yard waste amendment (2 quart samples) and submit to Soils and Plant Laboratory for evaluation and recommendations. The composted yard waste amendment sample shall be a grab sample from the currently available material that has been tested within the last 30 days and



shall include the composter's Compost Technical Data Sheet that includes lab analytical test results and directions for product use along with list of ingredients. The composted yard waste amendment shall be a mixture of feedstock materials including green material consisting of chipped, shredded, or ground vegetation and mixed food waste, or clean processed recycled wood products. Single source, Biosolids (sewage waste) compost will not be acceptable.

- B. Based on the Soils and Plant Laboratory evaluation, the addition of composted yard waste amendment shall not be acceptable if it creates a leaching requirement.
- C. The addition of the compost shall result in a final ECe of the amended soil of less than 4.0 dS/m @ 25 degrees C. as determined in a saturation extract. Use the following table to determine the maximum allowable Ece (dS/m of saturation extract) of compost at desired use rate and allowable Ece increase.

DESIRED USE RATE		MAXIMUM ALLOWABLE Ece INCREASE FROM AMENDMENT		
Cu. Yds. Amendment Per 1000 Sq. Ft. for Incorporation to 6" depth	Volume percentage of amendment	1 dS/m	2 dS/m	3 dS/m
		Maximum ECe of Compost		
1	5	14	28	42
2	11	7	14	21
3	16	5	9.5	14
4	22	3.5	7	10.5
5	27	3	5.5	8.5
6	32	2.5	4.5	7

1. Example: Specification calls for 6 cu. Yds. Compost per 1000 sq. ft. for incorporation to 6" depth, and site soil has an ECe of 2.0. In order to avoid exceeding ECe of 4 in final blend,

compost ECe shall be less than 4.5 dS/m.

D. Composted Yard Waste Soil Amendment Properties as follows:

1. Gradation:

<u>Percent Passing by weight</u>		<u>Sieve Designation</u>	
90		1/2"	
85-100		9.51 mm	3/8"
50-80	2.38 mm	No. 8	8 mesh
0-40	500 micron	No. 35	32 mesh
Maximum length 4 inches			

2. Organic Content: Minimum 45% based on dry weight and determined by ash method.
3. Carbon to nitrogen ratio: Maximum 35:1 if material is claimed to be nitrogen stabilized.
4. pH: 5.5 - 8.0 as determined in saturated paste.
5. Soluble Salts: See above.
6. Moisture Content: 35-60%.
7. Physical Contaminants:
  - a. The compost shall be free of contaminants such as glass, metal and visible plastic per Man Made Inert Removal and Classification: TMECC 02.02, % > 4mm fraction. Combined total less than 1.0.
  - b. Man Made Inert Removal and Classification: Sharps % > 4mm fraction. (sewing needles, hypodermic needles) Non Detected.
8. Pathogens: TMECC 07.01-B Fecal Coliform Bacteria <1000 MPN/gram dry wt. <1000 (Pass)
9. Pathogens: TMECC 07.01-B Salmonella <3 MPN/4grams dry wt. <3 (Pass)
10. Maturity: Physical characteristics suggestive of maturity include:
  - a. Color: Dark brown to black.
  - b. Acceptable Odor: None, soil-like, musty or moldy.
  - c. Unacceptable Odor: Sour, ammonia or putrid.

- d. Particle Characterization: Identifiable wood pieces are acceptable but the balance of the material shall be soil-like without recognizable grass or leaves.
- e. TMECC 07.01-A Germination and Vigor, % Relative to Positive Control for Seed Emergence and Seedling Vigor: 80 or above.
- E. Submit planting soil and composted yard waste amendment samples along with laboratory report from Soils and Plant Laboratory for degree of compliance as specified above and composter's Compost Technical Data Sheet that includes lab analytical test results and directions for product use along with list of ingredients to the Resident Engineer a minimum of 3 weeks prior to beginning soil prep. The laboratory report shall include recommendations for adjusting fertilizer and amendment quantities. Upon approval of the Laboratory's report by the Resident Engineer, the recommendations in the report shall become a part of the Specifications and the quantities of soil amendment and fertilizer shall be adjusted to conform with the report at no additional cost to the owner.

## **2.6 IRON SULFATE**

- A. Type: Dry form.

## **2.7 PLANT BACKFILL**

- A. Except for acid loving plants (Azaleas, Rhododendrons, Ferns, Camellias, etc.), use a mixture of 2 parts soil from the hole, and 1 part amendment with iron added at the following rates:

<b>1. Size</b>	<b>Rate</b>
----------------	-------------

1 gallon can plants	iron, 1/4 cup
5 gallon can plants	iron, 1/3 cup
15 gallon can plants	iron, 1/2 cup
24" box and larger	iron, 1 cup

- 2. Mix the iron, amendment and soil thoroughly for use only in the top 8 inches of backfill around plants. For acid loving plants, mixture to be 1/2 soil from the hole and 1/2 amendment only in the top 8 inches.

**2.8 MULCH**

- A. Organic Mulch: Fir tree or pine tree bark, dark gray or black in color; 3/4-inch to 1-inch size.
- B. Submit samples of organic mulch to the Resident Engineer for approval within two weeks of award of Contract. Resubmit until acceptable to Resident Engineer, at no extra cost.

**2.9 TREE SUPPORT POLES**

- A. Type: Peeled lodge pole pine logs, clean, smooth, new, and sized as follows:
  - 1. Two-inch (2") diameter by eight feet (8') long for trees less than 8' high and 1" caliper.
  - 2. Three-inch (3") diameter by eight to ten feet (8' - 10') long for trees greater than 8' high and 1" caliper.

**2.10 TIES**

- A. Rubber strap, 24-inch minimum length without sharp edges adjacent to trunk.

**2.11 TREE ROOT BARRIER**

- A. Root Barrier shall be black injection molded panels of .080" wall thickness in modules 24d" long by 18" deep manufactured with a minimum 50% post consumer recycled polypropylene plastic with added ultraviolet inhibitors, recyclable
- B. Each panel shall have not less than 4 molded integral vertical root deflecting ribs of at least 0.06" thickness protruding 1/2" at 90 degrees from interior of the barrier panel, spaced 6" apart. A double top edge consisting of two parallel, integral, horizontal ribs at the top of the panel of a minimum 0.06" thickness 3/8" wide and 1/4" apart. A minimum of 9 anti-lift tabs consisting of integral horizontal ridges of a minimum 0.06" thickness.
- C. Panels shall have an instant assembly system by sliding one panel into another.

**2.12 PLANTING SOIL (TOPSOIL):**

- A. Planting soil is defined as screened imported soil. Satisfactory planting soil shall be free of subsoil, clay, lumps, stones, and other

objects over 2" in diameter, and without weeds, roots, and other objectionable material.

**2.13 IMPORTED PLANTING SOIL (TOPSOIL):**

- A. Imported planting soil shall be fertile, friable, natural, productive soil containing a normal amount of humus, and shall be capable of sustaining healthy plant life. Planting soil shall be free of subsoil, heavy or stiff clay, rocks, gravel, brush, roots, weeds, noxious seeds, sticks, trash, and other deleterious substances. Soil shall not be infested with nematodes or with other noxious animal life or toxic substances. Soil shall be obtained from well-drained, arable land, and shall be of an even texture. Soil shall not be taken from areas on which are growing any noxious weeds such as Morning Glory, Sorrel, or Bermuda Grass.
- B. Imported planting soil shall have a pH value of between 6.0 and 7.5, a boron concentration of the saturation extract of less than 1 ppm, salinity of the saturation extract at 25 degrees C. of less than 4.0 millimoles, and a sodium absorption rate (SAR) of less than 8.
- C. The silt and clay content of imported planting soil shall not exceed that of the existing soil it is to be placed over. It shall be a "Sandy Loam" as classified in accordance with USDA Standards with a combined total of between 25% to 40% Clay and Silt. Provide existing site soil sample analysis report for comparison with the imported soil report.
- D. Make the site of the source of supply of planting soil available to the Resident Engineer for observation and approval prior to any hauling or placing of soil. In addition, submit for approval a 1-quart sample of soil, together with a standard soil analysis report by an accredited soils analyst showing chemical analysis stating source, fertility, agricultural suitability and particle size distribution of the soil. Deliver the sample to the Resident Engineer two weeks before starting the contemplated hauling of the soil. Following approval of the sample, provide a one-half cubic yard sample, which shall be stored at the site of work for comparison with subsequent loads of soil. The comparison sample shall be protected by a cover until the furnishing of all soil has been completed and accepted. Should the soil submittal lack certain requirements which can be added

to the soil, the Resident Engineer will consider a request by the Contractor to amend the soil as recommended by the Soils Analyst at the Contractor's expense.

**2.14 PRE-EMERGENCE WEED KILLER**

- A. Clean non-staining as recommended by a licensed pest control specialist.

**2.15 FILTER FABRIC**

- A. Needle punched nonwoven geotextile Filter Fabric composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids weighing 18 grams per square meter. Meets Aashto M288-06 Class 3 for elongation > 50%.

**2.16 PIPE:**

- A. Polyvinyl Chloride (PVC) pipe and pipe fittings shall meet extra strength minimum of SDR-35 of the requirements of ASTM Specification D3034.
- B. Perforated and non-perforated corrugated polyethylene pipe, 3- to 10-inch diameter, shall meet the requirements of ASTM D883 and ASTM F412, and shall conform to Section 68 of the Standard Specifications.
  - 1. Corrugated polyethylene pipe fittings shall comply with all requirements of AASHTO M-252-85I for 3- to 10-inch diameter pipe. Couplings shall be split or snap-on type for perforated pipe and split couplings with gaskets for non-perforated pipe. Cutting pipe with integral couplings will not be allowed.
  - 2. Corrugated polyethylene pipe and fittings manufactured by Advanced Drainage Systems, Inc., shall be considered the standard to determine compliance to this specification.
- C. Inspection Tube Cap
  - 1. Paint cap one coat chocolate-brown color using Flat, exterior grade latex paint as accepted by Resident Engineer.

**2.17 PERMEABLE BACKFILL (FILTER ROCK)**

- A. Permeable backfill used in subsurface drain installations to be Class 2 permeable material in conformance with Section 68 "Subsurface Drains" of the Caltrans Standard Specifications; gradation to 3/4" maximum size. Submit Sample for approval.

## **2.18 EROSION CONTROL NETTING**

- A. New, with a uniform, open plain-weave, flame-retardant mesh. The mesh shall be [natural brown-tan] [dyed green] and made from unbleached single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Furnish jute mesh in rolled strips to meet the following requirements:

1. Width: 48 inches, with a tolerance of one-inch wider or narrower.
2. Not less than 78 warp ends per width.
3. Not less than 41 weft ends per yard.
4. Weight shall average 1.22 pounds per linear yard, with a tolerance of 5 percent heavier or lighter.

## **2.19 ANTIDESICCANT**

- A. Antidesiccant shall be an emulsion specifically manufactured for agricultural use that will provide a protective film over plant surfaces permeable enough to permit transpiration.

## **PART 3 - EXECUTION**

### **3.1 FINE GRADING AND SOIL PREPARATION**

- A. General:
1. Soil in all planting areas shall be moist, but not so moist that it sticks to a hand shovel, and loose and friable to a minimum depth of 12 inches with a relative maximum compaction of 85%. Rip and scarify and dry any areas that do not meet this requirement.
  2. Prior to excavating for plant pits and bed, verify the location of any underground utilities. Damage to utility lines shall be repaired at the Contractor's expense. Where lawns have been established prior to planting operation, cover the surrounding turf before excavations are made in a manner that will protect turf areas. Barricade existing trees, shrubbery, and beds that are to be preserved in a manner that will effectively protect them during the project construction
  3. No work shall be done when the ground is too wet or in an otherwise unsuitable condition for earthwork and planting.

Special conditions may exist that warrants a variance. Submit a written request to the Resident Engineer stating the special conditions and proposal variance.

4. Before proceeding with the work: Carefully inspect all areas and verify all dimensions and quantities. Immediately inform the Resident Engineer of any discrepancy between the drawings and specifications and actual conditions and secure approval to proceed.

B. Lime Treated Soil Removal:

1. Any Lime treated soils shall be removed full depth of treated soil from planting areas and replaced with approved planting soil as accepted by Resident Engineer. Contractor shall field measure and record all lime treated areas on As Built Drawings showing both depth and areas.
2. Following removal of lime treated material, scarify subgrade to a minimum depth of 6 inches prior to backfilling.
3. Test subgrade in all planting areas for drainage by flooding with 4 inch depth of water puddle and verify complete absorption of standing water within two hours. If standing water is still present after two hours, provide perforated pipe and drain rock "French Drain" system in bottom of non-draining planters and connect to storm drainage system, as accepted by Resident Engineer.

C. Planting Soil Placement:

1. Inspect planting areas and remove all base rock and other foreign material. Verify placement of planting soil within dripline of trees with Resident Engineer. Except within tree driplines, rip all planting areas in two directions full depth of compacted fill (to a minimum of 12 inches) into undisturbed native soil prior to backfilling. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Resident Engineer to the specified depth to ensure proper percolation/drainage.
2. Prior to placing planting soil secure the Resident Engineers acceptance of the planting areas subgrade condition. Test depth of loose soil with hand shovel in presence of Resident Engineer



- in several locations as directed. After acceptance of the planting areas subgrade condition, uniformly distribute and spread planting soil backfill over scarified subgrade in planting areas as specified and compact to a maximum of 85% relative compaction.
3. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.
  4. Water settling, puddling, and jetting of fill and backfill materials as a compaction method is not acceptable.
  5. Provide a minimum of [ 12" ] depth in planting areas, or more where shown or specified otherwise.
- D. Planting Soil Placement in Planting Islands and Adjacent to Pavement Areas:
1. Provide planting soil as a final lift in all planting areas within and adjacent to paved areas and other construction where native site soil has been covered by engineered fill and/or base rock. Remove all engineered fill, base rock and compacted subgrade full depth of compaction and replace with approved planting soil, a minimum lift of [ 12" ]. Unless shown otherwise, finish grade in planting islands shall be crowned with a minimum 2 % pitch to the edges.
- E. All planting areas soil shall be loose and friable prior to planting. Rip any overly compacted and re-compacted planting areas in two directions full depth of compacted soil prior to planting.
- F. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.
- G. Thoroughly wet down the planting areas to settle the soil and confirm irrigation coverage and operation. Allow soil to dry so as to be workable as described herein.
- H. Drag to a smooth, even surface. Grade to form all swales. Pitch grade with uniform slope to catch basins, streets, curb, etc., to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly sloped between finish elevations. Slope surface away from walls so water will not

stand against walls or buildings. Control surface water to avoid damage to adjoining properties or to finished work on the site. Take required remedial measures to prevent erosion of freshly graded areas and until such time as permanent drainage and erosion control features have been installed. Refer to Erosion Control Netting below for treatment of slopes 3:1 and steeper.

- I. Finish Grade: Hold finish grade and/or mulch surface in planting areas 1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc. The subgrade of the mulch in mulched planting areas shall be a minus 2 inches for a distance of 12 to 18 inch from the edge of pavement. The remainder of the planting area shall be graded to receive the required 3 inch layer of mulch.
- J. In Situ Soil Preparation:
  - 1. Spread organic amendment, iron and Type A fertilizer evenly over installed and rough graded topsoil in all planting areas including ground cover and shrub areas at the following rates:
    - a. Organic Amendment: 6 cubic yards per 1,000 square feet
    - b. Fertilizer: Type A (6-20-20) at 20 lbs. per 1,000 square feet.
    - c. Iron Sulfate: 10 lbs. per 1,000 square feet
  - 2. Rototill above additives into soil 6 to 8 inches deep. Keep iron sulfate off pavement and other surfaces to prevent rust staining. Correct all rust damage to work.
  - 3. Planting soil shall have a pH range of 6.5 to 7.5.
- K. After the rototill work, float areas to a smooth, uniform grade as indicated on the drawings. Slope all planting areas to drain. Roll, scarify, rake and level as necessary to obtain true, even planting surfaces. Remove rocks, sticks and debris 2 inches or larger in shrub and ground cover areas. Secure approval of the grade by the Resident Engineer before any planting.

### **3.2 EROSION CONTROL NETTING**

- A. Verify finished grades and provide Jute Mesh and single grind Redwood bark mulch on all slopes 3:1 and steeper as accepted by the Resident Engineer. Install jute mesh loosely up and down the slope in accordance with manufacturer's specifications and as follows. Fit the soil surface contour and hold in place with 12-inch long, 11-gauge

(minimum) steel wire staples driven vertically into the soil at 18- to 24-inch spacing. Jute mesh strips shall overlap along all edges at least 6 inches. Ends of side strips shall be buried into the soil at least 6 inches. Drive staples along edges to securely anchor mesh to ground.

### 3.3 TREE AND SHRUB PLANTING

- A. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the Resident Engineer before plant holes are dug. Review location of plants in relationship to irrigation heads and adjust location(s) that interfere with the function of the spray heads as accepted by the Resident Engineer prior to planting.
- B. Test drainage of plant pits by filling with water (minimum 6"). The retention of water in planting beds and plant pits for more than two (2) hours shall be brought to the attention of the Resident Engineer. If rock, underground construction work, tree roots, poor drainage, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Resident Engineer.
- C. Excavate tree, shrub and vine pits as follows (Note square Tree Pit pattern required below):
- |                                 |              |              |
|---------------------------------|--------------|--------------|
| 1. <u>Excavation for</u>        | <u>Width</u> | <u>Depth</u> |
| Boxed Trees                     | Box + 24"    | Box depth    |
| Canned Trees (15 gc)            | Can + 18"    | Can depth    |
| Canned Shrubs/Vines (1 or 5 gc) | Can + 12"    | Can depth    |
- D. Break and loosen the sides and bottom of the pit to ensure root penetration and water test hole for drainage as required above.
- E. Backfill plant holes with mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement. Backfill remainder of the hole with soil mix and place plant tablets or packets (Type B fertilizer) 3 inches below finish grade and 1/2-inch from roots at the following rates:

1. <u>Size</u>	<u>Rate</u>
1 gallon can plant	- 1 tablet or packet
5 gallon can plant	3 tablets or packet
15 gallon can plant	6 tablets or packet

24-inch box plant - 6 tablets or packet

36-inch box plant - 8 tablets or packet

- F. Carefully remove and set plants without damaging the rootball. Superficially cut edge roots vertically on three sides. Remove bottom of plant boxes before planting. Remove sides of boxes after positioning the plant and partially backfilling.
- G. Set plants in backfill with top of the rootball 2 inches above finished grade. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole.
- H. Build 6" high watering basin berms around trees and shrubs to drain through rootball. Stake and/or guy trees as detailed and noted herein. Drive stake(s) until solid (at least 12" beyond bottom of rootball) and remove excess stake protruding above top tree tie to prevent rubbing against branches. Avoid driving stakes through rootball. If subgrade does not accept stakes to a stable degree, delete stakes and guy the trees as specified herein and as detailed. Locate tree ties to avoid contact with tree branches. Locate top tie at tree flex point.
- I. Where tree guying is required, Guy Trees using 3 cables with below grade anchors and rubber collars secured with cable clamps.
- J. Remove any soil from top of plant rootballs and secure Resident Engineer's approval of rootball height prior to mulching.
- K. After approval of rootball height, install mulch as required below.

### **3.4 GROUND COVER PLANTING**

- A. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.

### **3.5 MULCH**

- A. Except where rock mulch is required, mulch all tree, shrub and ground cover areas with organic mulch to a 3-inch depth, except adjacent to walkways where soil grade is 2 inches below top of pavement, mulch shall be 2 inches deep, and 2-inches deep where planting ground cover plants from flats. Hold bark mulch away from base (trunk) of plant 4" or as directed by the Resident Engineer. Individual trees and/or

shrubs planted in non-irrigated areas shall, at minimum, receive bark mulch over their watering basin and berm. No mulch is required around trees in bioswales or bioretention basins.

- B. Install rock mulch to a minimum 3-inch depth where shown.

### **3.6 ROOT BARRIER**

- A. Install in linear fashion along and adjacent to the edges of the planting area as detailed or, if not shown, in accordance with manufacturer's recommendations. Set top of barrier approximately ½-inch above finished soil surface to allow concealment with mulch, as accepted by Resident Engineer.

### **3.7 PRE-EMERGENCE WEED KILLER**

- A. Apply pre-emergence weed killer in all areas to receive ground cover planting. Work shall be done under the supervision of a person licensed by the State of California as a pest control applicator and holding a qualified applicator license or a Qualified Applicator Certificate. Obtain approval of the finish grades prior to applying weed killer and coordinate planting and watering with the pest control specialist prior to planting. Take care to keep weed killer off areas to be seeded.

### **3.8 WATERING**

- A. Water trees, shrubs and ground cover immediately after planting. Apply water to plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Do supplemental hand watering of trees and shrubs during the first 3 weeks of plant establishment.

### **3.9 RESTORATION AND CLEAN-UP**

- A. Where existing or new turf areas have been damaged or scarred during planting and construction operations, restore disturbed area to their original condition. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. In areas where planting work have been completed, clear the area of all debris, spoil piles, and containers. Clear all other paved areas when work in adjacent areas is completed. Remove all debris, rubbish and excess material from the station.

### **3.10 ENVIRONMENTAL PROTECTION**

- A. All work and Contractor operations shall comply with the requirements

of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**3.11 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

- - - E N D - - -

**SECTION 33 10 00**  
**WATER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Relocation of fire hydrant on an existing water lateral.

**1.2 RELATED WORK:**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTHWORK.
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Fire protection system connection and supervisory switch for post indicator valve: Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.
- F. Fire protection system connection, Section 21 10 00, WATER-BASED FIRE-SUPPRESSION SYSTEMS.

**1.3 DEFINITIONS:**

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.
- B. Water Service Line: Pipe line connecting building piping to water distribution lines.

**1.4 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
  - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.

- C. Comply with all rules and regulations of Federal, State, and Local Health Department having jurisdiction over the design, construction, and operation of potable water systems.
- D. All material surfaces in contact with potable water shall comply with NSF 61.

#### **1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data (Submit all items as one package):  
(Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to Contracting Officer's Representative for approval.)
  - 1. Piping.
  - 2. Gaskets.
  - 4. Fire hydrants.
  - 13. Joint restraint.
  - 14. Disinfection products.
  - 15. Link/sleeve seals.
- C. Testing Certifications:
  - 2. Hydrostatic Testing.
  - 3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

#### **1.6 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI/ASME):
  - B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
  - B16.18.....Cast Bronze Solder Joint Pressure Fittings
  - B16.26-88.....Cast Copper Alloy Fittings for Flared Copper Tubes
  - B40.100-98.....Pressure Gauges and Gauge Attachments
- C. American Society for Testing and Materials (ASTM):
  - A123-97.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A148M-03.....Standard Specifications for Steel Castings
  - A242-00.....Standard Specifications for High Strength Low Alloy Structural Steel AASHTO No. M161



- A307-02.....Standard Specifications for Carbon Steel Bolts  
and Studs, 60,000 psi Tensile Strength
- A536-04.....Standard Specifications for Ductile Iron  
Castings
- B61-02.....Steam or Valve Bronze Castings
- B62-02.....Composition Bronze or Ounce Metal Castings
- B88-02.....Seamless Copper Water Tube
- B828.....Standard Practice: Soldering and Brazing Copper  
Tube and fittings
- C32-04.....Sewer and Manhole Brick (Made from Clay or  
Shale)
- C139-03.....Concrete Masonry Units for Construction of Catch  
Basins and Manholes
- D1784-03.....Standard Specifications for Rigid PVC Compounds  
and CPVC Compounds
- D1869-00.....Standard Specifications for Rubber Rings for  
Asbestos Cement Pipe
- D2464-99.....Standard Specifications for Threaded PVC Pipe  
Fittings, Schedule 80
- D2467-02.....Standard Specifications for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe Fittings, Schedule  
80
- D3139-98.....Joints for Plastic Pressure Pipes Using Flexible  
Elastomeric Seals
- F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic  
Pipe
- C32-04.....Standard Specifications for Sewer Manhole Brick
- D. American Water Works Association (AWWA):
- B300-04.....Hypochlorites
- B301-04.....Liquid Chlorine
- C104-04.....Cement Mortar Lining for Ductile Iron Pipe and  
Fittings for Water
- C105-99.....Polyethylene Encasement for Gray and Ductile  
C.I. Piping for Water and Other Liquids
- C110-03.....Ductile-Iron and Gray-Iron Fittings, 80 mm (3  
Inches) Through 1200 mm (48 Inches) for Water  
and Other Liquids
- C111-01.....Rubber-Gasket Joints for Ductile-Iron and  
Gray-Iron Pressure Pipe and Fittings

- C115-99.....Flanged Ductile-Iron and Gray-Iron Pipe with  
Threaded Flanges
- C150-02.....American National Standard for Thickness Design  
of Ductile Iron Pipe
- C151-96.....Ductile-Iron Pipe, Centrifugally Cast in Metal  
Molds or Sand-Lined Molds, for Water or Other  
Liquids
- C153-00.....Ductile-Iron Compact Fittings, 80 mm (3 inches)  
Through 300 mm (12 Inches) for Water and Other  
Liquids
- C500-02.....Gate Valves for Water and Sewerage Systems
- C502a-95.....Dry-Barrel Fire Hydrants
- C503-97.....Wet-Barrel Fire Hydrants
- C508-01.....Swing Check Valves for Waterworks Service, 2  
Inches (50 mm) Through 24 Inches (600mm) NPS
- C509-01.....Resilient Seated Gate Valve for Water and Sewage  
System
- C510-97.....Double Check Valve Back-Flow Prevention Assembly
- C511-97.....Reduced Pressure Principle Back-Flow Prevention  
Assembly
- C550-01.....Protective Epoxy Interior Coatings for Valves  
and Hydrants
- C600-01.....Installation for Ductile-Iron Water Mains and  
Their Appurtenances
- C605-94.....Underground Installation of Polyvinyl Chloride  
(PVC) Pressure Pipe and Fittings for Water
- C651-92.....Disinfecting Water Mains
- C800-01.....Underground Service Line Valves and Fittings
- C900-97.....Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches  
Thru 12 Inches, for Water
- C905-97.....Polyvinyl Chloride (PVC) Pressure Pipe 14 Inches  
Thru 36 Inches
- E. National Fire Protection Association (NFPA):
- 24-95.....Installation of Private Fire Service Mains and  
Their Appurtenances
- 291-01.....Fire Flow Testing and Marking of Hydrants
- 1141-98.....Fire Protection in Planned Building Groups
- F. NSF International:
- 14-03.....Plastics Piping Components and Related Materials

61-02.....Drinking Water System Components-Health Effects  
(Sections 1-9)

G. American Welding Society (AWS):

A5.8-04.....Braze Filler Metal

H. Foundation for Cross-Connection Control and Hydraulic Research-2005

I. Copper Development Association's Copper Tube Handbook-2005

## **PART 2 - PRODUCTS**

### **2.1 DUCTILE IRON PIPE AND FITTINGS:**

A. Ductile iron pipe, direct buried:

1. Provide ductile iron pipe conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 100 mm through 300 mm (4 inches through 12 inches) in diameter, with standard thickness cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.
2. Below Grade: Supply pipe in lengths not in excess of a nominal 6 m (20 feet) with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide flange joint pipe where shown on the drawings. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.

B. Ductile Iron Pipe Above Grade or in Below Ground Concrete Pits:

1. Flanged ductile iron pipe, AWWA C115, with factory applied screwed long hub flanges except as otherwise specified hereinafter. Face and drill flanges after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and flush with end of pipe, ANSI B16.1, 850 kPa (125 psi) or 1725 kPa (250 psi) standard, for the purpose intended.
2. Wall Sleeve Castings: Size and types shown on the drawings and be hot dipped galvanized. Seal strips, where required shall be Link Seal as manufactured by Thunderline Corp., Wayne, Michigan or equal.
3. Pipe Thickness Class: Minimum of Class 53 as defined in AWWA C150 for all sizes of flanged pipe.

4. Rubber Ring Gaskets: Full face type, AWWA C111, 2 mm (1/16 inch) rubber ring gaskets and of approved composition suitable for the required service.
5. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop-Coat No. 621 Rust Inhibitive Primer or equal. Paint color shall match the wall color.
6. Bolts and Nuts on Flanged Fittings: Grade B, ASTM A307. Low alloy, high strength steel in accordance with AWWA C111. Assemble stainless steel bolts and nuts using anti-seize compound to prevent galling.
- C. All Pipe Fittings: Ductile iron with a minimum pressure rating of 2400 kPa (350 psi). Fittings shall meet the requirements of ANSI and AWWA specifications as applicable. Rubber gasket joints shall conform to AWWA C111 for mechanical and push-on type joints. Ball joints shall conform to AWWA C151 with a separately cast ductile iron bell conforming to ASTM A148. Flanged fittings shall conform to AWWA C115 and be furnished flat faced and drilled to 850 kPa (125 psi) or 1725 kPa (250 psi) template in accordance with ANSI B16.1 with full faced gaskets.
- D. Provide cement mortar lining and bituminous seal coat on the inside of the pipe and fittings in accordance with AWWA C104. Provide standard asphaltic coating on the exterior.
- E. Provide a factory hydrostatic test of not less than 3.5 MPa (500 psi) for all pipe in accordance with AWWA C151.
- F. Provide non-detectable adhesive backed identification tape on top and sides of all buried ductile iron pipe, extended from joint to joint along the length of the pipe and have black lettering identifying the pipe service at no more than 300 mm (12 inch) intervals. According to service, the tape background color shall be as follows: potable water-blue.

## **2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS:**

- A. Class-Rated Polyvinyl Chloride (PVC) Pipe:
  1. PVC pipe and accessories 100 mm to 356 mm (4 inches-14 inches) in diameter, AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe", Class 200, DR 14, cast iron outside diameters, unless otherwise shown or specified.
- B. Joints:

1. Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.

C. Fittings:

1. Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153.

### **2.3 FIRE HYDRANTS:**

- A. Size of main valve opening of each hydrant shall be 125 mm (5 inches), minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with present local fire department and/or water department standards those in use at station.
- B. Hydrant shall be type AWWA C503, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with safety flange on barrel and safety couplings on the valve stem with the following features:
  1. Interior removable without digging up hydrant; can be packed under pressure; 150 mm (6 inch) bell connection; one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; single rubber or leather-faced valve in base; nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 50 mm (2 inches) above finished grade. All fire hydrants shall have 150 mm (6 inch) bottom connection.
  2. Provide fire hydrants with a finish paint identical to the existing fire hydrants.
- C. Provide wrenches with handles not less than 350 mm (14 inches) long.

### **2.4 POTABLE WATER:**

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

### **2.5 DISINFECTION CHLORINE:**

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

**2.6 WARNING TAPE**

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

**PART 3 - EXECUTION****3.1 REGRADING:**

Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

**3.2 PIPE LAYING, GENERAL:**

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Contracting Officer's Representative.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.

- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.7 "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- M. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

### **3.3 DUCTILE IRON PIPE:**

- A. Installing Pipe: Lay pipe in accordance with AWWA C600 with polyethylene encasement if required in accordance with AWWA C105. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.
- B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:
  - 1. Push-on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home with approved means.
  - 2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque.
  - 3. Ball Joints: Install in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.

4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

### 3.4 PVC PIPE:

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTHWORK.
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.
- C. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe locating. Generally, install markers on 6 m (20 foot) centers. If pipe is in a congested piping area, install on 3 m (10 foot) centers. Prepare as-built drawing indicating exact location of magnetic markers.

### 3.5 RESTRAINED JOINTS:

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.
- C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be restrained.
- D. Ductile iron pipe bell and spigot joints shall be restrained.



- E. Ductile iron mechanical joint fittings shall be restrained. The restraining device shall be designed to fit standard mechanical joint bells with standard T head bolts conforming to AWWA C111 and AWWA C153. Glands shall be manufactured of ductile iron conforming to ASTM A536. Set screws shall be hardened ductile iron and require the same torque in all sizes. Steel set screws not permitted. These devices shall have the stated pressure rating with a minimum safety factor of 2:1. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.
- F. Thrust blocks shall not be permitted.
- G. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.
- H. PVC pipe bell and spigot joints shall be restrained. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.
- I. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

### **3.6 PIPE SEPARATION:**

- A. Horizontal Separation-Water Mains and Sewers:
  - 1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
  - 2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
    - a. Local conditions prevent a lateral separation of 3 m (10 feet); and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
    - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
  - 3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile

iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.

**B. Vertical Separation-Water Mains and Sewers:**

1. A water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
  - a. It is impossible to obtain the proper vertical separations described in (1) above; or
  - b. The water main passes under a sewer or drain.
3. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

**3.7 SETTING OF FIRE HYDRANTS:**

- A. Set center of each hydrant not less than 600 mm (2 feet) nor more than 1800 mm (6 feet) back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 450 mm (18 inches) above finished grade. Set barrel flange not more than 50 mm (2 inches) above finished grade.
- B. Set each hydrant on a slab of stone or concrete not less than 100 mm (4 inches) thick and 375 mm (15 inches) square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
- C. Set bases in not less than 0.4 cubic meter (1/2 cubic yard) of crushed rock or gravel placed entirely below hydrant drainage device.
- D. Clean interiors of hydrants of all foreign matter before installation.

**3.8 FLUSHING AND DISINFECTING:**

- A. Flush and disinfect new water lines in accordance with AWWA C651.
- B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1(25)	1 ½(38)	2(51)	2 1/2-in (64 mm)
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

The backflow preventers shall not be in place during the flushing.

- C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.
- D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Health Department of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.
- G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

**3.14 HYDROSTATIC TESTING:**

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.

- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1375 kPa (200 psi). Leakage shall not exceed the following requirements.
  - 1. Ductile Iron Pipe: AWWA C600. Provide to Contracting Officer's Representative office.
  - 2. Polyvinyl Chloride (PVC) AWWA C605. Provide to Contracting Officer's Representative office.

- - - E N D - - -

**SECTION 33 30 00**  
**SANITARY SEWERAGE UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Adjusting sanitary sewer manholes to new grade.

**1.2 RELATED WORK:**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTHWORK.
- C. Concrete Work Reinforcing, Placement and Finishing; Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

**1.3 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:
  - 1. Manhole and Structure Material.
  - 2. Frames and Covers.
  - 3. Steps and Ladders.

**1.5 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A48/A48M-03.....Gray Iron Castings
  - A536-84(2004).....Ductile Iron Castings

- A615/A615M-06.....Deformed and Plain Carbon-Steel Bars for  
Concrete Reinforcement
- A625/A625M-03.....Tin Mill Products, Black Plate, Single Reduced  
C150-05.....Portland Cement
- C478-06a/C478M-06a.....Precast Reinforced Concrete Manhole Sections
- C857-95(2001).....Minimum Structural Design Loading for  
Underground Precast Concrete Utility Structures
- C. American Association of State Highway and Transportation Officials  
(AASHTO):
- M198-05.....Joints for Concrete Pipe, Manholes, and Precast  
Box Sections using Preformed Flexible Joint  
Sealants

## **PART 2 - PRODUCTS**

### **2.1 MANHOLES AND VAULTS:**

- A. Manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The manholes and vaults shall be in accordance with the following:
1. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1200 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top section shall be eccentric cone type. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  2. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  3. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.
  4. Mortar:
    - a. Precast Concrete Segmental Block Structures: By volume, 1 part of Portland cement, 1/4 part lime hydrate, and 3 parts sand.
    - b. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 21 L (5-1/2 gallons) per sack of cement.
  5. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections,

and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M198.

6. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20-44 loading, have a studded pattern on the cover, and the words "sanitary sewer". The studs and the lettering shall be raised 8 mm (5/16 inch). The cover shall be a minimum of 600 mm (24 inches) in diameter and shall have four 19 mm (3/4 inch) vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
7. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 406 mm (16 inches) wide and project a minimum of 178 mm (7 inches) away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 300 mm (12 inch) centers.
8. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 10 mm (3/8 inch) by 63 mm (2-1/2 inches) spaced a minimum of 400 mm (16 inches) apart. Rungs shall be 35 mm (1-3/8 inches) in diameter and have a non-slip surface. Standoffs shall offset the ladder 180 mm (7 inches) from the wall. The ladder assembly shall be rated for a minimum of 2200 N (500 pounds).

## **2.2 CONCRETE:**

Concrete shall have a minimum compressive strength of 20 MPa (3000 psi) at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform with the provisions of Division 03 of these specifications.

## **2.3 REINFORCING STEEL:**

Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

## **PART 3 - EXECUTION**

### **3.1 REGRADING:**

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

### **3.2 MANHOLES AND VAULTS:**

#### **A. General:**

##### **1. Circular Structures:**

- a. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
  - b. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
- 2. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
  - 3. The wall that support access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.
  - 4. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
  - 5. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

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**SECTION 33 40 00**  
**STORM SEWER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

**1.2 RELATED WORK**

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTHWORK.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.
- E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.3 ABBREVIATIONS**

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes, catch basins, and stormwater inlets according to manufacturer's written rigging instructions.

**1.5 COORDINATION**

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

**1.6 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

#### 1.7 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

#### 1.8 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for  
Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for  
Concrete Reinforcement

A760/A760M-10.....Corrugated Steel Pipe, Metallic-Coated for  
Sewers and Drains

A798/A798M-07.....Installing Factory-Made Corrugated Steel Pipe  
for Sewers and Other Applications

A849-10.....Post-Applied Coatings, Paving, and Linings for  
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007).....Steel Sheet, Metallic-Coated by the Hot-Dip  
Process for Corrugated Steel Pipe

B745/B745M-97(2005).....Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09.....Installing Factory-Made Corrugated Aluminum  
Culverts and Storm Sewer Pipe

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and  
Culvert Pipe

STORM DRAINAGE UTILITIES

33 40 00-2

C33/C33M-08.....	Concrete Aggregates
C76-11.....	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C139-10.....	Concrete Masonry Units for Construction of Catch Basins and Manholes
C150/C150M-11.....	Portland Cement
C443-10.....	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C478-09.....	Precast Reinforced Concrete Manhole Sections
C506-10b.....	Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
C507-10b.....	Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
C655-09.....	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C857-07.....	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
C891-09.....	Installation of Underground Precast Concrete Utility Structures
C913-08.....	Precast Concrete Water and Wastewater Structures
C923-08.....	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
C924-02(2009).....	Testing Concrete Pipe Sewer Lines by Low- Pressure Air Test Method
C990-09.....	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
C1103-03(2009).....	Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

- C1173-08.....Flexible Transition Couplings for Underground  
Piping Systems
- C1433-10.....Precast Reinforced Concrete Monolithic Box  
Sections for Culverts, Storm Drains, and Sewers
- C1479-10.....Installation of Precast Concrete Sewer, Storm  
Drain, and Culvert Pipe Using Standard  
Installations
- D448-08.....Sizes of Aggregate for Road and Bridge  
Construction
- D698-07e1.....Laboratory Compaction Characteristics of Soil  
Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600  
kN-m/m<sup>3</sup>))
- D1056-07.....Flexible Cellular Materials—Sponge or Expanded  
Rubber
- D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80, and 120
- D2321-11.....Underground Installation of Thermoplastic Pipe  
for Sewers and Other Gravity-Flow Applications
- D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer  
Pipe and Fittings
- D2774-08.....Underground Installation of Thermoplastic  
Pressure Piping
- D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe  
and Fittings
- D3350-10.....Polyethylene Plastics Pipe and Fittings  
Materials
- D3753-05e1.....Glass-Fiber-Reinforced Polyester Manholes and  
Wetwells
- D4101-11.....Polypropylene Injection and Extrusion Materials
- D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain,  
Waste, and Vent (DWV), Sewer, Sanitary, and  
Storm Plumbing Systems

STORM DRAINAGE UTILITIES

33 40 00-4

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic  
Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter  
Plastic Gravity Sewer Pipe and Fittings

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based  
on Outside Diameter

F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity  
Sewer Pipe and Fittings Based on Controlled  
Inside Diameter

F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic  
Pipe With a Cellular Core

F894-07.....Polyethylene (PE) Large Diameter Profile Wall  
Sewer and Drain Pipe

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer  
Pipe With a Smooth Interior and Fittings

F1417-11.....Installation Acceptance of Plastic Gravity  
Sewer Lines Using Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials  
(AASHTO):

M190-04.....Bituminous-Coated Corrugated Metal Culvert Pipe  
and Pipe Arches

M198-10.....Joints for Concrete Pipe, Manholes, and Precast  
Box Sections Using Preformed Flexible Joint  
Sealants

M252-09.....Corrugated Polyethylene Drainage Pipe

M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300  
to 1500 mm) Diameter

D. American Water Works Association(AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile iron Pipe  
Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings

STORM DRAINAGE UTILITIES

33 40 00-5

C219-11.....Bolted, Sleeve-Type Couplings for Plain-End  
Pipe

C600-10.....Installation of Ductile iron Mains and Their  
Appurtenances

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and  
Fabricated Fittings, 4 In. Through 12 In. (100  
mm Through 300 mm), for Water Transmission and  
Distribution

M23-2nd ed.....PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary

350/350M-06.....Environmental Engineering Concrete Structures  
and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for  
Erosion and Sediment Control

## **PART 2 - PRODUCTS**

### **2.1 FACTORY-ASSEMBLED PRODUCTS**

A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

### **2.2 PE PIPE AND FITTINGS**

A. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S for pipes 12 to 24 inches (300 to 600 mm) with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.

1. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.

### 2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. Bell-and-spigot or tongue-and-groove ends and rubber gaskets.

2. Class III:

B. Reinforced arch culvert and storm drain pipe and fittings shall be ASTM C506, Class A-IV rubber gaskets.

### 2.4 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials

1. For concrete pipes: ASTM C443, rubber.

2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

### 2.5 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile iron flexible expansion joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile iron expansion joints: Three-piece assemblies of telescoping sleeve with gaskets and restrained-type, ductile iron or steel with protective coating, bell-and-spigot end sections complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile iron deflection fittings: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

## **2.6 CLEANOUTS**

A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): H-20 Traffic Rated within vehicular areas.

2. Pipe fitting and riser to cleanout shall be same material as main pipe line.

B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.

## **2.7 DRAINS**

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

B. Cast-Iron Trench Drains: ASME A112.6.3, 6 inch (150 mm) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Top-Loading Classification(s): H-20 Traffic Rated within vehicular areas.

C. Steel Trench Drains: ASTM A242, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate.

1. Plate Thicknesses: 1/8 inch (3.2 mm) and 1/4 inch (6.4 mm)

2. Overall Widths: 7-1/2 inches (190 mm) and 12-1/3 inches (313 mm) //

D. Grate openings shall be 1/4 inch (6.4 mm) circular, 3/8 inch (9.5 mm) circular, or 3/8 by 3 inch (9.5 by 76 mm) slots.

## **2.8 MANHOLES AND CATCH BASINS**

A. Standard Precast Concrete Manholes:



1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, , width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

**B. Manhole Frames and Covers:**

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.

**2.9 CONCRETE FOR MANHOLES AND CATCH BASINS**

**A. General:** Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.

- 3. Coarse Aggregate: ASTM C33, crushed gravel.
- 4. Water: Potable.
- B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.
  - 1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.
  - 1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

## **2.10 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS**

- A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.
- B. Sloped-Invert, Polymer-Concrete Systems:
  - 1. Channel Sections:
    - a. Interlocking-joint, precast, modular units with end caps.
    - b. 4-inch (102 mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
    - c. Extension sections necessary for required depth.
    - d. Frame: Include gray-iron or steel frame for grate.
  - 2. Grates:
    - a. H-20 Traffic Rated in vehicular areas, with slots or perforations that fit recesses in channels.
    - b. Material: Galvanized steel, Gray iron or/ Stainless steel.
  - 3. Covers: Solid gray iron if indicated.
  - 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- C. Narrow-Width, Level-Invert, Polymer-Concrete Systems:
  - 1. Channel Sections:

- a. Interlocking-joint, precast, modular units with end caps.
  - b. 5 inch (127 mm) inside width and 9-3/4 inch (248 mm) deep, rounded bottom, with level invert and with NPS 4 (DN 100) outlets in quantities, sizes, and locations indicated.
- 2. Grates:
  - a. Slots or perforations that fit recesses in channels.
  - b. Material: Galvanized steel, Gray iron, or Stainless steel.
- 3. Covers: Solid gray iron if indicated.
- 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Wide-Width, Level-Invert, Polymer-Concrete Systems:
  - 1. Channel Sections:
    - a. Interlocking-joint, precast, modular units with end caps.
    - b. 8 inch (203 mm) inside width and 13-3/4 inch (350 mm) deep, rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
  - 2. Grates:
    - a. Slots or other openings that fit recesses in channels.
    - b. Material: Gray iron.
  - 3. Covers: Solid gray iron if indicated.
  - 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- E. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
- F. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## **2.11 PLASTIC, CHANNEL DRAINAGE SYSTEMS**

- A. General Requirements for Plastic, Channel Drainage Systems:
  - 1. Modular system of plastic channel sections, grates, and appurtenances.
  - 2. Designed so grates fit into frames without rocking or rattling.
  - 3. Number of units required to form total lengths indicated.
- B. Fiberglass Systems:
  - 1. Channel Sections:
    - a. Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps.

- b. Rounded or inclined inside bottom surface, with outlets in quantities, sizes, and locations indicated.
    - c. Width: 6 or 8 inches (150 or 203 mm).
  - 2. Factory- or field-attached frames that fit channel sections and grates.
    - a. Material: Galvanized steel, Stainless steel or Manufacturer's standard metal.
  - 3. Grates with slots or perforations that fit frames.
    - a. Material: Galvanized steel, Gray iron, or Stainless steel.
  - 4. Covers: Solid gray iron if indicated.
- C. PE Systems:
- 1. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
  - 2. Grates: PE, ladder shaped; with stainless-steel screws.
  - 3. Color: Gray unless otherwise indicated.
  - 4. Drainage Specialties: Include the following PE components:
    - a. Drains: 4 inch (102 mm) diameter, round, slotted top; with NPS 4 (DN 100) bottom outlet.
    - b. Drains: 8 inch (203 mm) diameter, round, slotted top; with NPS 6 (DN 150) bottom outlet.
    - c. Drains: 4 inch (102 mm) square, slotted top; with NPS 3 (DN 80) bottom outlet.
    - d. Drains: 8 inch (203 mm) square, slotted top; with NPS 6 (DN 150) bottom outlet.
    - e. Catch Basins: 12 inch (305 mm) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.
- D. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
- E. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## **2.12 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

**PART 3 - EXECUTION****3.1 PIPE BEDDING**

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

**3.2 PIPING INSTALLATION**

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
  2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
  3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
  4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
  5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly

wiped or swabbed to remove any dirt, trash or excess jointing materials.

6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.

7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
3. Install hub-and-spigot cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
4. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
5. Install reinforced concrete piping according to ASTM C1479.

### **3.3 REGRADING**

A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

### 3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.
- B.

### 3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
  - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
  - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
  - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.
- C. Set drain frames and covers with tops flush with pavement surface.
- D. Assemble trench sections with flanged joints and embed trench sections in 4 inch (102 mm) minimum concrete around bottom and sides.

### 3.6 MANHOLE INSTALLATION

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- C. Circular Structures:
  - 1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
  - 2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the

rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.

3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
  - a. Forming directly in concrete base of structure.
  - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12



inch (300 mm) concrete collar around the perimeter of the frame.

Slope the top of the collar away from the frame.

### **3.7 CATCH BASIN INSTALLATION**

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

### **3.8 CHANNEL DRAINAGE SYSTEM INSTALLATION**

A. Install with top surfaces of components, except piping, flush with finished surface.

B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

C. Embed channel sections and drainage specialties in 4 inch (102 mm) minimum concrete around bottom and sides.

D. Assemble channel sections with flanged or interlocking joints.

E. Embed channel sections in 4 inch (102 mm) minimum concrete around bottom and sides.

F.

### **3.9 CONNECTIONS**

A. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.

3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
  1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    - a. Shielded flexible couplings for same or minor difference OD pipes.
    - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
  2. Use pressure-type pipe couplings for force-main joints.

### **3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS**

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  1. Close open ends of piping with at least 8 inch (203 mm) thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
  1. Remove manhole or structure and close open ends of remaining piping.
  2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section EARTHWORK.

### **3.11 IDENTIFICATION**

- A. Install green warning tape directly over piping and at outside edge of underground structures.

### 3.12 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.

### 3.13 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
  - 4. Submit separate report for each test.
  - 5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
  - 6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than // 150 psi (1035 kPa) // Insert value //.

- a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
- b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### **3.14 CLEANING**

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

--- E N D ---

DEPARTMENT OF VETERANS AFFAIRS  
MPD Upgrade Entry, Roads, Parking  
And Lighting.  
795 Willow Road, Menlo Park, CA

DVA Project No.: 640A0-12-204FCA

**SECTION 33 40 00.01**  
**STORM SEWER UTILITIES - OFFSITE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation, within the City of Menlo Park right of way. This includes piping, structures and all other incidentals.

**1.2 GENERAL**

A. Storm drain piping and structures shall be in conformance with the 2006 Caltrans Standard Specifications, sections 65 "REINFORCED CONCRETE PIPE" and 75 "MISCELLANEOUS METAL", as well as the City of Menlo Park Standard Details.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

--- E N D ---

**SECTION 34 41 13.01**  
**TRAFFIC SIGNALS - OFFSITE**

**PART 1 - GENERAL**

**1.1 GENERAL**

This section includes specifications for installing, modifying, and removing:

- Traffic signal poles and signal equipment
- Lighting system

The Contractor shall comply with Part 4 of the California MUTCD.

Nothing in this Section is to be construed as to reduce the minimum standards in this manual.

The locations of electrical system elements are approximate; the City will approve the final locations in the field.

A. Definitions -Definitions Pertain Only To Section 86, "Electrical Systems", of the Standard Specifications.

1. Actuation: The action of a vehicle or pedestrian causing a detector to create a call in that phase or movement to request right of way.
2. Channel: Discrete information path.
3. Controller assembly: Controller unit and auxiliary equipment housed in a rainproof cabinet to control a system's operations.
4. Controller unit: Part of the controller assembly performing the basic timing and logic functions.
5. Detector: Device indicating passage or presence of vehicles or pedestrians.
6. Electrolier: Complete assembly of lighting standard and luminaire.
7. Flasher: Device to open and close signal circuits at a repetitive rate.
8. Flashing beacon control assembly: Switches, circuit breakers, terminal blocks, flasher, wiring, and necessary electrical components all housed in a single enclosure to properly operate a beacon.
9. Inductive loop detector: Detector capable of being actuated by inductance change caused by vehicle passing or standing over the loop.
10. Lighting standard: Pole and mast arm supporting the luminaire.

11. Luminaire: Consists of housing, reflector, refractor or lens, lamp socket, integral ballast, terminal strip, and lamp.
12. Magnetic detector: Detector capable of being actuated by induced voltage caused by vehicle passing through the earth's magnetic field.
13. Powder coating: A coating applied electrostatically using UV-stable polyester triglycidyl isocyanurate exterior grade powder
14. Pre-timed controller assembly: Operates traffic signals under a predetermined cycle length.
15. Signal face: As defined in the California MUTCD.
16. Signal head: As defined in the California MUTCD.
17. Signal indication: As defined in the California MUTCD.
18. Signal section: As defined in the California MUTCD.
19. Signal standard: Pole and mast arm supporting one or more signal faces with or without a luminaire mast arm.
20. Traffic-actuated controller assembly: Operates traffic signals under the varying demands of traffic as registered by detector actuation.
21. Traffic phase: Signal phase as defined in the California MUTCD.
22. Vehicle: As defined in the California Vehicle Code.

## **1.2 REGULATIONS AND CODE**

- A. Electrical Equipment Must Comply With One Or More Of The Following:
  1. EIA
  2. ETL
  3. NEMA
  4. NETA
  5. UL
- B. Materials and workmanship must comply with:
  1. ANSI
  2. ASTM
  3. 8 CA Code of Regs § 2299 et seq.
  4. FCC
  5. ITE
  6. NEC
  7. Public Utilities Commission, General Order No. 95, "Rules for Overhead Electrical Line Construction"

8. Public Utilities Commission, General Order No. 128, "Rules for Construction of Underground Electric Supply and Communication Systems"

### **1.3 COST BREAK-DOWN**

- A. The Contractor shall determine quantities required to complete work and shall submit the quantities as part of the cost breakdown.

The sum of the amounts for the units of work listed in the cost breakdown must equal the contract lump sum price bid for the work. Include overhead and profit for each unit of work listed in the cost breakdown. If mobilization is a bid item, include bond premium, temporary construction facilities, and material plants into the mobilization bid item, otherwise, include in each unit of work listed in the cost breakdown. The Contractor shall not include costs for traffic control system in the cost breakdown.

The cost breakdown may be used to determine partial payment and to calculate payment adjustments for additional costs incurred due to a change order. If a change order increases or decreases the quantities, payment adjustment may be determined under Section 4-1.03B, "Increased or Decreased Quantities."

The cost breakdown must include type, size, and installation method for:

1. Foundations
2. Standards and poles
3. Conduit
4. Pull boxes
5. Conductors/cables
6. Signal heads and hardware
7. Pedestrian signal heads and hardware
8. Pedestrian push buttons
9. Luminaries and lighting fixtures
10. Signs
11. Emergency Pre-emption System
12. Video Detection System

### **1.4 EQUIPMENT LIST AND DRAWINGS**

- A. Within 5 days of contract execution, the Contractor shall submit for review the submittals for the following list of equipment and materials:

1. Standards and poles



2. Conduit
3. Pull boxes
4. Controller
5. Signal heads and hardware
6. Pedestrian signal heads and hardware
7. Pedestrian push buttons
8. Luminaires and lighting fixtures
9. Video Detection System (conductors)
10. Emergency Preemption System (conductors)

The Contractor's submittals shall comply with Section 5-1.02, "Plans and Working Drawings." The list must include:

1. Name of manufacturer
2. Dimension
3. Item identification number
4. List of components

B. The list must be supplemented by other data as required, including:

1. Schematic wiring diagrams
2. Scale drawings of cabinets showing location and spacing of shelves, terminal blocks, and equipment, including dimensioning
3. Operation manual

The Contractor shall submit 2 copies of the above data. The City will review within 15 days.

Electrical equipment that is manufactured as detailed on the plans will require detailed drawings and diagrams. The Contractor shall furnish 3 sets of computer-generated cabinet schematic wiring diagrams.

The cabinet schematic wiring diagram must be placed in a heavy duty plastic envelope and attached to the inside of the door of each cabinet.

The Contractor shall prepare diagrams, plans, and drawings using graphic symbols in IEEE 315, "Graphic Symbols for Electrical and Electronic Diagrams."

Due to material lead time, within three days from approval of submittal for the traffic signal standards and poles and prior to the receipt of the Notice to Proceed, the Contractor shall order the traffic signal poles.

### 1.5 CERTIFICATE OF COMPLIANCE

The Contractor shall submit a Certificate of Compliance for all electrical material and equipment to the City under Section 6-1.07, "Certificates of Compliance."

### 1.6 SCHEDULING OF WORK

The Contractor shall not work above ground until all materials are on hand to complete electrical work at each location. The Contractor shall schedule work to allow each system to be completed and ready for operation before opening the corresponding section of the roadway to traffic.

If street lighting exists or is installed in conjunction with traffic signals, do not turn on the signals until the street lighting is energized.

The existing traffic signal shall remain in operation during construction. The Contractor shall coordinate with the City of Menlo Park prior to the system transfer and installation of new conductors. If the existing traffic signal system is damaged during construction, the Contractor shall repair it to working order prior to proceeding with work.

Care should be taken to avoid visual obstructions to existing vehicular and pedestrian signal heads.

The contractor shall schedule installation of salvaged EVP detectors and video cameras to minimize down time.

Lighting and traffic signals, including flashing operation, will not be placed in operation before starting the functional test period specified in Section 86-2.14, "Testing."

The Contractor shall not pull conductors into conduit until:

- Pull boxes are set to grade
- Metallic conduit is bonded

The initial traffic signal turn-on must be made between 9:00 a.m. and 2:00 p.m. Before the initial turn-on, all equipment, including pedestrian signals, pedestrian push buttons, vehicle detectors, lighting, signs, and pavement delineation must be installed and in working order. Direct louvers, visors, and signal faces to maximize visibility.

Start functional tests on any working day except Friday or the day before a legal holiday. You must notify the City 48 hours before the start of functional test.

### **1.7 EXCAVATING AND BACKFILLING**

The Contractor shall dispose of surplus excavated material under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way", of the Caltrans Standard Specifications. Backfill as specified in Section 19-3, "Structure Excavation and Backfill", of the Caltrans Standard Specifications. The Contractor shall compact backfill in conduit trenches outside the hinge point of slopes and not under pavement to a minimum relative compaction of 90 percent. The Contractor shall compact backfill within hinge points and in areas where pavement is to be constructed to a minimum relative compaction of 95 percent. The Contractor shall backfill trenches and restore sidewalk, pavement, and landscaping at one intersection before starting excavation at another intersection.

If excavating on a street or highway, the Contractor shall restrict closure to 1 lane at a time.

### **1.8 REMOVING AND REPLACING IMPROVEMENTS**

The Contractor shall replace or reconstruct sidewalk, curb, gutter, concrete pavement, asphalt concrete pavement, underlying material, lawn, plant, and other facilities damaged during construction. Replacement material must be of equal or better quality than the material replaced. Work must be in a serviceable condition.

If a part of a square or slab of concrete sidewalk, curb, gutter, or driveway is broken or damaged, the entire square or slab must be removed and reconstructed.

The Contractor shall cut outline of PCC sidewalk or driveway to be removed:

- Using a power-driven saw
- On a neat line
- To a 0.17-foot minimum depth

### **1.9 FOUNDATIONS**

Traffic Signal foundation details shall comply with the 2006 Caltrans Standard Plans

PCC must comply with Section 90-10, "Minor Concrete", of the Caltrans Standard Specifications.

The Contractor shall construct concrete foundation on firm ground. After each post, standard, and pedestal is properly positioned, the Contractor shall place mortar under the base plate. The Contractor shall finish exposed portion to present a neat appearance. Mortar must

comply with Standard Specification Section 51-1.135, "Mortar," except mortar must have:

- 1 part by volume of cementitious material
- 3 parts by volume of clean sand

Reinforced cast-in-drilled-hole concrete pile foundation must comply with Standard Specification Section 49, "Piling," except:

- Material resulting from drilling holes must be disposed of as specified in Section 86-2.01, "Excavating and Backfilling" of the Caltrans Standard Specifications.
- Concrete for cast-in-drilled-hole concrete pile will not be considered as designated by compressive strength

The Contractor shall form exposed portion of the foundation to present a neat appearance and true to line and grade. The top of a foundation for post and standard must be finished to curb or sidewalk grade.

Forms must be rigid and securely braced in place. Conduit ends and anchor bolts must be placed at proper height and position. Anchor bolts must be installed a maximum of 1:40 from vertical and held in place by rigid top and bottom templates. The Contractor shall use a steel bottom template at least 1/2 inch thick that provides proper spacing and alignment of anchor bolts near the embedded bottom end. The Contractor shall install bottom template before placing footing concrete.

The Contractor shall provide new foundation and anchor bolts of the proper type and size for all standards.

Steel parts must be galvanized as specified in Section 75 1.05, "Galvanizing", of the Caltrans Standard Specifications.

The Contractor shall provide 2 nuts and washers for the upper threaded part of each anchor bolt. The Contractor shall provide 3 nuts and washers for each anchor bar or stud.

The Contractor must not weld high-strength steel used for anchor bolt, anchor bar, or stud.

Before placing concrete, the Contractor shall moisten forms and ground. The Contractor shall keep forms in place until the concrete sets for at least 24 hours and is strong enough to prevent damage to surface.

Except if located on a structure, the Contractor shall construct foundation for post, standard, and pedestal monolithically.

The Contractor shall apply ordinary surface finish as specified in Section 51-1.18A, "Ordinary Surface Finish", of the Caltrans Standard Specifications.

The Contractor must not erect post, pole, standard, pedestal, or cabinet until the foundation is set for a minimum of 7 days.

The City will choose the plumbing or raking technique for posts, standards, and pedestals. The Contractor shall plumb or rake by adjusting the leveling nuts before tightening nuts. The Contractor must not use shims or similar devices. After final adjustments of both top nuts and leveling nuts on anchorage assemblies have been made, and each post, standard, and pedestal on structure is properly positioned, the Contractor shall tighten nuts as follows:

- Tighten leveling nuts and top nuts, following a crisscross pattern, until bearing surfaces of all nuts, washers, and base plates are in firm contact.
- Use an indelible marker to mark the top nuts and base plate with lines showing relative alignment of the nut to the base plate.
- Tighten top nuts, following a crisscross pattern, an additional 1/6th of a turn.

In unpaved areas, the Contractor shall construct a raised PCC pad in front of the controller cabinet.

#### **1.10 STANDARDS, STEEL PEDESTALS AND POSTS**

- A. Standards, steel pedestals, and posts shall conform to Section 86-2.04, "Standard, Steel Pedestals and Posts," of the Caltrans Standard Specifications and these project specifications.

All traffic signal standards, posts, and mast arms shall be painted "Mesa Brown" in accordance with Section 91, "Paint", of the Caltrans Standard Specifications.

All traffic lighting posts and mast arms shall be painted "Mesa Brown" in accordance with Section 91, "Paint", of the Caltrans Standard Specifications and these project specifications.

Bolts, including anchor bolts, nuts, and washers for signal and lighting support structures must comply with Section 55-2, "Materials", of the Caltrans Standard Specifications. Except for bearing-type connection or slip-base, high-strength bolted connection must comply with Section 55-3.14, "Bolted Connections", of the Caltrans Standard Specifications. Welding, nondestructive testing of welds and

acceptance and repair criteria for steel member nondestructive testing must comply with American Welding Society (AWS) D1.1.

Using stainless steel rivets, the Contractor shall attach rectangular corrosion-resistant metal identification tag on all standards and poles, except Type 1:

1. Above the hand hole, near the base of standards and poles
2. On the underside of mast arms near the arm plate

The lettering on each identification tag must be depressed or raised, 1/4 inch tall, legible, and include the following information:

1. Name of the manufacturer
2. Date of manufacture
3. Identification number
4. Contract number
5. Unique identification code that is:
  - 5.1. Assigned by the manufacturer
  - 5.2. Traceable to a particular contract and the welds on that component
  - 5.3. Readable after the support structure is coated and installed

Type 1 standard and steel pedestal for controller cabinet must be manufactured of one of the following:

1. 0.12-inch or thicker galvanized steel
  2. 4-inch standard weight galvanized steel pipe as specified in ASTM A 53
  3. 4-inch Type 1 conduit with the top designed for post-top slip-fitter
- Ferrous metal parts of a standard that has a shaft length of 15 feet or longer must comply with the provisions in Section 55-2, "Materials", of the Caltrans Standard Specifications, and the following:
1. Standard must be manufactured from sheet steel of weldable grade having a minimum yield strength of 40,000 psi after manufacturing.
  2. Certified test report verifying compliance with minimum yield strength requirements must be submitted. Test report may be the mill test report for the as-received steel or if the as-received steel has a lower yield strength than required you must provide test data assuring that your method of cold forming will consistently increase the tensile properties of the steel to meet the specified minimum yield strength. Test data must include tensile properties of the steel after cold forming for specific heats and thicknesses.

3. If a single-ply 5/16-inch thick pole is specified, a 2-ply pole with equivalent section modulus may be substituted.
4. Standard may be manufactured of full-length sheets or shorter sections. Each section must be manufactured from 1 or 2 pieces of sheet steel. If 2 pieces are used, the longitudinal welded seams must be directly opposite from one another. If the sections are butt-welded together, the longitudinal welded seams of adjacent sections must be placed to form continuous straight seams from base to top of standard.
5. Butt-welded circumferential joints of tubular sections requiring CJP groove welds must be made using a metal sleeve backing ring inside each joint. The sleeve must be 1/8 inch nominal thickness, or thicker, and manufactured from steel having the same chemical composition as the steel in the tubular sections to be joined. If the sections to be joined have different specified minimum yield strengths, the steel in the sleeve must have the same chemical composition as the tubular section having the higher minimum yield strength. The width of the metal sleeve must be consistent with the type of nondestructive testing selected and must be a minimum width of 1 inch. At fitting time, the sleeve must be centered at the joint and in contact with the tubular section at the point of the weld.
6. Welds must be continuous.
7. Weld metal at the transverse joint must extend to the sleeve, making the sleeve an integral part of the joint.
8. During manufacturing, longitudinal seams on vertical tubular members of cantilevered support structures must be centered on and along the side of the pole that the pole plate is located. Longitudinal seams on horizontal tubular members, including signal and luminaire arms, must be within  $\pm 45$  degrees of the bottom of the arm.
9. Longitudinal seam weld in steel tubular section may be made by the electric resistance welding process.
10. Longitudinal seam weld must have 60 percent minimum penetration, except:
  - 10.1. Within 6 inches of circumferential weld, longitudinal seam weld must be CJP groove weld.
  - 10.2. Longitudinal seam weld on lighting support structure having telescopic pole segment splice must be CJP groove weld on the

- female end for a length on each end equal to the designated slip-fit splice length plus 6 inches.
11. Exposed circumferential weld, except fillet and fatigue-resistant weld, must be ground flush with the base metal before galvanizing or painting. Ground flush is specified as -0, +0.08-inch.
  12. Circumferential weld and base plate-to-pole weld may be repaired only one time.
  13. Exposed edges of the plates that make up the base assembly must be finished smooth and exposed corners of the plates must be broken. Provide shafts with slip-fitter shaft caps.
  14. Surface flatness requirements of ASTM A 6 apply to plates:
    - 14.1. In contact with concrete, grout, or washers and leveling nuts
    - 14.2. In high-strength bolted connections
    - 14.3. In joints, where cap screws are used to secure luminaire and signal arms
    - 14.4. Used for breakaway slip-base assemblies
  15. Standard must be straight with a maximum variation of:
    - 15.1. 1 inch measured at the midpoint of a 30-foot to 35-foot standard
    - 15.2. 3/4 inch measured at the midpoint of a 17-foot to 20-foot standard
    - 15.3. 1 inch measured 15 feet above the base plate for Type 35 and Type 36 standards
  16. The Contractor shall zinc-coated nuts used on fastener assemblies having a specified preload obtained by specifying a prescribed tension, torque value, or degree of turn must be provided with a colored lubricant, clean and dry to the touch. The lubricant color must contrast the zinc coating color on the nut so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.
  17. The Contractor must not make additional holes in structural members.
  18. Standard with an outside diameter of 12 inches or less must be round. Standard with an outside diameter greater than 12 inches must be round or multisided. Multisided standard must be convex with a minimum of 12 sides and have a minimum bend radius of 4 inches.



19. Mast arm must be manufactured from material specified for standard.
20. Cast steel option for slip base must be manufactured from material of Grade 70-40, as specified in ASTM A 27/A 27M. Other comparable material may be used if approved by the City. The casting tolerances must comply with the Steel Founders' Society of America's recommendations for green sand molding.
21. One casting from each lot of a maximum of 50 castings must be radiographed as specified in ASTM E 94. Casting must comply with the acceptance criteria for severity level 3 or better for the types and categories of discontinuities in ASTM E 186 and E 446. If the casting fails the inspection, 2 additional castings must be radiographed. If the 2 additional castings fail the inspection, the entire lot will be rejected.
22. Material certification, consisting of physical and chemical properties, and radiographic film of the casting must be filed at the manufacturer's office. Certification and film must be available for inspection.
23. High-strength bolts, nuts, and flat washers used to connect slip-base plate must comply with ASTM A 325 or A 325M and be galvanized as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications.
24. Plate washers must be manufactured by saw cutting and drilling steel plate. Steel plate must comply with AISI 1018 and be galvanized as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications. Before galvanizing, remove burrs and sharp edges and chamfer both sides of holes to allow the bolt head to make full contact with the washer without tension.
25. High-strength cap screws for attaching arms to standards must comply with ASTM A 325, A 325M, or A 449, and the mechanical requirements in ASTM A 325 or A 325M after galvanizing. Cap screws must be galvanized as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications. Coat threads of cap screws with a colored lubricant, clean and dry to the touch. Lubricant color must contrast the zinc-coating color on the cap screw so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.

26. Bolted connection attaching signal or luminaire arm to pole must be considered slip critical. Galvanized faying surfaces of plates on luminaire, signal arm, and pole must be roughened by hand using a wire brush before assembly and must comply with requirements for Class C surface conditions for slip-critical connections in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," a specification approved by the Research Council on Structural Connections (RCSC). Paint for faying surfaces must be as specified in the RCSC specification for Class B coating.
27. The City will randomly take samples of fastener components from each production lot and submit to the Transportation Laboratory with test reports as specified in ASTM fastener specifications for QA testing and evaluation. The City will determine sample sizes for each fastener component.
- Change in mast arm configuration is allowed as long as the mounting height and stability are maintained.
- Before manufacturing, details must be adjusted to ensure that cap screw heads can be turned using conventional installation tools.
- During manufacturing process, to avoid interference with the cap screw heads, the position of the luminaire arm on the arm plate must be properly located.
- Mast arm must configured as a smooth curving arm.
- Push button post, pedestrian barricade, and guard post must comply with ASTM A 53.
- The Contractor shall assemble and tighten slip base when pole is on the ground. Threads of heavy hex nuts for each slip-base bolt must be coated with additional lubricant that is clean and dry to the touch. The Contractor shall tighten high strength slip-base bolts to within  $\pm 10$  foot-pounds of the following:

#### Slip-Base Bolt-Tightening Requirements

Standard Type	Torque (foot-pounds)
15-SB	150
30	150
31	200
36-20A	165

Hole in shaft of existing standard, due to removal of equipment or mast arms, must be sealed by fastening a galvanized steel disk to cover the hole. The Contractor shall fasten using a single central galvanized steel fastener. The Contractor shall seal edges of disk and hole with polysulfide or polyurethane sealing compound of Type S, Grade NS, Class 25, and Use O, as specified in ASTM C 920.

New nuts, bolts, cap screws, and washers must be provided if:

1. Standard or mast arm is relocated
2. Used standard or mast arm is State furnished

If the standard has a slip base, a new keeper plate must be provided.

#### 1.11 CONDUIT

The Contractor shall run conductors in conduit except for overhead and where conductors are run inside poles.

The Contractor may use a larger size conduit than specified as long as the Contractor uses it for the entire length between outlets. The Contractor must not use reducing coupling.

New conduit must not pass through existing foundations for standards.

##### A. Material

Conduit and conduit fitting must be UL or ETL listed and comply with the following:

##### Conduit and Conduit Fitting Requirements

Type 1	Hot-dip galvanized rigid steel conduit and conduit couplings must comply with UL 6 and ANSI C80.1. Zinc coating testing must comply with copper sulfate test requirements in UL 6. Conduit couplings for rigid steel conduit must be electrogalvanized.
Type 2	Hot-dip galvanized rigid steel conduit must comply with requirements for Type 1 conduit and be coated with polyvinyl chloride (PVC) or polyethylene. Exterior thermoplastic coating must have a minimum thickness of 35 mils. Internal coating must have a minimum thickness of 2 mils. Coated conduit must comply with UL 6; NEMA RN 1; or ETL PVC-001.
Type 3	Rigid non-metallic conduit must comply with UL 651, UL 651A or UL 651B. Install at underground locations only.

Type 4	Waterproof flexible metal conduit must consist of conduit with a waterproof non-metallic sunlight-resistant jacket over an inner flexible metal core. Type4 conduit must be UL listed for use as the grounding conductor.
Type 5	Intermediate steel conduit and conduit couplings must comply with UL 1242 and ANSI C80.6. Zinc coating testing must comply with copper sulfate test requirements in UL 1242. Conduit couplings for intermediate rigid steel conduit must be electrogalvanized. Type 5 conduit must only be used if specified.

Bonding bushings to be installed on metal conduit must be insulated and either galvanized or zinc alloy type. Fittings for steel conduit and for watertight flexible metal conduit must be UL listed at UL 514B.

#### B. Use

Install Type 1 conduit on all exposed surfaces and at the following locations:

1. In concrete structures
2. Between a structure and nearest pull box

Exposed conduit installed on painted structure must be painted the same color as the structure.

The Contractor shall change or extend existing conduit runs using the same material. The Contractor shall install pull box if an underground conduit changes from the metallic type to Type 3.

Minimum trade size of conduit must be:

1. 1-1/2 inches from electrolrier to adjacent pull box
2. 1 inch from pedestrian push button post to adjacent pull box
3. 2 inches from signal standard to adjacent pull box
4. 3 inches from controller cabinet to adjacent pull box
5. 2 inches from overhead sign to adjacent pull box 1-1/2 inches if unspecified

Two conduits must be installed between controller cabinet and adjacent pull box.

#### C. Installation

Whether shop or field cut, the Contractor shall ream ends of conduit to remove burrs and rough edges. The Contractor shall make cuts square and true. Slip joints and running threads are not allowed for coupling

conduit. If a standard coupling cannot be used for coupling metal type conduit, the Contractor shall use a threaded union coupling that is UL or ETL listed. The Contractor shall tighten couplings for metal conduit to maintain a good electrical connection through conduit run. The Contractor shall cut Type 3 conduit with tools that will not deform the conduit. The Contractor shall use solvent weld for connections. The Contractor shall cut Type 2 conduit with pipe cutters; the Contractor must not use hacksaws. Coated conduit must be threaded with standard conduit- threading dies. The Contractor shall tighten conduit into couplings or fittings using strap wrenches or approved groove-joint pliers.

The Contractor shall protect shop-cut threads from corrosion as follows:

**Shop-Cut Thread Protection**

Steel Conduit and conduit couplings	ANSI C80.1
Intermediate metal conduit and conduit couplings	ANSI C80.6

The Contractor shall paint conduits as specified in section 91, "Paint", of the Caltrans Standard Specifications. Apply 2 coats of approved unthinned zinc-rich primer of organic vehicle type. The Contractor must not use aerosol cans. The Contractor shall paint the following parts of conduits:

- All-exposed threads
- Field-cut threads before installing conduit couplings to steel conduit
- Damages surfaces on metal conduit

The Contractor must not remove shop-installed conduit couplings. Damaged Type 2 conduit or conduit couplings must be wrapped with at least 1 layer of 2 inch-wide, 20 mil minimum thickness PVC tape, as specified in ASTM D 1000, with a minimum tape overlap of 1/2 inch. Before applying tape, conduit or fitting must be cleaned and painted with 1 coat of rubber-resin based adhesive as recommended by the tape manufacturer. The Contractor may repair damaged spots in the

thermoplastic coating by painting over with a brushing type compound supplied by the conduit manufacturer rather than the tape wrap.

The ends of Types 1, 2, or 5 conduits must be threaded and capped with standard pipe caps until wiring is started. If caps are removed, the Contractor shall replace with conduit bushings. The Contractor shall fit insulated bonding bushings on the end of metal conduit ending in pull box or foundation. Bell or end bushings for Type 3 conduit must be non-metallic type.

Conduit bends, except factory bends, must have a radius of not less than 6 times the inside diameter of the conduit. If factory bends are not used, bend the conduit without crimping or flattening using the longest radius practicable. Bend conduit as follows:

**Conduit Bending Requirements**

Type 1	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.
Type 2	Use standard bending tool designed for use on thermoplastic coated conduit. Conduit must be free of burrs and pits.
Type 3	By methods recommended by the conduit manufacturer and with equipment approved for the purpose. Do not expose conduit to direct flame.
Type 4	--
Type 5	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.

Install pull tape in conduit that is to receive future conductors. The pull tape must be a flat woven lubricated soft-fiber polyester tape with a minimum tensile strength of 1,800 pounds and have printed sequential measurement markings every 3 feet. At least 2 feet of pull tape must be doubled back into the conduit at each end.

Existing underground conduit to be incorporated into a new system must be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

The Contractor shall install conduit to a depth of not less than 30 inches below finished grade, except in sidewalk and curbed paved median areas, where it must be at least 18 inches below grade. The Contractor may lay conduit on existing pavement within new curbed median.

Conduit coupling must be a minimum of 6 inches from face of foundation.

The Contractor shall place a minimum of 2 inches of sand bedding in the trench before installing Type 2 or Type 3 conduit. The Contractor shall place a minimum of 4 inches of same material over conduit before placing additional backfill material.

The Contractor shall obtain approval from the City before disturbing pavement. If obstruction is encountered, the Contractor shall obtain approval from City to cut small holes in the pavement to locate or remove obstruction. If jacking or drilling method is used, the Contractor shall keep jacking or drilling pit 2 feet away from edge of pavement. Pavement must not be weakened or subgrade softened from excess water use.

Conduit used for drilling or jacking must be removed; install new conduit for completed work. If a hole larger than the conduit is pre-drilled and you install conduit by hand or by method recommended by the conduit manufacturer with equipment approved for purpose, the Contractor may install Type 2 or Type 3 conduit under pavement.

If trenching in pavement method is specified, conduit installation under pavement that is not a freeway lane or freeway to freeway connector ramp, the Contractor must comply with the following:

1. Use Type 3 conduit. Place conduit under pavement in a trench approximately 2 inches wider than the outside diameter of conduit, but not exceeding 6 inches in width. Trench depth must not exceed the greater of 12 inches or conduit trade size plus 10 inches, except that at pull boxes the trench may be hand dug to required depth. The top of the installed conduit must be a minimum of 9 inches below finished grade.
2. Trenching installation must be completed before placing final pavement layer.
3. Cut pavement to be removed with a rock cutting excavator. Minimize shatter outside the removal area.
4. Place conduit in bottom of trench and backfill with minor concrete as specified in Section 90-10, "Minor Concrete", of the Caltrans Standard Specifications. Minor concrete must contain a minimum of 590 pounds of cementitious material per cubic yard. If the trench is in asphalt concrete pavement and pavement overlay is not placed, backfill the top 1-3/4-inch of trench with minor HMA.
5. Before spreading HMA, apply tack coat as specified in Section 39, "Hot Mix Asphalt", of the Caltrans Standard Specifications.

6. Backfill trenches, except for the top 0.10 foot, by the end of each day. The top 0.10 foot must be filled within 3 days after trenching.

If jacking or drilling method is used, the Contractor shall construct jacking pit to a minimum of 13 feet from the centerline of track at the near side of jacking pit. The Contractor shall cover jacking pit with substantial planking if left overnight.

Conduit ending in standard or pedestal must not extend more than 3 inches vertically above the foundation and must be sloped toward the handhole opening. Conduit entering through the side of non-metallic pull box must end inside the box within 2 inches of the wall and 2 inches above the bottom and be sloped toward the top of box to facilitate pulling of conductors. Conduit entering through the bottom of a pull box must end 2 inches above the bottom and be located near the end walls to leave the major portion of the box clear. At outlet, conduit must enter from the direction of the run.

Conduit for future use in structures must be threaded and capped.

Conduit leading to soffit, wall, or other lights or fixtures below pull box grade must be sealed and made watertight, except where conduit ends in a No. 9 or No. 9A pull box.

#### D. Expansion Fittings

The Contractor shall install expansion fitting where the conduit crosses an expansion joint in structure. Each expansion fitting for metal conduit must include a copper bonding jumper having the ampacity specified in NEC.

Each expansion-deflection fitting for expansion joints of 1-1/2-inch movement rating must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs. Each fitting must allow a minimum of 3/4-inch expansion, contraction, and lateral deflection.

### 1.12 PULL BOXES

The Contractor may use a larger standard size pull box than that shown on the plans or specified. Pull box, cover, and extensions must be of the same material.

#### A. Materials

Pull box, cover, and extension for installation in ground or sidewalk area must be precast reinforced PCC or non-PCC material. Non-PCC material must:



1. Be fire resistant with a burn rate no greater than 0.3-inch per minute per 0.1 inch of thickness when tested as specified in ASTM D 635
  2. Show no significant change in physical properties with exposure to weather
  3. Be dense, free of voids or porosity, and gray or brown in color
- Non-PCC pull box must comply with the following:

1. Top dimensions must not exceed the bottom dimensions by more than 1 inch.
2. Extension must be attached to pull box to maintain the minimum combined depths.
3. Cover must not fail and must not deflect more than 1/4 inch when a vertical force of 1,500 pounds is applied through a 1/2" x 3" x 6" steel plate to a non-PCC cover on a pull box. Center the steel plate on cover with its longitudinal axis coinciding with longitudinal axis of cover.

Non-PCC pull boxes must be of sufficient rigidity that when a designated concentrated force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it must be possible to remove the cover without the use of tools. The designated concentrated force must be 150 pounds for a No. 3-1/2 pull box and must be 100 pounds for a No. 5 or No. 6 pull box.

If a transformer or other device must be placed in a non-metallic pull box, the Contractor shall include recesses for hanger.

The Contractor shall secure cover, except ceiling pull box cover, with 3/8-inch hold down bolts, cap screws, or studs, washers, and brass stainless steel or other non-corroding-metal nut. Stainless steel hardware must have an 18 percent or greater chromium content and an 8 percent or greater nickel content.

The Contractor shall galvanize ferrous metal parts as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications.

Traffic pull box must be provided with steel cover and special concrete footing. Steel cover must have an embossed non-skid pattern.

Traffic pull box and cover must have a vertical proof-load strength of 25,000 pounds. Comply with Federal Specification RR-F-621 and distribute the 25,000 pound load through a 9" x 9" x 2" steel plate.

You must be able to place the load anywhere on box and cover for 1 minute without causing cracks or permanent deformations.

No. 3-1/2(T) and No. 5(T) traffic pull box must be reinforced with a galvanized Z bar welded frame and cover similar to that shown on the plans for No. 6(T) pull box. Frame must be anchored to box with 1/4" x 2-1/4" concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides. Hold down screws must be 3/8 inch hex flange cap screws of Type 316 stainless steel. Nut must be zinc plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread. Nut must be spot welded to the underside or manufactured with galvanized Z bar pull box frame.

Steel cover must be countersunk approximately 1/4 inch to accommodate bolt head. When tightened, bolt head must not exceed more than 1/8 inch above the top of cover. A 1/4 inch tapped hole and brass bonding screw must be included.

Concrete placed around and under traffic pull box must be minor concrete as specified in Section 90-10, "Minor Concrete", of the Caltrans Standard Specifications.

#### B. Cover Marking

Marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of cover. Marking letters must be between 1 inch to 3 inch high. City pull boxes for traffic signals shall be marked "Traffic Signal" and PG&E pullboxes shall be marked "Service".

Before galvanizing steel or cast iron cover, the Contractor shall apply marking by one of the following methods:

1. Use cast iron strip at least 1/4-inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4 inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027-inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4 inch stainless steel rivets or 1/4 inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.

3. Bead weld the letters on cover so that letters are raised a minimum of 3/32 inch.

#### C. Installation and Use

The Contractor shall space pull boxes no more than 200 feet apart. The Contractor may install additional pull boxes to facilitate the work.

Pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of pull box in crushed rock.
2. Place a layer of roofing paper on crushed rock.
3. Place mortar over layer of roofing paper. Mortar must be 0.50 inch to 1 inch thick and be sloped toward the drain hole.
4. Make a 1-inch drain hole in center of pull box through mortar and roofing paper.
5. Place mortar between pull box and pull box extension, and around conduits.

The Contractor shall reconstruct sump of existing pull box if disturbed by Contractor's operations. The Contractor shall remove old grout and replace with new if the sump was grouted.

After installation of traffic pull box, the Contractor shall install steel cover and keep bolted down when Contractor's activities are not in progress at the pull box. When steel cover is placed for final time, cover and Z bar frame must be cleaned of debris and securely tightened.

### 1.13 CONDUCTORS AND CABLES

Conductor must be copper wire that complies with ASTM B 3 and B 8. Wire size must comply with the following:

#### Wire Size Requirements

Conductor usage	Requirement
In loop detector lead-in cable	ASTM B 286
Everywhere except in loop detector lead-in cable	American Wire Gage (AWG), Except conductor diameter must not be less than 98 percent of specified AWG diameter.

Single conductor and cable, except detector lead-in cable, must have clear, distinctive, and permanent markings on the outer surface throughout its length. The markings must include the manufacturer's name or trademark, insulation type letter designation, conductor size,

voltage, and temperature rating, and for cables, it must also include number of conductors.

#### A. Conductor Identification

Conductor insulation must be a solid color with a permanent stripe as specified below. The solid color must be homogeneous through the full depth of insulation. Identification stripe must be continuous throughout the length of conductor. For conductor sizes No. 2 and larger, the insulation may be black and the ends of the conductors must be taped for a minimum length of 20 inches with electrical insulating tape of the required color.

#### Conductor Identification

Circuit	Signal Phase or Function	Identification		Size
		Insulation Color (j)		
		Base	Stripe (a)	
Vehicle Signals (a,b,d)	2,6	Red, Yel, Brn	Blk	14
	4,8	Red, Yel, Brn	Ora	14
	1,5	Red, Yel, Brn	None	14
	3,7	Red, Yel, Brn	Pur	14
	Ramp Meter 1	Red, Yel, Brn	None	14
	Ramp Meter 2	Red, Yel, Brn	Blk	14
Pedestrian Signals (d)	2p,6p	Red, Brn	Blk	14
	4p,8p	Red, Brn	Ora	14
	1p,5p	Red, Brn	None	14
	3p,7p	Red, Brn	Pur	14
Pedestrian Push Buttons (d)	2p,6p	Blu	Blk	14
	4p,8p	Blu	Ora	14
	1p,5p	Blu	None	14
	3p,7p	Blu	Pur	14
Traffic Signal Controller Cabinet	Ungrounded Circuit Conductor	Blk	None	6
	Grounded Circuit Conductor	Wht	None	6

Highway Lighting Pull Box to Luminaire	Ungrounded-Line 1	Blk	None		14
	Ungrounded-Line 2	Red	None		14
	Grounded	Wht	None		14
Multiple Highway Lighting	Ungrounded-Line 1	Blk	None		10
	Ungrounded-Line 2	Red	None		10
Lighting Control	Ungrounded to PEU	Blk	None		14
	Switching leg from PEU unit or SM transformer	Red	None		14
Multiple Service	Ungrounded-Line 1 (Signals)	Blk	None		6
	Ungrounded-Line 2 (Lighting)	Red	None		8
Sign Lighting (h)	Ungrounded-Line 1	Blk	None		10
	Ungrounded-Line 2	Red	None		10
Flashing Beacons (g)	Ungrounded between Flasher and Beacons	Red or Yel	None		14
Grounded and Common	Pedestrian Push Buttons	Wht	Blk		14
	Signals and Multiple Lighting	Wht	None		10
	Flashing Beacons and Sign Lighting	Wht	None		12
	Lighting Control	Wht	None		14
	Multiple Service	Wht	None		14
Railroad Preemption		Blk	None		14
Spares		Blk	None		14

NBR = No Band Required PEU=Photoelectric unit

- On overlaps, insulation is striped for 1st phase in designation.  
e.g., phase (2+3) conductor is striped as for phase 2.
- Band for overlap and special phases as required.
- Flashing beacons having separate service do not require banding.
- These requirements do not apply to signal cable.

- e. "S" if circuit is switched on line side of service equipment by utility.
- f. Band conductors in each pull box and near ends of termination points. On signal light circuits, a single band may be placed around 2 or 3 ungrounded conductors comprising a phase.
- g. Ungrounded conductors between service switch and flasher mechanism must be black and banded.
- h. Conductors between ballasts and sign lighting lamps must be No. 16 and color must correspond to the ballast leads.
- i. Black acceptable for size No. 2 and larger. Tape ends for 20 inches with indicated color.
- j. Color Code: Yel-Yellow, Brn-Brown, Blu-Blue, Blk-Black, Wht-White, Ora-Orange, Pur-Purple.

#### B. Multiple Circuit Conductors

Conductor for multiple circuit must be UL or ETL listed and rated for 600 V(ac) operation. Insulation for No. 14 to No. 4 conductors must be one of the following:

- 1. Type TW PVC as specified in ASTM D 2219
- 2. Type THW PVC
- 3. Type USE, RHH, or RHW cross-linked polyethylene

Minimum insulation thickness must comply with the following:

#### Insulation Thickness

Insulation Type	Conductor Size	Insulation Thickness (mils)
USE, RHH, or RHW	No. 14 to No. 10	39
	No. 8 to No. 2	51
THW or TW	No. 14 to No. 10	27
	No. 8	40
	No. 6 to No. 2	54

Insulation for No. 2 and larger conductor must be one of the types listed above or Type THWN.

Conductor for wiring wall and soffit luminaire must be stranded copper with insulation rated for use at temperatures up to 125 °C.

#### C. Signal Cable

Signal cable, except for the 28-conductor type, must:

1. Not be spliced
2. Be marked in each pull box with the signal standard information it is connecting to

Signal cable must comply with the following:

1. Cable jacket must be:
  - 1.1. Black polyethylene with an inner polyester binder sheath
  - 1.2. Rated for 600 V(ac) and 75 °C
2. Filler material, if used, must be polyethylene material.
3. Conductor must be solid copper with Type THWN insulation as specified in Section 86-2.08, "Conductors and Cables," and ASTM B 286. The minimum thickness of Type THWN insulation must be 12 mils for conductor sizes No. 14 to No. 12 and 16 mils for conductor size No. 10. The minimum thickness of nylon jacket must be 4 mils.

**Conductor Signal Cable Requirements**

Conductor Quantity and Type	Cable Jacket Thickness (mils)		Maximum Nominal Outside Diameter (inch)	Conductor Color Code	Remarks
	Average	Minimum			
3 - No. 14	44	36	0.40	blue/black, blue/orange, white/black stripe	Use for pedestrian push buttons and spare
5 - No. 14	44	36	0.50	red, yellow, brown, black, white	
8 - No. 14 1 - No. 12	60	48	0.65	No. 12 - white No. 14 - red, yellow, brown, black, and red/black, yellow/black, brown/black, white/black stripe	

11 - No. 14 1 - No. 12	60	48	0.80	No. 12 - white No. 14 - see "12CSC Color Code and Functional Connection" table	Use for vehicle signals, pedestrian signals, spares, and signal common
27 - No. 14 1 - No. 10	80	64	0.90	No. 10 - white No. 14 - see "28CSC Color Code and Functional Connection" table	Keep signal commons in each cable separate except at the signal controller. Label each cable as "C1" or "C2" in pull box. Use "C1" for signal phases 1, 2, 3, and 4. Use "C2" for phases 5, 6, 7, and 8.

Conductor signal cable description starts with the number of conductors, followed by "CSC". (e.g., a signal cable with 3 conductors is labeled "3CSC.")

#### 12CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red	Vehicle signal red	2, 4, 6, or 8
Yellow	Vehicle signal yellow	2, 4, 6, or 8
Brown	Vehicle signal green	2, 4, 6, or 8
Red/black stripe	Vehicle signal red	1, 3, 5, or 7
Yellow/black	Vehicle signal yellow	1, 3, 5, or 7
Brown/black stripe	Vehicle signal green	1, 3, 5, or 7
Black/red stripe	Spare, or use as required for red or DONT WALK	
Black/white stripe	Spare, or use as required for yellow	
Black	Spare, or use as required for green or WALK	
Red/white stripe	Ped signal DONT WALK	
Brown/white stripe	Ped signal WALK	

#### 28CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red/black stripe	Vehicle signal red	2 or 6
Yellow/black stripe	Vehicle signal yellow	2 or 6
Brown/black stripe	Vehicle signal green	2 or 6
Red/orange stripe	Vehicle signal red	4 or 8
Yellow/orange stripe	Vehicle signal yellow	4 or 8



Brown/orange stripe	Vehicle signal green	4 or 8
Red/silver stripe	Vehicle signal red	1 or 5
Yellow/silver stripe	Vehicle signal yellow	1 or 5
Brown/silver stripe	Vehicle signal green	1 or 5
Red/purple stripe	Vehicle signal red	3 or 7
Yellow/purple stripe	Vehicle signal yellow	3 or 7
Brown/purple stripe	Vehicle signal green	3 or 7
Red/2 black stripes	Ped signal DONT WALK	2 or 6
Brown/2 black stripes	Ped signal WALK	2 or 6
Red/2 orange stripes	Ped signal DONT WALK	4 or 8
Brown/2 orange stripes	Ped signal WALK	4 or 8
Red/2 silver stripes	Overlap A, C red	OLA, OLC
Brown/2 silver stripes	Overlap A, C green	OLA, OLC
Red/2 purple stripes	Overlap B, D red	OLB, OLD
Brown/2 purple stripes	Overlap B, D green	OLB, OLD
Blue/black stripe	Ped push button	2 or 6
Blue/orange stripe	Ped push button	4 or 8
Blue/silver stripe	Overlap A, C yellow	OLA(y), OLC(y)
Blue/purple stripe	Overlap B, D yellow	OLB(y), OLD(y)
White/black stripe	Ped push button common	
Black/red stripe	Railroad preemption	
Black	Spare	

#### 1.14 WIRING

The Contractor shall run conductors in conduit, except for overhead and temporary installations and where conductors are run inside poles.

The Contractor shall solder by hot iron, pouring, or dipping method, connectors and terminal lugs for conductor sizes No. 8 and smaller. Do not perform open-flame soldering.

##### A. Circuitry

The Contractor must not run traffic signal indication conductors to a terminal block on a standard unless connected to a mounted signal head. The Contractor shall use only 1 conductor to connect to each terminal of a pedestrian push button.

The common for pedestrian push button circuit must be separate from traffic signal circuit grounded conductor.

##### B. Installation

The Contractor shall use a UL- or ETL-listed inert lubricant for placing conductors in conduit.

The Contractor shall pull conductors into conduit by hand using pull tape specified in Section 86-2.05C, "Installation", of the Caltrans Standard Specifications. The Contractor must not use winches or other power-actuated pulling equipment.

If adding new conductors or removing existing conductors, the Contractor shall remove all conductors, clean conduit as specified in Section 86-2.05C, "Installation", of the Caltrans Standard Specifications, and pull all conductors in conduit as 1 unit.

If traffic signal conductors are run in lighting standard containing street lighting conductors from a different service point, the Contractor shall encase the traffic signal conductors or the lighting conductors with a flexible or rigid metal conduit for a length until the 2 types of conductors are no longer in the same raceway.

If less than 10 feet above grade, the Contractor shall enclose temporary conductors in flexible or rigid metal conduit.

The Contractor shall leave slack for each conductor as follows:

**Conductor Slack Requirements**

Location	Slack (feet)
Signal standard	1
Lighting standard	1
Signal and lighting standard	1
Pull box	3
Splice	3
Standards with slip base	0

After conductors are installed, the Contractor shall seal ends of conduits with an approved sealing compound.

To form a watertight seal, the Contractor shall tape ends of spare conductors and conductors ending in pull boxes.

Conductors and cables inside fixture or cabinet must be neatly arranged and tied together by function with self-clinching nylon cable ties or enclosed in plastic tubing or raceway.

The Contractor shall identify conductors for:

- Signal overlap phase as specified for vehicle signals in the table titled "Conductor Identification."
- Metered and unmetered conductors occupying the same pull box.  
Identify unmetered circuit conductors with "UNMETERED-STREET LTG," or "UNMETERED-COUNT STATION."

The Contractor shall permanently identify conductors by function. The Contractor shall place identification on each conductor, or each group of conductors forming a signal phase, at each pull box and near the end of conductors.

The Contractor shall label, tag, or band conductors by mechanical methods. Identification must not move along the conductors.

**C. Connectors and Terminals**

Connectors and terminals must be UL- or ETL-listed crimp type. Use manufacturer-recommended tool for connectors and terminals to join conductors. Comply with MIL-T-7928.

The Contractor shall terminate stranded conductors smaller than No. 14 in crimp style terminal lugs.

**D. Splicing and Terminations**

Splices are allowed for:

1. Grounded conductors in pull box.
2. Pedestrian push button conductors in pull box.
3. Conductors in pull box adjacent to each electrolier or luminaire.
4. Ungrounded traffic signal conductors in pull box, if traffic signals are modified.
5. Ungrounded traffic signal conductors to a terminal compartment or signal head on a standard with conductors of the same phase in the pull box adjacent to the standard.
6. Ungrounded lighting circuit conductors in pull box, if lighting circuits are modified.

**E. Splice Insulation**

Splice must function under continuous submersion in water.

Multi-conductor cable must be spliced and insulated to form a watertight joint and to prevent moisture absorption by the cable.

Low-voltage tape must be:

1. UL or ETL listed
2. Self-fusing, oil and flame-resistant, synthetic rubber
3. PVC, pressure-sensitive adhesive of 6 mils minimum thickness

Insulating pad must be a combination of an 80-mils thick electrical grade PVC laminate and a 120-mils thick butyl splicing compound with removable liner.

Heat-shrink tubing must comply with the following:

1. Be medium or heavy wall thickness, irradiated polyolefin tubing with an adhesive mastic inner wall.
2. Before contraction, minimum wall thickness must be 40 mils.
3. Heating must be as recommended by the manufacturer. Do not perform open-flame heating.

4. When heated, the inner wall must melt and fill crevices and interstices of the covered object and the outer wall must shrink to form a waterproof insulation.
5. After contraction, each end of the heat-shrink tubing or the open end of end cap of heat-shrink tubing must overlap the conductor insulation at least 1-1/2 inches. Coat ends and seams with electrical insulation coating.
6. Comply with requirements for extruded insulated tubing at 600 V(ac) in UL Standard 468D and ANSI C119.1, and the following requirements:

**Heat-Shrink Tubing Requirements**

Shrinkage Ratio	33 percent, maximum, of supplied diameter when heated to 125 °C and allowed to cool to 25 °C
Dielectric Strength	350 kV per inch, minimum
Resistivity	2513 $\Omega$ per inch, minimum
Tensile Strength	2,000 psi, minimum
Operating Temperature	-40 °C to 90 °C (135 °C in emergency)
Water Absorption	0.5 percent, maximum

7. If 3 or more conductors are to be enclosed in 1 splice, place mastic around each conductor before placing inside tubing. Use mastic type recommended by heat-shrink tubing manufacturer.

The Contractor may use "Method B" as an alternative method for splice insulation. The Contractor shall use at least 2 thicknesses of electrical insulating pad. The Contractor shall apply pad to splice as recommended by manufacturer.

**1.15 FUSED SPLICE CONNECTORS**

The Contractor shall install a fused disconnect splice connector in each ungrounded conductor, between the line and the ballast, in the pull box adjacent to each luminaire. Connector must be accessible in the pull box.

For 240 and 480 V(ac) circuits, each connector must simultaneously disconnect both ungrounded conductors. Connector must not have exposed metal parts, except for the head of stainless steel assembly screw. The Contractor shall recess head of stainless steel assembly screw a minimum of 1/32 inch below top of plastic boss that surrounds the head.

Splice connector must protect fuse from water or weather damage. Contact between fuse and fuse holder must be spring loaded. Splice connector terminals must be:

1. Rigidly crimped, using a tool recommended by manufacturer of fused splice connector, onto ungrounded conductors
2. Insulated
3. Watertight

Fuses must be standard midget ferrule type, with "Non-Time-Delay" feature, and 13/32" x 1-1/2".

#### **1.16 BONDING AND GROUNDING**

Secure all metallic components, mechanically and electrically, to form a continuous system that is effectively grounded.

Bonding jumper must be copper wire or copper braid of the same cross sectional area as a No. 8 or larger to match the load. Equipment grounding conductors must be color coded as specified in NEC or be bare.

Attach bonding jumper to standard as follows:

##### **Bonding Jumper Attachment**

Standard type	Requirements
Standard with handhole and traffic pull box lid cover	Use UL-listed lug and 3/16-inch diameter or larger brass or bronze bolt. Run jumper to conduit or bonding wire in adjacent pull box. Grounding jumper must be visible after the standard is installed and mortar pad is placed on foundation.
Standard without handhole	Use UL-listed ground clamp on each anchor bolt.
Slip-base standard	Use UL-listed ground clamp on each anchor bolt or attach UL-listed lug to bottom slip-base plate with 3/16-inch diameter or larger brass or bronze bolt.

The Contractor shall ground one side of secondary circuit of step-down transformer.

The Contractor shall ground metal conduit, service equipment, and grounded conductor at service point as specified by NEC and service utility, except grounding electrode conductor must be No. 6 or larger. Equipment bonding and grounding conductors are required in conduit. Run a No. 8 minimum bare copper wire continuously in conduit system. The bonding wire must be sized as specified in the NEC.

Ground electrode must be:

1. 1 piece
2. 10-foot minimum length of one of the following:
  - a. Galvanized steel rod or pipe not less than 3/4 inch in diameter
  - b. Copper clad steel rod not less than 5/8 inch in diameter
3. Installed as specified in NEC
4. Bonded to service equipment using one of the following:
  - a. Ground clamp
  - b. Exothermic weld
  - c. No. 6 or larger copper conductor

On wood pole, metallic equipment mounted less than 8 feet above ground surface must be grounded.

Bond metallic conduit in non-metallic pull box using bonding bushing or bonding jumper.

Bond metallic conduit in metal pull box using bonding bushings and bonding jumpers connected to bonding wire running in the conduit system.

#### **1.17 GALVANIZING**

The Contractor shall galvanize as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications. Cabinet material may be galvanized before manufacturing as specified in ASTM A 653/653M, Coating Designation G 90.

Steel pipe standard and pipe mast arm must be hot-dip galvanized after manufacturing and must comply with Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications. The Contractor shall remove spikes from galvanized surfaces.

A minimum of 10 inches of upper end of anchor bolts, anchor bars or studs, and nuts and washers must be galvanized as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications.

After galvanizing, bolt threads must accept galvanized standard nuts without requiring tools or causing removal of protective coatings.

Galvanizing existing materials in an electrical installation will not be required.

#### **1.18 PAINTING**

- A. The Contractor shall paint electrical equipment and material as specified in Section 59, "Painting", of the Caltrans Standard Specifications, as indicated in the plans, and the following:

1. Use paint material specified in Section 91, "Paint", of the Caltrans Standard Specifications.
2. Factory or shop cleaning methods for metals are acceptable if equal to the methods specified.
3. Instead of temperature and seasonal restrictions for painting as specified in Section 59, "Painting", of the Caltrans Standard Specifications, paint may be applied to equipment and materials for electrical installations if ordered by the City.
4. Ungalvanized ferrous surface to be painted must be cleaned before applying prime coat. Blast cleaning is not required.
5. If an approved prime coat is applied by manufacturer, and in good condition, the 1st primer application is not required.
6. Existing equipment to be painted in the field, including City-furnished equipment, must be washed with a stiff bristle brush using a solution of water containing 2 tablespoons of heavy duty detergent powder per gallon. After rinsing, surface must be wire-brushed with a coarse, cup-shaped, power-driven brush to remove badly bonded paint, rust, scale, corrosion, grease, or dirt. Dust or residue remaining after wire brushing must be removed before priming.
7. Do not paint galvanized metal guard post, galvanized equipment.
8. New galvanized metal surface to be painted in the field must be cleaned as specified for existing equipment before applying the prime coat. Do not wire brush new galvanized surface.
9. After erection, examine exterior surface for damaged primer, clean, and spot coat with primer.
10. Paint Types II and III steel service equipment enclosures with a polymeric or an enamel coating system matching Color No. 14672, light green, of Federal Standard 595B. Coating must be commercially smooth and free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance. Coating must comply with the following:  
 Coating hardness - Finish must have pencil lead hardness of HB, minimum, using an Eagle Turquoise pencil.  
 Salt spray resistance - Undercutting coating system's film must not exceed 1/8-inch average, from lines scored diagonally and deep enough to expose the base metal, after 336 hours of exposure in a salt spray cabinet complying with ASTM B 117.

- Adherence - Must not have coating loss when tested as specified in California Test 645. Perform testing by applying coating to 4" x 8" x 0.024" test specimens of the same material as the cabinet, using the same application method.
11. Finish interior of metal signal visor, louver, and front face of back plates with 2 applications of lusterless black exterior grade latex paint formulated for application to properly prepared metal surface. Good condition factory finish will be acceptable.
  12. Finish metal signal section, signal head mounting, brackets and fittings, outside of visor, pedestrian push button housing, pedestrian signal section and visor, and back face of back plate with 2 applications of lusterless black or dark olive green exterior grade latex paint formulated for application to properly prepared metal surface. Match dark olive green color to Color Chip No. 68 filed at the Transportation Laboratory.
  13. Prepare and finish conduit and conduit fitting above ground the same as adjacent standard or post.
  14. Relocated, reset or modified equipment previously finished as specified in this section, except for previously-finished galvanized standard with traffic signal yellow enamel, must be given a spot finishing application on newly primed areas and 1 finishing application over the entire surface. If signal face or mounting brackets are required to be painted under this section, all signal faces and mounting brackets on the same mounting must be repainted.
  15. Small rusted or repaired areas of relocated or reset galvanized equipment must be cleaned and painted as specified in Section 75-1.05, "Galvanizing", of the Caltrans Standard Specifications, for repairing damaged galvanized surfaces.
  16. Stencil equipment number neatly on the standard or adjacent structure. Obtain number from the City.
  17. Perform painting neatly. The City reserves the right to require use of brushes if the work performed by paint spraying machine is unsatisfactory.

#### **1.19 CONTROLLER ASSEMBLIES**

A controller assembly houses a complete mechanism for controlling the operation of traffic signals or other systems. Model 2070, specified as a Model 2070 controller assembly, includes a Model 2070 controller



unit, a wired cabinet, and all auxiliary equipment required to control the system.

#### **1.20 CABINET WIRING**

Conductors used in controller cabinet wiring must:

- Be neatly arranged and laced, or enclosed in plastic tubing or raceway.
- End with properly sized captive or spring-spade terminal or be soldered to a through-panel solder lug on the back side of the terminal block. Apply crimp-style connector with proper tool to prevent opening of handle until crimp is completed.

Controller cabinet must have an equipment grounding conductor bus that is grounded to the cabinet and connected to metal conduit system or other approved ground with a No. 8, or larger, grounding conductor. With all cabinet equipment in place and connected, resistance between grounded conductor terminal bus and equipment grounding conductor bus must be 50 MΩ, minimum, when measured with an applied voltage of 150 V(dc).

If direct current is to be grounded, the Contractor shall connect to equipment ground only.

Use two or more terminal blocks for field connection. Install field terminal within 22 inches from front of cabinet and orient for screwdriver operation. Terminal must be a minimum of 5 inches above foundation.

No more than 3 conductors per terminal are allowed. Two flat metal jumpers, straight or U shaped, may be placed under terminal screw. At least 2 full threads of terminal screws must be fully engaged when screw is tightened. Live parts must not extend beyond the barrier.

#### **1.21 VEHICLE SIGNAL FACES**

A. Each vehicle signal face must:

1. Be adjustable and allow for 360-degree rotation about vertical axis
2. Comply with ITE publication ST-017B, "Vehicle Traffic Control Signal Heads"
3. Comply with California Test 604, except for arrow and "X" faces
4. Have 3 sections arranged vertically: red at top, yellow at center, and green at bottom
5. Be of the same manufacturer and material, if more than 1 is installed at an intersection, except for programmed visibility type
6. Be sealed with neoprene gasket at top opening

7. Be LED modules

#### B. Signal Sections

Each signal section must comply with the following:

1. Maximum height must be 10-1/4 inches for an 8-inch section and 14-3/4 inches for a 12-inch section.
2. Housing must:
  - Be either die-cast or permanent mold-cast aluminum, or if specified, be structural plastic.
  - Comply with ITE publication ST-017B if die-cast or permanent mold-cast aluminum is used.
  - Have a 1-piece, hinged, square-shaped door designed to allow access for relamping without the use of tools. Door must be secured to hold the door closed during loading tests. Module or lens must be watertight and mounted in the door.
3. Hinge pins, door latching devices, and other exposed hardware must be Type 304 or 305 stainless steel. Interior screws and fittings must be stainless steel, or steel with a corrosion resistant plating or coating.
4. Opening must be placed on top and bottom to receive 1-1/2-inch pipe. The 8-inch and 12-inch sections of an individual manufacturer must be capable of joining to form a signal face in any combination. This interchangeability is not required between metal and plastic sections.
5. Gaskets must be made of a material that is not affected if installed in a section with metal or plastic housing that is continuously operated for 336 hours. Structural failure is described as follows:

#### Signal Section Structural Failure

Signal Section Type	Requirements	Description of Structural Failure
Metal	California Test 666	Fracture within housing assembly or deflection of more than half the lens diameter of signal section during wind load test
Plastic	California Test 605	Fracture within housing assembly or deflection of more than 10 degrees in either the vertical or horizontal plane after wind load has been removed from front of signal face, or deflection of more than 6 degrees in either the vertical or horizontal plane after wind load has been removed from back of signal face

## 1. Metal Signal Sections

Each metal signal section must have a metal visor. Metal signal faces requiring backplates must have metal backplates.

## 2. Plastic Signal Sections

Housing must be molded in 1 piece, or fabricated from 2 or more pieces and joined into a single piece. Plastic must have ultraviolet stability, be unaffected by lamp heat, and be self-extinguishing. Housing and door must be colored throughout and be black, matching Color No. 17038, 27038, or 37038 of Federal Standard 595B.

Each face section must be joined to adjacent section by one of the following:

- Minimum of 3 machine screws for 8-inch sections and 4 machine screws for 12-inch sections, installed through holes near front and back of housing. Each screw must be a No. 10 and have a nut, flat washer, and lock washer.
- Two machine screws, each with a nut, flat washer, and lock washer, installed through holes near the front of the housing, and a fastening through the 1-1/2-inch pipe opening. Fastening must have 2 large flat washers to distribute the load around the pipe opening and 3 carriage bolts, each with a nut and lock washer. Minimum screw size must be No. 10. Minimum carriage bolt size must be 1/4 inch.

Supporting section of each signal face supported only at top or bottom must have reinforcement.

Reinforcement plate must be either sheet aluminum, galvanized steel, or cast aluminum. Each plate must be a minimum of 0.11-inch thick and have a hole concentric with 1-1/2-inch pipe-mounting hole in the housing. Place reinforcement plate as follows:

### **Reinforcement Plate Placement**

Type of Reinforcement	Placement
Sheet aluminum	Inside and outside of housing
Galvanized steel	Inside of housing
Cast aluminum	Outside of housing

Reinforcement plates placed outside of the housing must be finished to match signal housing color and be designed to allow proper serrated coupling between signal face and mounting hardware.

Minimum of 3 No. 10 machine screws must be installed through holes

in each plate and matching holes in the housing. Each screw must have a round or binder head, a nut, and lock washer.

If signal face is supported by a Type MAS side attachment slip-fitter inserted between 2 sections, place spacers between the 2 sections. Vertical dimension of spacers must allow proper seating of serrations between the slip-fitter and the 2 sections. In addition to the fastening through the large openings in housing, the 2 sections must join with at least 2 machine screws through holes near the front of housing and the spacers, and through matching holes in a reinforcing plate installed in housing. Machine screws must be No. 10 minimum size. Spacers must be made of same material as signal housing.

If reinforcing webs are used to connect back of housing to top, bottom, and sides, reinforcing plates are not required.

Holes for machine screws must be either cast or drilled during signal section manufacturing. Surround each hole with a 1/8-inch minimum width boss to allow contact between signal sections about axis of hole.

Each plastic signal section must have a plastic or metal visor. Plastic signal faces requiring backplates must have plastic backplates.

Serrated nylon washer must be inserted between each plastic signal section and metal mounting assembly. Each washer must be between 3/16- and 1/4-inch thick. Serrations must match those on signal section and mounting assembly.

#### C. Visors

Include removable visor with each signal section. Comply with ITE publication ST-017B. Visors are classified by lens enclosure as full circle, tunnel or cap. Bottom opens for tunnel type and both, bottom and lower sides open for cap type. Visors must be tunnel type.

Visor must have a downward tilt between 3 and 7 degrees with a length of:

- 9-1/2-inch minimum for nominal 12-inch round lenses
- 7 inch for nominal 8-inch round lenses

Metal visor must be formed from 0.050-inch, minimum thickness, aluminum alloy sheet.

Plastic visor must be either formed from sheet plastic or assembled from one or more injection, rotational, or blow- molded plastic

sections. Material must be of a black homogeneous color with lusterless finish. Sections must be joined using thermal, chemical, or ultrasonic bonding, or with aluminum rivets and washers permanently colored to match visor.

Secure each visor to its door and prevent removal or permanent deformation when wind load specified in California Test 605 for plastic visors or 666 for metal visors is applied to its side for 24 hours. If directional louvers are used, the Contractor shall fit louvers snugly into full-circular signal visors. Outside cylinder must be constructed of 0.030-inch nominal thickness, or thicker, sheet steel and vanes must be constructed of 0.016-inch nominal thickness, or thicker, sheet steel, or the cylinder and vanes must be constructed of 5052-H32 aluminum alloy of equal thickness.

#### **1.22 BACKPLATES**

Background light must not be visible between backplate and signal face or between sections.

Plastic backplates must be either formed from sheet plastic or assembled from extruded, molded, or cast sections. Sections must be factory joined using one of the following:

- Appropriate solvent cement
- Aluminum rivets and washers painted or permanently colored to match backplate
- No. 10 machine screws with washers, lock washers, and nuts, painted to match backplate

Backplate material must be of black homogeneous color with a lusterless finish. Secure each plastic backplate to the plastic signal face in a manner that prevents its removal or permanent deformation when the wind-load test is applied to either the front or back of signal face. Permanent deformation of any portion of backplate must not exceed 5 degrees forward or backward after wind loading is applied for 24 hours. If plastic backplate requires field assembly, join with at least 4 No. 10 machine screws at each field-assembled joint. Each machine screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and either a locking nut or a nut and lockwasher. Machine screws, nuts, and washers must be stainless steel or steel with a zinc or black-oxide finish.

If a metal backplate has 2 or more sections, fasten sections with rivets or aluminum bolts peened after assembly to avoid loosening.

Instead of the screws shown on the plans, you may use self-threading No. 10 steel screws to fasten plastic backplates to plastic signal face. Each screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and is stainless steel or steel with a zinc or black-oxide finish.

### **1.23 PEDESTRIAN SIGNAL FACES**

Pedestrian signals shall be GELcore countdown or approved equal.

International Symbol Type and must comply with the following sections:.

Message symbols for pedestrian signal faces must be white "WALKING PERSON" and Portland orange "UPRAISED HAND." The Contractor shall comply with ITE Standards: "Pedestrian Traffic Control Signal Indications" and California MUTCD. Each symbol's height must be at least 10 inches and width must be at least 6-1/2 inches.

Luminance of "UPRAISED HAND" symbol must be 1,100 foot-lamberts, minimum, and luminance of "WALKING PERSON" symbol must be 1,550 foot-lamberts, minimum, when tested as specified in California Test 606.

Uniformity ratio of an illuminated symbol must not exceed 4 to 1 between the highest luminance area and the lowest luminance area.

Luminance difference between a nonilluminated symbol and the background around the symbol must be less than 30 percent when viewed with the visor and front screen in place and at a low sun angle.

Each housing, including front screen, must have maximum overall dimensions of 18-1/2-inch width, 19-inch height, and 11-1/2-inch depth.

All new pedestrian signal faces installed at an intersection must be the same make and type.

#### **A. Type A**

Each Type A pedestrian signal face must include a housing, 1 LED pedestrian signal combo module and a front screen.

#### **B. Front Screen**

Front screen installation for each Type A signal must comply with one of the following:

1. Install, tilting downward, at an angle of  $15 \pm 2$  degrees out from the top, an aluminum honeycomb screen with 0.2- inch cells, 3/8-inch thick, or a plastic screen of 3/8-inch squares, 1/2-inch thick with wall thickness of 1/16-inch. Completely cover message plate. Include a clear front cover of 1/8-inch minimum thickness acrylic plastic sheet or 1/16-inch minimum thickness polycarbonate plastic. Hold screen and cover firmly in place with stainless steel or

2. Aluminum clips or stainless steel metal screws.
3. Install a 1-1/2-inch deep eggcrate or Z crate type screen of 1/32-inch nominal thickness polycarbonate. Mount screening in a frame constructed of 0.040-inch minimum thickness aluminum alloy or polycarbonate. Install screen parallel to face of message plate and hold in place with stainless steel screws. Visor as specified in Section 86-4.06D, "Visors", of the Caltrans Standard Specifications, is not required.

Screen and frame must be one of the following:

1. Manufactured from aluminum anodized flat black
2. Finished with lusterless black exterior grade latex paint formulated for application to properly prepared metal surfaces.
3. Manufactured from flat black plastic

**C. Housing**

Pedestrian signal housing must comply with Section 86-4.01A, "Signal Sections", of the Caltrans Standard Specifications.

**D. Visors**

The Contractor shall use material similar to housing. The Contractor shall extend top of visor a minimum length of 6 inches at top and 5 inches at bottom when measured from front surface of line. Front must be normal to top.

**E. Finish**

The Contractor shall paint exterior of each housing and visor, and interior of visor with "Mesa Brown" as specified in Section 86-2.16, "Painting", of the Caltrans Standard Specifications.

**F. Control**

Pedestrian signals must be controllable by solid-state switching devices specified for traffic signal controller assemblies.

**G. Terminal Blocks**

Include light duty terminal block, as specified in Section 86-4.01B, "Electrical Components", of the Caltrans Standard Specifications, with each pedestrian signal face.

**1.24 SIGNAL MOUNTING ASSEMBLIES**

**A. Signal mounting assembly must include:**

1. 1-1/2-inch standard steel pipe or galvanized conduit
2. Pipe fitting made of ductile iron, galvanized steel, aluminum alloy Type AC-84B No. 380, or bronze

3. Mast arm and post top slip-fitters, and terminal compartments made of cast bronze or hot-dip galvanized ductile iron

After installation, clean and paint exposed threads of galvanized conduit brackets and bracket areas damaged by wrench or vise jaws. Use wire brush to clean and apply 2 coats of approved unthinned zinc-rich primer, organic vehicle type, as specified in Section 91, "Paint." Do not use aerosol can.

Fit each terminal compartment with a terminal block having a minimum of 12 positions, each with 2 screw-type terminals. Each terminal must accommodate at least five No. 14 conductors. Include a cover on compartment for ready access to terminal block. Terminal compartment used to bracket mount signals must be bolted securely to pole or standard.

Horizontal dimension of mounting assembly members between vertical centerline of terminal compartment or slip-fitter, and the vertical centerline of each signal face must not exceed 11 inches, except where required for proper signal face alignment or to allow programming of programmed visibility signal faces.

Mounting assembly members must be plumb or level, symmetrically arranged, and securely assembled.

Mounting assembly must be watertight, and free of sharp edges or protrusions that might damage conductor insulation. Include positive locking serrated fittings that, if mated with similar fittings on signal faces, will prevent faces from rotating.

Orient each mounting assembly to allow maximum horizontal clearance to adjacent roadway.

Use slip-fitter for post-top mounting of signals. Fit slip-fitter over a 4-1/2-inch outside diameter pipe or tapered standard end.

Include cadmium-plated steel set screws. Include an integral terminal compartment for each slip-fitter used to post-top mount signals with brackets.

Do not install signal faces at an intersection until all other signal equipment, including complete controller assembly, is in place and ready for operation. You may mount signal faces if covered or not directed toward traffic.

## **1.25 DETECTORS**

Video Detection System



The Video Detection System shall be the Autoscope Encore (by Econolite) salvaged from the existing traffic signal system.

A. System Hardware

The Contractor shall relocate the existing video cameras to the new traffic signal system after all conductors have been installed. The contractor shall coordinate with the City of Menlo Park to minimize down time.

Video cameras shall be installed on a 6' pole riser and per City of Menlo Park standards.

B. Power

The MVP sensor shall operate on 110/220 VAC, 50/60Hz at a maximum of 25 watts. The camera and processor electronics shall consume a maximum of 10 watts and the remaining 15 watts shall support an enclosure heater.

C. Detection Zone Programming

Placement of detection zones shall be by means of a PC with a Windows XP or Vista operating system, a keyboard, and a mouse. The PC monitor shall be able to show the detection zones superimposed on images of traffic scenes.

The detection zones shall be created by using a mouse to draw detection zones on the PC monitor. Using the mouse and keyboard it shall be possible to place, size, and orient detection zones to provide optimal road coverage for vehicle detection. It shall be possible to download detector configurations from the PC to the MVP sensor and cabinet interface module, to retrieve the detector configuration that is currently running in the MVP sensor, and to back up detector configurations by saving them to the PC fixed disks or other removable storage media.

The supervisor computer's mouse and keyboard shall be used to edit previously defined detector configurations to permit adjustment of the detection zone size and placement, to add detectors for additional traffic applications, or to reprogram the MVP sensor for different traffic applications or changes in installation site geometry or traffic rerouting.

D. Optimal Detection

The video detection system shall optimally detect vehicle passage and presence when the MVP sensor is mounted 30 feet (10 m) or higher above the roadway, when the image sensor is adjacent to the desired coverage area, and when the distance to the farthest detection zone locations

are not greater than ten (10) times the mounting height of the MVP. The recommended deployment geometry for optimal detection also requires that there be an unobstructed view of each traveled lane where detection is required. Although optimal detection may be obtained when the MVP is mounted directly above the traveled lanes, the MVP shall not be required to be directly over the roadway. The MVP shall be able to view either approaching or receding traffic or both in the same field of view. The preferred MVP sensor orientation shall be to view approaching traffic since there are more high contrast features on vehicles as viewed from the front rather than the rear. The MVP sensor placed at a mounting height that minimizes vehicle image occlusion shall be able to simultaneously monitor a maximum of six (6) traffic lanes when mounted at the road-side or up to eight (8) traffic lanes when mounted in the center with four lanes on each side.

#### **1.26 PEDESTRIAN PUSH BUTTON ASSEMBLIES**

Housing must be either die-cast or permanent mold-cast aluminum, or ultraviolet stabilized, self-extinguishing structural plastic, if specified. Plastic housing must be black matching Color No. 17038, 27038 or 37038 of Federal Standard 595B, and colored throughout. Assembly must be rainproof and shockproof in any weather condition. Switch must be a single-pole, double-throw, switching unit, with screw type terminals, rated 15 A at 125 V (ac), and must have:

- Plunger actuator and a U frame to allow recessed mounting in push button housing
- Operating force of 3.5 pounds
- 1/64-inch maximum pretravel
- 7/32-inch minimum overtravel
- 0.0004- to 0.002-inch differential travel
- 2-inch minimum diameter actuator

Where pedestrian push button is attached to a pole, shape housing to fit the pole curvature and secure. Include saddles to make a neat fit if needed.

Where a pedestrian push button is mounted on top of a 2-1/2-inch diameter post, fit housing with a slip-fitter and use screws for securing rigidly to post.

Pedestrian push button signs must be porcelain enameled metal or structural plastic.

Install push button and sign on crosswalk side of pole.

Point arrows on push button signs in the same direction as the corresponding crosswalk.

Attach sign on Type B push button assembly.

For Type C pedestrian push button assembly, mount instruction sign on the same standard as the push button assembly, using 2 straps and saddle brackets. Straps and saddle brackets must be corrosion-resisting chromium nickel steel and comply with ASTM A 167, Type 302B. Theft-proof bolts must be stainless steel with a chromium content of at least 17 percent and a nickel content of at least 8 percent.

#### **1.27 LIGHTING**

Traffic signal lighting shall conform to Section 86-6 "Lighting" of the Caltrans Standard Specifications and these project specifications.

Luminaires shall be BETA LED or approved equal.

Each luminaire shall be furnished with photoelectric unit receptacle.

All luminaires to be mounted on horizontal mast arms, when tested in accordance with California Test 611, shall be capable of withstanding cyclic loading in:

- A vertical plane at a minimum peak acceleration level of 3.0 g's peak-to-peak sinusoidal loading (same as 1.5 g's peak) with the internal ballast removed for a minimum of 2 million cycles without failure of any laminar parts; and
- A horizontal plane perpendicular to the direction of the mast arm at a minimum peak acceleration level of 1.5 g's peak-to-peak sinusoidal (same as 0.75-g peak) with the internal ballast installed, for a minimum of 2 million cycles without failure of any laminar parts.

No part of the slip filter mounting brackets on the luminaires shall develop a permanent set in excess of 0.020-inch when the four 3/8-inch diameter cap screws used for mounting are tightened to a torque of 10 foot-pounds.

Ballasts shall be the lag or lead regulator, non-regulating reactor, autotransformer or high reactance type.

#### **1.28 EMERGENCY VEHICLE DETECTOR SYSTEM**

The Emergency Vehicle Detector System shall be the Opticom Infrared System (By Global Traffic Technologies) Emergency Vehicle Preemption salvaged from the existing traffic signal system.

#### A. General

The Contractor shall relocate the existing EVP detectors to the new traffic signal system after all conductors have been installed. The contractor shall coordinate with the City of Menlo Park to minimize down time.

EVP detectors shall be installed on a vehicle signal head and per City of Menlo Park standards.

#### B. Cable

Optical detector cable (EV-C) shall meet the requirements of IPCEA-S-61-402/NEMA WC 5, Section 7.4, 600-V (ac) control cable, 75°C, Type B, and the following:

1. The cable shall contain 3 conductors, each of which shall be No. 20 (7 x 28) stranded, tinned copper with low-density polyethylene insulation. Minimum average insulation thickness shall be 0.63-mm. Insulation of individual conductors shall be color coded: 1-yellow, 1-blue, 1-orange.
2. The shield shall be either tinned copper braid or aluminized polyester film with a nominal 20 percent overlap. Where film is used, a No. 20 (7 x 28) stranded, tinned, bare drain wire shall be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
3. The jacket shall be black polyvinyl chloride with minimum ratings of 600 V (ac) and 80°C and a minimum average thickness of 1.1 mm. The jacket shall be marked as required by IPCEA/NEMA.
4. The finished outside diameter of the cable shall not exceed 8.9 mm.
5. The capacitance, as measured between any conductor and the other conductors and the shield, shall not exceed 157 pf per meter at 1000 Hz.
6. The cable run between each detector and the controller cabinet shall be continuous without splices or shall be spliced only as directed by the detector manufacturer.

#### **1.29 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT**

##### Removing Electrical Equipment

The Contractor shall remove the existing traffic signal system at Willow Road and Durham Street, and the following provisions shall apply in its removal:

The existing traffic signal shall remain in operation during construction. The Contractor shall coordinate with the City of Menlo Park prior to the system transfer and installation of new conductors. Existing electrical equipment, pull boxes, and conduits, to be removed and not reused or salvaged, become the Contractor's property and the Contractor shall dispose of it under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way", of the Caltrans Standard Specifications.

Unused underground conduit shall be abandoned in place after all conductors have been removed, except that conduit terminations from conduit to be abandoned must be removed from pull boxes to remain. The Contractor shall exercise care in salvaging equipment so that it will not be damaged or destroyed. The following signal equipment shall be salvaged:

- Emergency Vehicle Preemption
- Video Detection System
- Pedestrian Signal Countdown Heads & Mounting Assemblies

Mast arms must be removed from standards.

Luminaires, signal heads, and signal mounting assemblies must be removed from standards and mast arms.

Holes resulting from removing pull boxes must be filled with material equivalent to the surrounding material.

**PART 2 - MATERIALS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

----- E N D -----

**SECTION 33 47 16.17**  
**BIORETENTION SWALE DRAINAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the drainage system under bioretention areas, swales, and permeable pavement areas including impermeable geomembranes, geotextile filter fabrics, drainage fill, subdrain piping, and cleanout extensions, to point of connection to storm sewer.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: For each type of filter fabric, pipe, and fitting indicated
- C. Product Data: Certifications from the manufacturers attesting that materials meet specification requirements.

**1.3 RELATED WORK**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Section 33 40 00, STORM DRAINAGE UTILITIES.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
1. M252 Corrugated Polyethylene Drainage Tubing
  2. M278 Class PS 50 Polyvinyl Chloride (PVC) Pipe
  3. M288 Geotextile Specification for Highway Applications
  4. M294 Corrugated Polyethylene Pipe, 12- to 24-in. Diameter
- C. American Society for Testing and Materials (ASTM):

1. C1173 Specifications for Flexible Transition Couplings for Underground Piping System
2. D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting
4. D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
5. D1203 Standard Test Methods for Volatile Loss From Plastics Using Activated Carbon Methods
6. D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
7. D1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
8. D1790 Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact
9. D2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and fittings
10. D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
11. D2564 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
12. D2729 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
13. D2729 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
14. D2751 Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
15. D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
16. D4716 Test Method for Constant Head Hydraulic Transmissivity (in-Plane Flow) of Geotextiles and Geotextile Related Products
17. D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
18. D6707 Circular-Knit Geotextile for Use in Subsurface Drainage Applications
19. D7176 Standard Specification for Non-Reinforced Polyvinyl Chloride (PVC) Geomembranes Used in Buried Applications
20. D7408 Standard Specification for Non Reinforced PVC (Polyvinyl Chloride) Geomembrane Seams

- 21. F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- 22. F656 Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- 23. F1336 Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- D. Caltrans Standard Specifications:
  - 1. Section 68 Subsurface Drains
  - 2. Section 88 Engineering Fabrics

#### **1.5 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 - Submittal Procedures.
- B. Product data for the following:
  - 1. Perforated pipe and fittings.
  - 2. Solid pipe and fittings.
  - 3. Geotextile fabrics.
- C. Samples:
  - 1. Drainage Fill.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe-fittings, and seals from dirt and damage.
- C. Protect permeable material from contamination by other materials.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORATED WALL AND SOLID WALL PIPE**

- A. ABS Pipe and Fittings: Smaller than 4-inch, ASTM D 2751, SDR 35. Solvent cement joints.
  - 1. Solvent Cement: ASTM D 2235.
  - 2. Perforation Size, Location, and Spacing: ASTM D 2729.
- B. ABS Pipe and Fittings: 4-inch through 12-inch, ASTM D 2751, SDR 35. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Perforation Size, Location, and Spacing: ASTM D 2729.
- C. PE Pipe and Fittings (HDPE): 4-inch through 10-inch, AASHTO M252 Type S (Solid wall.) or SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
  - 3. Perforation Size, Location, and Spacing: AASHTO M 252, Class 2.



D. PE Pipe and Fittings (HDPE): 12-inch through 48-inch, AASHTO M 294. Type S (Solid Wall.) or Type SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.

1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
3. Perforation Size, Location, and Spacing: AASHTO M 294, Class 2.

E. PVC pipe and Fittings: Smaller than 4-inch, ASTM D1785, Schedule 40. Solvent cement joints.

1. Solvent Cement: ASTM D 2564. Include primer according to ASTM F656.
2. Perforation Size, Location, and Spacing: ASTM D 2729.

F. PVC Pipe and Fittings:

1. Pipe: 4-inch through 15-inch, ASTM D 3034, SDR 35. Bell and spigot joints.
2. Perforation Size, Location, and Spacing: ASTM D 2729.
3. Fittings: ASTM F 1336.
4. Joint Gasket: Elastomeric seal, ASTM F 477.

## **2.2 SPECIAL PIPE COUPLINGS**

A. Description: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

## **2.3 CLEANOUTS**

A. See Section 33 30 00, SANITARY SEWERAGE UTILITIES

## **2.4 DRAINAGE FILL MATERIAL**

A. Caltrans Permeable Material: Class 2 conforming to Section 68-1.025 of Caltrans Standard Specifications, Class 2.

B. Sand: Conform to Section 19-3.025B of Caltrans Standard Specifications.

## **2.5 GEOTEXTILE FILTER FABRIC**

A. Where indicated on plans, use nonwoven geotextile filter fabric for encasing permeable drainage material.

1. Caltrans Filter Fabric: Section 88-1.02B of Caltrans Standard Specifications.
2. ASTM D6707.

B. The geotextile shall be manufactured with fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters.

1. Survivability shall be Class 3.
2. Apparent opening size shall be No. 70.

3. Permittivity shall be 0.5 per second, minimum.

## **2.6 IMPERMEABLE GEOMEMBRANE LINER**

- A. Where indicated on plans, use impermeable geomembrane for lining bioretention areas, swales, and permeable pavement areas.

1. 30 mil PVC, ASTM D7176.

Property	Thickness 30 mil	Test Method
Thickness, % Tolerance	±5	ASTM D 5199
Tensile Strength, lbs/in width	73	ASTM D 882, Method B
Modulus at 100% Elongation, lbs/in	30	ASTM D 882, Method B
Ultimate Elongation, %	380	ASTM D 882, Method A
Tear Resistance, lbs	8	ASTM D 1004
Low Temperature Impact, °F	-20	ASTM D 1790
Volatile loss, % max.	0.7	ASTM D 1203, Method A
Pinholes, No. per 10 sq. yds. max.	1	N/A
Bonded Seam Strength, % of tensile strength	80	N/A

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. Install only after unsatisfactory conditions have been corrected.

### **3.2 PIPING APPLICATIONS**

- A. Refer to Plans for location, size, and material designation for individual subdrains.

### **3.3 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS**

- A. Excavation: Section 6 of ASTM D 2321 and as indicated.
- B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.
- C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D 2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers written instructions. Use

increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

- D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.
- E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.
- G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations unless otherwise specified on the plans.

#### **3.4 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS**

- A. Conform to Section 33 40 00 - Storm Drainage Utilities.

#### **3.5 JOINING PIPE**

- A. Join ABS and PVC pipe and fittings with elastomeric seals according to ASTM D 2321 or solvent cement.
- B. Special pipe couplings: 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.

#### **3.6 CLEANING**

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

#### **3.7 INSTALLATION OF GEOMEMBRANE LINER**

- A. Install geomembrane liner on the bottom and sides of the drainage area, as depicted on the plans.
- B. Geomembrane shall be field-seamed using a dual track welder. Single track and/or adhesive seaming shall be allowed around pipe perforations, to patch seams removed for destructive seam testing, and for repairs.

- C. The liner shall be installed with slack to prevent tearing due to backfill, compaction, and settling.
- D. Place filter fabric above the geomembrane to protect it from being punctured during the placement of the drainage fill material above the liner.
- E. If the subgrade contains angular rocks or other material that could puncture the geomembrane, smooth-roll the surface to create a suitable surface.
- F. Connect the geomembrane to adjacent concrete surfaces (curbs, walls, precast drainage structures, etc.) adjacent to and within the drainage area with a nitrile-based vinyl adhesive. Use watertight PVC boots for drain pipe penetrations through the liner.

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