

Solicitation No.
VA-101-12-RP-0140
Project No. 640-424



**Department of
Veterans Affairs**

Specifications

Vol. 4 and 5 Addendum No. 02

For: Loop Road and Site Utilities

Radiology Consolidation

Parking Structure 2

At: VA Medical Center – Palo Alto

3801 Miranda Avenue

Palo Alto, California 94304

Issue:

Open Bids:

Property of Department of Veterans Affairs

Amendment	
No.	Date

TABLE OF CONTENTS

VOLUME 1:	DIVISION 01 - GENERAL REQUIREMENTS
VOLUME 2:	LOOP ROAD AND SITE UTILITIES
VOLUME 3:	LOOP ROAD AND SITE UTILITIES (CONTINUED)
VOLUME 4:	RADIOLOGY CONSOLIDATION
VOLUME 5:	RADIOLOGY CONSOLIDATION (CONTINUED)
VOLUME 6:	PARKING STRUCTURE 2
VOLUME 7	APPENDICES

VOLUME 1 OF 7	DIVISION 01 - GENERAL REQUIREMENTS
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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 010000 - GENERAL REQUIREMENTS ^(Add#02)	10/07/2013
SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION	
SECTION 013216.13 - NETWORK ANALYSIS SCHEDULES	
SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES	
SECTION 014219 - REFERENCE STANDARDS	
SECTION 015719 - TEMPORARY ENVIRONMENTAL CONTROLS	
SECTION 015816 - TEMPORARY INTERIOR SIGNAGE	
SECTION 016000 - PRODUCT REQUIREMENTS	
SECTION 017000 - EXECUTION REQUIREMENTS	
SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT	
SECTION 017700 - CLOSEOUT PROCEDURES	

VOLUME 4 OF 7	RADIOLOGY CONSOLIDATION
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DIVISION 00 - SPECIAL SECTIONS

SECTION 000115.02 - LIST OF DRAWING SHEETS	
- RADIOLOGY CONSOLIDATION ^(Add#01)	09/18/2013

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 014339.13 - VISUAL MOCKUPS ^(Add#01)	09/18/2013
SECTION 014529.02 - TESTING LABORATORY SERVICES - RADIOLOGY CONSOLIDATION	
SECTION 018111.02 - SUSTAINABLE DESIGN REQUIREMENTS - RADIOLOGY	
CONSOLIDATION ^(Add#01)	09/18/2013
LEED PRODUCT DATA SUBMITTAL FORM	
LEED REQUIREMENTS SCORECARD	

SECTION 019100.02 - GENERAL COMMISSIONING REQUIREMENTS - RADIOLOGY
CONSOLIDATION

DIVISION 02 - EXISTING CONDITIONS

SECTION 024100 - DEMOLITION (Add#01)	09/18/2013
SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION (Add#01)	09/18/2013
SECTION 028213.13 - GLOVEBAG ASBESTOS ABATEMENT (Add#01)	09/18/2013
SECTION 028213.31 - ASBESTOS TRANSITE ABATEMENT	

DIVISION 03 - CONCRETE

SECTION 033000 - CAST-IN-PLACE CONCRETE (Add#01)	09/18/2013
SECTION 033300 - ARCHITECTURAL CONCRETE	
SECTION 034100 - PRECAST STRUCTURAL CONCRETE FOR STEAM TRENCHES AND VAULTS (Add#01)	09/18/2013
SECTION 035200 - LIGHTWEIGHT INSULATING CONCRETE	

DIVISION 04 - MASONRY

SECTION 042513.13 - TERRACOTTA RAINSCREEN PANELS (Add#01)	09/18/2013
SECTION 047210 - STONE VENEER WALL (Add#01)	09/18/2013

DIVISION 05 - METALS

SECTION 051200 - STRUCTURAL STEEL FRAMING (Add#01)	09/18/2013
SECTION 051250 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL	
SECTION 053100 - STEEL DECKING	
SECTION 053600 - COMPOSITE METAL DECKING	
SECTION 054000 - COLD-FORMED METAL FRAMING	
SECTION 055000 - METAL FABRICATIONS (Add#01)	09/18/2013
SECTION 055100 - METAL STAIRS	

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

SECTION 061000 - ROUGH CARPENTRY	
SECTION 062000 - FINISH CARPENTRY	

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 070800 - FACILITY EXTERIOR CLOSURE COMMISSIONING	
SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING	
SECTION 071352 - MODIFIED BITUMINOUS SHEET WATERPROOFING	
SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING	
SECTION 072113 - THERMAL INSULATION (Add#01)	09/18/2013

SECTION 072613.13 - CONCRETE SLAB APPLIED VAPOR RETARDER	
SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS (Add#01)	....09/18/2013
SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS	
SECTION 074213.13 - FORMED METAL WALL PANELS	
SECTION 074213.16 - METAL PLATE WALL PANELS (Add#01)	.....09/18/2013
SECTION 075216.13 - STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING, COLD-APPLIED (Add#01)	.....09/18/2013
SECTION 076000 - FLASHING AND SHEET METAL	
SECTION 077100 - ROOF SPECIALTIES	
SECTION 078100 - APPLIED FIREPROOFING	
SECTION 078400 - FIRESTOPPING	
SECTION 079200 - JOINT SEALANTS	
SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES	

DIVISION 08 - OPENINGS

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES (Add#01)	.....09/18/2013
SECTION 081400 - INTERIOR WOOD DOORS (Add#01)	.....09/18/2013
SECTION 081710 - INTEGRATED DOOR ASSEMBLIES (Add#01)	.....09/18/2013
SECTION 083113 - ACCESS DOORS AND FRAMES	
SECTION 083473 - SOUND CONTROL DOOR ASSEMBLIES	
SECTION 083513.23 - ACCORDION FOLDING FIRE DOORS (Add#01)	.....09/18/2013
SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS	
SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS (Add#01)	.....09/18/2013
SECTION 086300 - METAL-FRAMED SKYLIGHTS	
SECTION 087100 - DOOR HARDWARE (Add#01)	.....09/18/2013
SECTION 087113 - AUTOMATIC DOOR OPERATORS (Add#01)	.....09/18/2013
SECTION 087113.11 - LOW ENERGY POWER ASSIST DOOR OPERATORS (Add#01)	.....09/18/2013
SECTION 088000 - GLAZING (Add#01)	.....09/18/2013

DIVISION 09 - FINISHES

SECTION 090600 - SCHEDULE FOR FINISHES (Add#01)	.....09/18/2013
SECTION 092216 - NON-STRUCTURAL METAL FRAMING (Add#01)	.....09/18/2013
SECTION 092400 - PORTLAND CEMENT PLASTERING	
SECTION 092900 - GYPSUM BOARD	
SECTION 093013 - CERAMIC/PORCELAIN TILING (Add#01)	.....09/18/2013
SECTION 095100 - ACOUSTICAL CEILINGS (Add#01)	.....09/18/2013
SECTION 095426 - LINEAR WOOD CEILINGS (Add#01)	.....09/18/2013
SECTION 095429 - WOOD PANEL CEILINGS	
SECTION 096513 - RESILIENT BASE AND ACCESSORIES (Add#01)	.....09/18/2013
SECTION 096516 - RESILIENT SHEET FLOORING	
SECTION 096516.13 - LINOLEUM FLOORING	
SECTION 096519 - RESILIENT TILE FLOORING	

SECTION 096536 - STATIC-CONTROL RESILIENT FLOORING	(Add#01)	.....09/18/2013
SECTION 096800 - CARPETING	(Add#01)	.....09/18/2013
SECTION 098433 - SOUND-ABSORBING WALL UNITS		
SECTION 099100 - PAINTING	(Add#01)	.....09/18/2013
SECTION 099600 - HIGH-PERFORMANCE COATINGS		
SECTION 099654 - POLYVINYLIDENE DIFLUORIDE (PVDF) COATING SYSTEM	(Add#01)	.....09/18/2013
SECTION 099659 - HIGH-BUILD GLAZED COATINGS	(Add#01)	.....09/18/2013

DIVISION 10 - SPECIALTIES

SECTION 101400 - SIGNAGE SIGNAGE SCHEDULE	(Add#01)	.....09/18/2013
SECTION 102113 - TOILET COMPARTMENTS	(Add#01)	.....09/18/2013
SECTION 102123 - CUBICLE CURTAIN TRACKS		
SECTION 102600 - WALL AND DOOR PROTECTION	(Add#01)	.....09/18/2013
SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES		
SECTION 104413 - FIRE EXTINGUISHER CABINETS		
SECTION 105116 - WOOD LOCKERS		
SECTION 108113 - BIRD CONTROL DEVICES		

DIVISION 11 - EQUIPMENT

SECTION 11 23 43 - HANGING GARMENT CONVEYORS	(Add#01)	.....09/18/2013
SECTION 112443.13 - WINDOW WASHING SYSTEMS SAFETY TIE-BACK ANCHOR		
SECTION 117000 - HEALTHCARE EQUIPMENT		

DIVISION 12 - FURNISHINGS

SECTION 122400 - WINDOW SHADES	(Add#01)	.....09/18/2013
SECTION 123200 - MANUFACTURED WOOD CASEWORK		
SECTION 123600 - COUNTERTOPS		
SECTION 124813 - ENTRANCE FLOOR MATS	(Add#01)	.....09/18/2013

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 130541 - SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS	(Add#01)	.....09/18/2013
SECTION 134900 - RADIATION PROTECTION	(Add#01)	.....09/18/2013
WEST PHYSICS CONSULTING SHIELDING DESIGN LETTER		
SECTION 134927 - MAGNETIC RESONANCE IMAGING (MRI) SHIELDED ENCLOSURES	(Add#01) (Add#02)	.....<u>10/07/2013</u>

VOLUME 5 OF 7

RADIOLOGY CONSOLIDATION (CONTINUED)

DIVISION 21 - FIRE SUPPRESSION

SECTION 210512 - MOTOR REQUIREMENTS FOR FIRE-SUPPRESSION EQUIPMENT	(Add#01)	09/18/2013
SECTION 210511 - COMMON WORK RESULTS FOR FIRE SUPPRESSION		
SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS	(Add#01)	09/18/2013
SECTION 213000 - FIRE PUMPS	(Add#01)	09/18/2013

DIVISION 22 - PLUMBING

SECTION 220511 - COMMON WORK RESULTS FOR PLUMBING	(Add#01)	09/18/2013
SECTION 220512 - GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT		
SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING		
SECTION 220711 - PLUMBING INSULATION		
SECTION 221100 - FACILITY WATER DISTRIBUTION		
SECTION 221300 - FACILITY SANITARY AND VENT PIPING	(Add#01)	09/18/2013
SECTION 221400 - FACILITY STORM DRAINAGE	(Add#01)	09/18/2013
SECTION 221436 - PACKAGED, SUBMERSIBLE, DRAINAGE PUMP UNITS		
SECTION 224000 - PLUMBING FIXTURES	(Add#01)	09/18/2013
SECTION 226200 - VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES		
SECTION 226300 - GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES		

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 230130.51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING		
SECTION 230511 - COMMON WORK RESULTS FOR HVAC	(Add#01)	09/18/2013
SECTION 230512 - GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT		
SECTION 230541 - NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT		
SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC		
SECTION 230711 - HVAC AND BOILER PLANT INSULATION	(Add#01)	09/18/2013
SECTION 230923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC	(Add#01)	09/18/2013
SECTION 232113 - HYDRONIC PIPING	(Add#01)	09/18/2013
SECTION 232123 - HYDRONIC PUMPS		
SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING		
SECTION 232223 - STEAM CONDENSATE PUMPS		
SECTION 232300 - REFRIGERANT PIPING		
SECTION 232500 - HVAC WATER TREATMENT		
SECTION 233100 - HVAC DUCTS AND CASINGS	(Add#01)	09/18/2013
SECTION 233400 - HVAC FANS		
SECTION 233600 - TERMINAL UNITS		
SECTION 233700 - OUTLETS AND INLETS		

SECTION 234000 - HVAC AIR CLEANING DEVICES	
SECTION 236400 - PACKAGED WATER CHILLERS (Add#01)	.....09/18/2013
SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS (Add#01)	.....09/18/2013
SECTION 238100 - DECENTRALIZED UNITARY HVAC EQUIPMENT	
SECTION 238200 - CONVECTION HEATING AND COOLING UNITS	
SECTION 238216 - AIR COILS	

DIVISION 26 - ELECTRICAL

SECTION 260511 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS	
SECTION 260521 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)	
SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	
SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (Add#01)	..09/18/2013
SECTION 260536 - WIREWAYS FOR RADIOLOGY EQUIPMENT	
SECTION 260541 - UNDERGROUND ELECTRICAL CONSTRUCTION	
SECTION 260571 - ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY	
SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS	
SECTION 260923 - LIGHTING CONTROLS	
SECTION 262200 - LOW-VOLTAGE TRANSFORMERS	
SECTION 262411 - DISTRIBUTION SWITCHBOARDS	
SECTION 262416 - PANELBOARDS	
SECTION 262419 - MOTOR-CONTROL CENTERS	
SECTION 262511 - BUSWAYS	
SECTION 262713 - ELECTRIC METERING	
SECTION 262726 - WIRING DEVICES	
SECTION 262911 - MOTOR STARTERS	
SECTION 262921 - DISCONNECT SWITCHES	
SECTION 263005 - PHOTOVOLTAIC SYSTEMS	
SECTION 264200 - CATHODIC PROTECTION (Add#01)	.....09/18/2013
SECTION 265100 - INTERIOR LIGHTING	
SECTION 265600 - EXTERIOR LIGHTING	

DIVISION 27 - COMMUNICATIONS

SECTION 270511 - REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS	
SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS	
SECTION 270533 - RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS	
SECTION 270543 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS	
SECTION 270811 - TESTING FOR COMMUNICATIONS	
SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS (Add#01)	...09/18/2013
SECTION 271313 - TELECOMMUNICATION BACKBONE TWISTED PAIR CABLING	
SECTION 271323 - TELECOMMUNICATION BACKBONE ISP FIBER CABLING	
SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING (Add#01)	.....09/18/2013

SECTION 274116 - INTEGRATED AUDIOVISUAL SYSTEMS
SECTION 274131 - MASTER ANTENNA TELEVISION EQUIPMENT AND SYSTEMS
SECTION 275116 - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS
SECTION 275123 - INTERCOMMUNICATIONS AND PROGRAM SYSTEMS
SECTION 275223 - TELECOMMUNICATION NURSE CALL SYSTEMS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 280000 - BASIC SECURITY REQUIREMENTS (Add#01)09/18/2013
SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY
SECTION 280553 - SECURITY SYSTEM LABELING
SECTION 280800 - SECURITY SYSTEM ACCEPTANCE TESTING
SECTION 281300 - ACCESS AND ALARM MONITORING SYSTEM (Add#01)09/18/2013
SECTION 283100 - DETECTION AND ALARM

DIVISION 31 - EARTHWORK

SECTION 312000 - EARTH MOVING
SECTION 312319 - DEWATERING
SECTION 312323.33 - FLOWABLE FILL
SECTION 315100 - EXCAVATION SUPPORT AND PROTECTION

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 320523 - CEMENT AND CONCRETE FOR EXTERIOR
IMPROVEMENTS (Add#01) (Add#02)10/07/2013
SECTION 321216 - ASPHALT PAVING
SECTION 321413 - TURF BLOCK PAVERS (Add#01)09/18/2013
SECTION 321723 - PAVEMENT MARKINGS
SECTION 328400 - PLANTING IRRIGATION (Add#01)09/18/2013
SECTION 329000 - PLANTING (Add#01) (Add#02)10/07/2013
SECTION 329453 - TREE SOIL CELLS (Add#01)09/18/2013

DIVISION 33 - UTILITIES

SECTION 331000 - WATER UTILITIES
SECTION 333000 - SANITARY SEWERAGE UTILITIES (Add#01)09/18/2013
SECTION 334000 - STORM DRAINAGE UTILITIES (Add#01)09/18/2013
SECTION 334716.17 - BIORETENTION AREA, SWALE, AND PERMEABLE PAVEMENT DRAINAGE
SECTION 336300 - STEAM AND CHILLED WATER SITE
DISTRIBUTION (Add#01)09/18/2013

DIVISION 34 - TRANSPORTATION

SECTION 347513.13 - ACTIVE VEHICLE BARRIERS

VOLUME 7 OF 7

APPENDICES

Appendix A - Geotechnical Investigation: Phase 2 Improvements - Packages 1, 2, 3, and 5

Appendix B - Facilities Protection Plan for Hillview-Porter Regional Program
Groundwater Remediation Facilities at the Veterans
Administration Hospital Property, Palo Alto, Ca.

Appendix C - Stormwater Pollution Prevention Plan

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(Add#01) 18 SEP 2013, Addendum No. 1

(Add#02) 07 OCT 2013, Addendum No. 2

SECTION 134927

MAGNETIC RESONANCE IMAGING (MRI) SHIELDED ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes integrated radio frequency (RF) shielded enclosures with magnetic shielding for magnetic resonance imaging (MRI) rooms.

1.2 RELATED WORK

- A. Sustainable design requirements and procedures including submittal requirements: Section 018111.02, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Procedures and requirements for managing and disposing construction and demolition waste: Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- C. Section 033000 "Cast-in-place Concrete" for concrete substrate.
- D. Section 055000 "Metal Fabrications" and Section 051200 "Structural Steel Framing" for structural steel supports for the attachment of the MRI shielding enclosure components.
- E. Section 072613.13 "Concrete Slab Applied Vapor Retarder" for concrete slab vapor emission controls.
- F. Section 092216 "Non-Structural Metal Framing" for parent wall framing systems.
- G. Section 099123 "Interior Painting" for field painting or other architectural finishes, either internal or external to MRI shielding enclosure
- H. Division 09 "Finishes" for finish work applied over MRI shielding enclosure or for preparing surfaced to receive MRI shielding enclosure.
- I. Division 22 "Plumbing" for pipe connections to or from the installed wave guide beyond cutoff pipe penetration.
- J. Division 23 "Heating, Ventilating, and Air Conditioning" and Division 26 "Electrical" for special filtering, other than that specified within this section, either mechanical or electrical, related specifically to the installation of the MRI imaging system.
- K. Division 23 "Heating, Ventilating, and Air Conditioning" for connections of ductwork to or from the installed wave-guide shielded air vents.
- L. Division 23 "Heating, Ventilating, and Air Conditioning" for dielectric connection to the exterior side of each mechanical pipe penetration of a suitable material to maintain a minimum of 1,000 ohms DC resistance to earth

ground, construct of material suitable to conditions of service on which it is installed.

- M. Division 26 "Electrical" for electrical connection to the installed RF power and/or signal filters, either internally or externally to the enclosure.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. LEED Submittals: Submit in accordance with Section 018111.02.
 - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
 - 2. LEED Product Data Submittal Form: Submit completed product data form provided by the Contracting Officer's Representative; certified by vendor, installer, subcontractor, and/or manufacturer as appropriate.
- D. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include construction details shielding enclosure assembly and component parts. Include RF shielding penetration location and details. Indicated dimensions, required clearances, method of attachment, components, and location and size of each field connection.
- E. Qualification Data: For manufacturer.
- F. Field Quality-Control Reports:
 - 1. RF Qualification Test - upon completion of shielding enclosure.
 - 2. RF Acceptance Test - upon completion of shielding enclosure.
 - 3. Ground Isolation Monitoring Test - before any utility connections.
- G. Sample Warranty: For manufacturer's warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An entity normally engaged in engineering, manufacturing, and installing of RF shielded enclosures, with documented successful in-service performance for at least five projects of similar scope as this project for at least five consecutive years.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Standards:
 - 1. IEEE-299(as modified for MRI testing) Methods of Attenuation Measurements for Electromagnetic Shielding Enclosures for Electrical Test Purposes.
 - 2. MIL STD 220 A Methods of Insertion Loss Measurements for Radio Frequency Power Line Filters.
 - 3. ASTM E84-11 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 4. ASTM E90-09 Standard Test Method for Airborne Sound Transmission Loss of Burning Partitions and Elements.
 - 5. ASTM E413-10 Classification for Rating Sound.

1.7 FIELD CONDITIONS

- A. MRI exam room and staging area shall be weatherproofed, dry (non-condensing) and temperature controlled between 60°F and 80°F. MRI exam room must be free of clutter and/or debris and the floor broom-swept. Floor slab shall be cured and heated to a minimum of 60°F prior to installing floor shield.

1.8 WARRANTY

- A. Work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21. Provide manufacturer's specialty warranty as follows:
- B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of MRI shielded enclosures that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period: From date of Substantial Completion.
 - a. MRI shielded enclosure: Five years.
 - b. EMI electrical filters, RF shielded doors, RF shielded windows, pipe penetrations, and air vent RF filters: One year.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Performance Requirements: The function of the MRI shielded enclosure is to provide a radio frequency and electromagnetic interference-free environment with a single point ground. For this purpose, the interference-free environment must meet the following minimum functional requirements:
 - 1. Plane field: 100 dB at 150 MHz.
 - 2. Ground Isolation: 3000 Ohms minimum.
 - 3. Perform additional tests per MRI equipment vendor's requirements.
- B. MRI shielded enclosure assembly consists of the following:
 - 1. RF shielded enclosure assembly.
 - 2. Magnetic shielding.
 - 3. RF door unit with pneumatic seals, including frames and hardware.
 - 4. High visibility RF view window.
 - 5. Removable magnet access panel.
 - 6. HVAC supply and return system wave guide.
 - 7. RF attenuation filters for electrical and communications services.
 - 8. Wave-guide type shielded fittings for pipes penetrating the MRI shielded enclosure.
 - 9. RF performance test and report by an independent testing agency.

2.2 MATERIALS

- A. Primary RF Shield (attenuating material): Annealed, pure copper.
- B. Magnetic Shielding: M36 silicon steel.
- C. Surface-Burning Characteristics: Comply with ASTM E 84.
 - 1. Flame Spread Index: 5 or less.
 - 2. Smoke Developed Index: 50 or less.
 - 3. Identify component wood products with appropriate markings complying with ASTM E 84 by a qualified testing agency.

2.3 RF SHIELDING ASSEMBLY

- A. Primary shield:
 - 1. RF shield wall assembly consisting of attenuating material vertically self-supported and structurally independent from the parent building. The wall assembly shall allow for the addition of interior finishes without penetration of the attenuating materials.

2. RF shield ceiling assembly consisting of attenuating material supported by structural assemblies of the parent building. The ceiling assembly shall allow for connection of interior finishes and utilities without penetration of the attenuating materials. RF ceiling supports shall employ RF competent fasteners.
 3. RF shield floor assembly consisting of attenuating material laminated to a substrate for floor application. Acceptable RF shield floor assembly shall be able to resist the ill effects of contacting fluids coming from inside or outside the RF enclosure. Acceptable RF shield floor assemblies:
 - a. RF attenuating material laminated to a non-porous, water-resistant core.
 4. RF Shield Attenuation: Provide RF shield sound reduction systems, minimum STC 41 as determined by ASTM E 413 when tested according to ASTM E 90.
- B. RF Shielded Entry Door: Finish and appearance to match adjacent interior doors as indicated on Drawings, Door Schedule.
1. RF Performance: Provide a proven RF seal design that is serviceable by the end-user. The RF door leaf, frame and seal assembly shall maintain a shielding effectiveness equal to that of shielded enclosure.
 2. Door Lock: Provide a keyed security lock that maintains a shielding effectiveness equal to that of the shielded enclosure.
 3. MRI-RF Door Interlock Switch: Provide RF door with an interlock switch. Refer to Division 26 "Electrical" for interconnections and mounting requirements.
 4. RF Seal: Provide RF door with a pneumatically automated RF seal. RF performance as follows:
 - a. Utilize a proven RF automatic seal design that is easily maintained and serviced.
 - b. Maintain a shielding effectiveness equal to that of the shielded enclosure
 5. Life Cycle Test Rating: Demonstrated life cycle test rating of at least 10,000 operational cycles without loss of specified RF attenuation.
 6. Sound Attenuation: Minimum STC 41 as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.
 7. Door Frame: Pre-finished, non-ferrous aluminum extrusion.
 8. Door Hardware:
 - a. General:
 - 1) Door shall employ fail-safe unlatching; upon loss of power the door will revert to an unsealed condition.
 - 2) Remote activation/deactivation capable.
 - 3) Ferromagnetic parts or items are not permitted.
 - b. Hinges: Full mortise, ball-bearing type, made from non-magnetic material complying with ANSI/BHMA A156.1.

- 1) Provide minimum of three hinges for 7'-0" doors, or one hinge for every 30 inches of door height or fraction thereof. Provide an extra hinge for doors with widths greater than 37 inches up to 48 inches.
 - c. Lock: Mortise type complying with BHMA A156.13, operational Grade 1, non-magnetic construction; classroom function (F05).
 - 1) Trim: Provide trim design to match those of adjacent doors. Refer to Section 087100.
 - 2) Lock Cylinder and Key Requirements: Refer to Section 087100.
 - d. Interlock switch mechanism
 - 1) Two normally open mechanical switches.
 - 2) Exposed, frame mounted, micro-switches are not permitted
 - e. Threshold: Flush to floor finish (without tapers, ramps or vertical edge).
 - f. ~~deleted. Radiation Shield for PET/MR: Shall be lead lined with shade plates as indicated on RF shielding drawings.~~ (Add#01) (Add#02)
- C. RF Shielded Windows: Two-layer screen, manufactured to reduce the moiré pattern, and painted a black finish to increase visibility, dual pane glazing, with trim finish included.
1. Sound Attenuation: Minimum STC 41 as determined by ASTM E 413 when tested according to ASTM E 90.
 2. ~~deleted. Radiation shielding: Window shall include leaded glass as indicated on drawings.~~ (Add#01) (Add#02)
- D. Heating Ventilation and Air Conditioning (HVAC).
1. Vent Type: Wave-guide below cutoff type, 3/16-inch brass hex cell, and 1 inch in thickness.
 2. Design RF shielded air vents to maintain a shielding effectiveness equal to that of the shielded enclosure.
 3. Provide interior and exterior dielectric collars for the attachment of ventilation ductwork.
 4. Refer to Division 23 "Heating Ventilating and Air Conditioning" for installation of HVAC services - employ installation techniques approved by RF shielded enclosure supplier and MRI manufacturer.
- E. Cryogenic Gas Exhaust Wave Guide Vent: Wave-guide below cutoff type, size as required by MRI system manufacturer. Construct cryogenic wave-guide vent of suitable material to maintain a shielding effectiveness equal to that of the shielded enclosure and to prevent structural failure of the wave-guide tube during a magnet quench event.
1. Refer to Division 23 "Heating, Ventilating, and Air Conditioning" for dielectric connections at both the interior and exterior side of the cryogenic RF vent. Dielectric connections shall be of a suitable material to maintain a minimum of 1,000 ohms DC resistance to earth ground and prevent structural failure during a magnet quench event.

2. Refer to Division 23 "Heating, Ventilating, and Air Conditioning" for cryogenic gas exhaust piping systems both below and above the cryogen wave-guide tube assembly installation - employ installation techniques approved by RF shielded enclosure supplier and MRI manufacturer.
- F. EMI Rated Power Line and Signal Electrical Filters: RF shielded electrical filters shall provide an insertion loss as specified within MIL-STD 220 A and maintain the shielding effectiveness equal to that of the shielded enclosure. Provide an EMI filter for each electrical conductor that penetrates the enclosure, including neutral conductors. UL certification will be required for all power line filters.
1. Coordinate information provided by Division 26 "Electrical" to identify specific electrical characteristics and total number of conductors required for all lighting and power circuits, communication devices, environmental control devices, data transmission devices, and fire alarm devices that will be utilized within the RF enclosure.
 2. Refer to Division 26 "Electrical", Division 27 "Communications", and Division 28 "Electronic Safety and Security" for installation of electrical services entering and routing within the RF enclosure - employ installation techniques approved by RF shielded enclosure supplier and MRI manufacturer.
- G. Mechanical Pipe Penetrations: Wave-guide below cutoff type. Construct pipe penetrations of a material suitable to the conditions of service on which it is installed, and to maintain shielding effectiveness equal to that of the shielded enclosure.
1. Refer to Division 21 "Fire Suppression", Division 22 "Plumbing", and Division 23 "Heating, Ventilating, and Air Conditioning" for mechanical pipe penetration services entering and routing within the RF enclosure - employ installation techniques approved by RF shielded enclosure supplier and MRI manufacturer.
- H. Medical Gas Piping Systems: Provide a medical gas panel that complies with NFPA 99C, chapter 42, and of the wave-guide below cutoff type. Each individual medical gas line shall be medically clean type K copper and pass, without seams, through the provided pipe wave-guides. Provide a brass or copper mechanical coupling between the exterior end of the threaded gas line wave-guide that the pass through copper pipe. Division 15 subcontractor to RF seal the exterior end of each pipe wave-guide to the respective gas pipe using approved methods.
1. The use of threaded fittings with dielectric connectors shall be prohibited.
 2. Refer to Division 22 "Plumbing" for installation of medical gas lines.
- I. Grounding Conductor Terminal: Provide a single point ground conductor terminal using a brass stud and an external and internal tapped and threaded copper buss bar. The grounding stud shall be common to both interior and exterior of enclosure. Locate grounding buss bar terminal as directed by the MRI manufacturer in relation to both the MRI penetration panel and EMI power line filters.

1. Refer to Division 26 "Electrical" for installation of ground conductors entering and routing within the RF enclosure - employ installation techniques approved by RF shielded enclosure supplier and MRI manufacturer.
2. RF shield shall be properly grounded prior to the connection of electrical services to any EMI power and/or signal filter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation of MRI shielded enclosure and other conditions affecting performance of the Work.
 1. Verify concrete floor for installation tolerances as follows:
 - a. Levelness: +/- 1/8-inch from established floor elevation, not to exceed 1/4-inch across entire MRI Scan Room.
 - b. Survey concrete floor using a laser level and record the floor elevation readings at the intersections of a 48-inch grid. Record the floor elevation readings using the sheets attached to this Section.

3.2 PREPARATION

- A. Concrete Substrates with Adhered RF Shielding:
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by RF shielding manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by RF shielding manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Water Vapor Emission Testing and Application of Vapor Retarder (Water Vapor Emission Control):
 - a. Condition the area to be tested for at least 48 hours prior to testing to allow the concrete slab to reach equilibrium with the building's ambient conditions at the service temperature and humidity expected during normal operation. Maintain the temperature and relative humidity for the duration of the testing.
 - b. Perform three tests for the first 1000 sq. ft. (92.9 m2) of flooring. Add one test for each additional 1000 sq. ft. (92.9 m2) or fraction thereof. Conduct tests around the perimeters of the room, at columns, and where moisture may be evident.
 - c. Perform ASTM F 2170 in situ hygrometer probe test at depth of 40% slab thickness for concrete slab that is allowed to dry from top

only, and at depth of 20% of slab thickness for concrete slab that is allowed to dry from top and bottom.

- d. Apply concrete slab vapor retarder (water vapor emission control) in accordance with Section 072613.13.
- 5. Tensile Bond Pull-Off Testing: Perform ASTM C 1583. Proceed with installation only after substrates meet or exceed 200 psi (1.5 MPa) pull-off tensile strength.

B. Concrete Substrates with Modular RF Shielding:

- 1. Verify that substrates are dry.
- 2. Water Vapor Emission Testing:
 - a. Condition the area to be tested for at least 48 hours prior to testing to allow the concrete slab to reach equilibrium with the building's ambient conditions at the service temperature and humidity expected during normal operation. Maintain the temperature and relative humidity for the duration of the testing.
 - b. Perform three tests for the first 1000 sq. ft. (92.9 m2) of flooring. Add one test for each additional 1000 sq. ft. (92.9 m2) or fraction thereof. Conduct tests around the perimeters of the room, at columns, and where moisture may be evident.
 - c. Perform ASTM F 2170 in situ hygrometer probe test at depth of 40% slab thickness for concrete slab that is allowed to dry from top only, and at depth of 20% of slab thickness for concrete slab that is allowed to dry from top and bottom. Proceed with installation only after substrates have a maximum relative humidity level per shielding manufacturer's requirements.
 - d. Where the substrate's relative humidity exceeds the limits indicated, apply concrete slab vapor retarder (water vapor emission control) in accordance with Section 072613.13.

3.3 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturer's recommendations
- B. Assemble MRI shielding enclosure components level, plumb, and true to line, with uniform joints.
- C. Perform installation by system manufacturer, or under manufacturer's direct supervision.

3.4 TESTING

- A. Test enclosure in accordance with IEEE-299, as modified for MR system installation. Demonstrate the required attenuation as detailed under Performance paragraph and as required by magnet manufacturer's documented RF shielding requirements.
- B. Qualification Testing: Perform immediately after completion of the enclosure and prior to installation of architectural surfaces within or

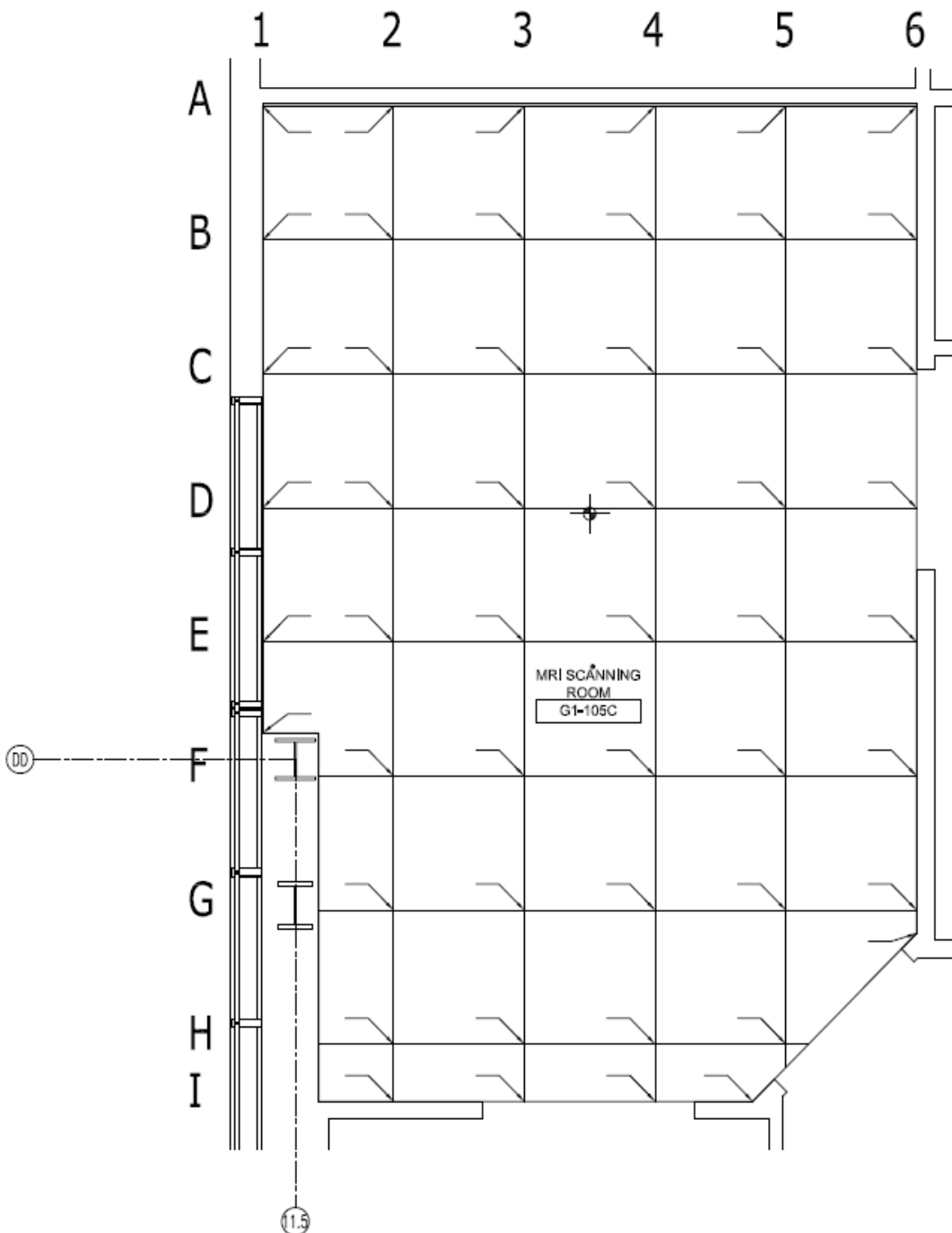
outside the enclosure. Make no trade connections to enclosure until successful completion of test process.

1. An observer of the Government and/or MRI equipment manufacturer will witness the test procedure. Notify the Resident Engineer at least fourteen days prior to the test. Furnish a test report as required.
- C. Acceptance Testing: Perform immediately after installation of the selected MRI assembly and closure of the RF entrance panel.
1. An observer of the Government and/or the MRI equipment manufacturer will witness the test procedure. Notify the Resident Engineer at least fourteen days prior to the test. Furnish a test report as required.
- D. Ground Isolation Monitoring: Monitor ground isolation during entire phase of construction for a minimum of 3,000 ohms above earth potential. Immediately correct deficiencies found that are the result of a fault condition caused by the enclosure supplier. Immediately report deficiencies found to be caused by other trades.
1. Provide a device for continuous monitoring of the RF enclosures ground isolation. Device is to remain with the enclosure for follow up monitoring by the general subcontractor.
 2. Furnish a certification of compliance to the Government.

3.5 CONSTRUCTION WASTE MANAGEMENT

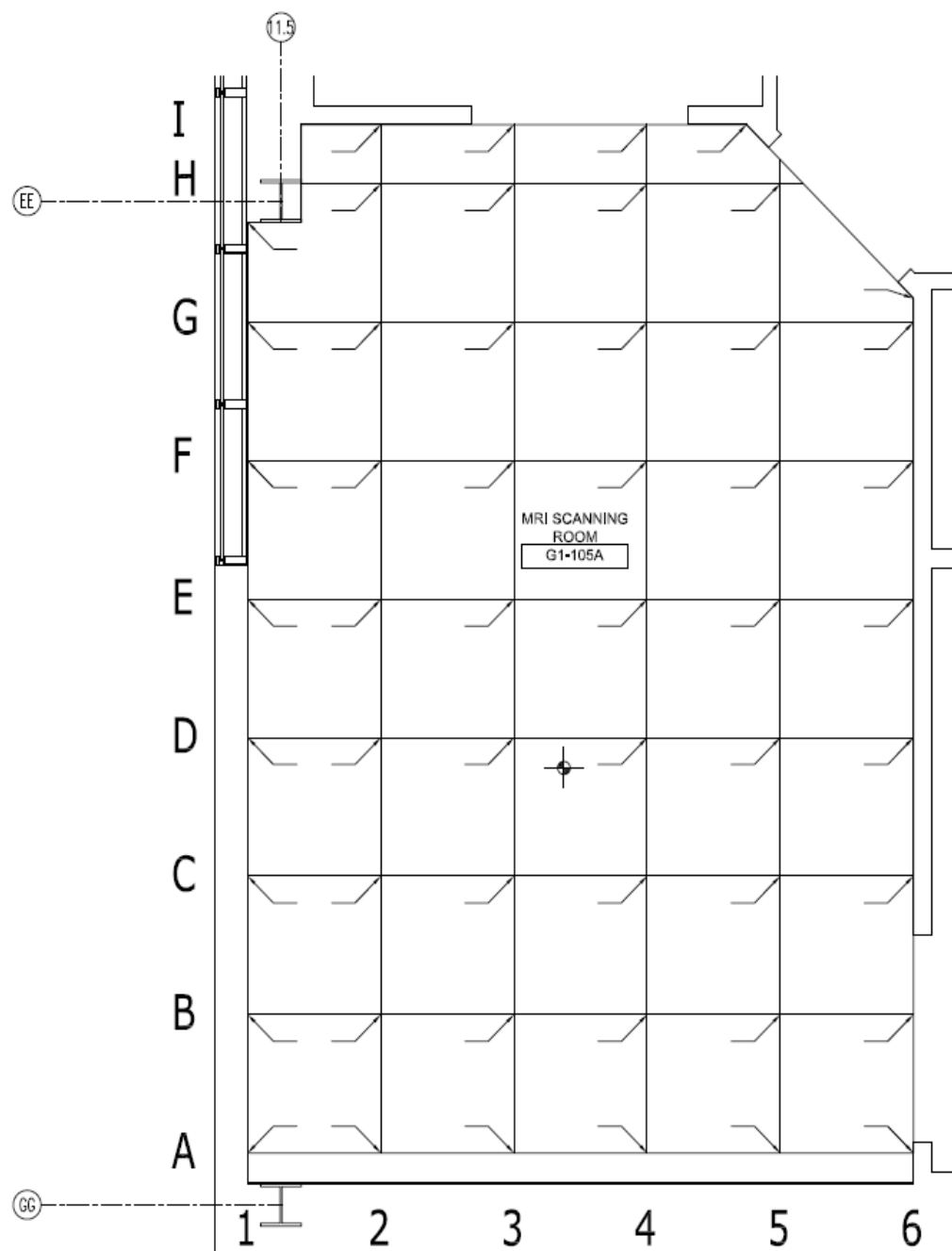
- A. General: Comply with Contractor's Waste Management Plan and Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

3.6 CONCRETE FLOOR LEVELNESS SURVEY



FLOOR LEVELNESS CHART (EAST): (48"x48" GRID)

Verify floor levelness. Reading should be recorded using laser level and results to be recorded on this sheet.

**FLOOR LEVELNESS CHART (WEST): (48"x48" GRID)**

Verify floor levelness. Reading should be recorded using laser level and results to be recorded on this sheet.

- - - E N D - - -

(Add#01) 18 SEP 2013, Addendum No. 01

(Add#02) 07 OCT 2013, Addendum No. 02

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. Curbs, gutters, and wheel stops. (Add#01)
- C. Concrete for stone veneer walls and footings. (Add#01)
- D. Pedestrian Pavement: Walks and wheelchair curb ramps. (Add#01)
- E. Integrally colored cast-in-place concrete.
- F. Finishes (only) for Special ED Drop off concrete pavement. (Add#01)
- G. Vehicular Pavement.
- H. Equipment Pads: transformers.

1.2 RELATED WORK

- A. Sustainable design requirements and procedures including submittal requirements: Section 01 81 11.02, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Procedures and requirements for managing and disposing construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- C. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- D. Color Additives Specified: Section 09 06 00, SCHEDULE FOR FINISHES (Add#01)
- E. Subgrade Preparation: Section 31 20 00, EARTH MOVING.
- F. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.
- G. Deleted (Add#01)

1.3 DESIGN REQUIREMENTS

- A. Design all elements with the latest published version of applicable codes.

1.4 WEATHER LIMITATIONS

- A. 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

- A. The Contractor shall retain and reimburse a testing laboratory to design a select subbase material mixture and submit a job-mix formula to the Resident Engineer, 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:
1. ED Drop off vehicular integral color: Submit color to COTR for approval. *(Add#01)*
 2. Submit full-scale mock-up (minimum 4' by 4') sample panels of all concrete finishes and color. The samples shall include curing compound if any is to be used, and include an expansion joint and a score joint, as indicated on the Drawings. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the Work. *(Add#01)*
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
1. Expansion joint filler
 2. Deleted *(Add#01)*
 3. Reinforcement
 4. Curing materials
 5. Deleted *(Add#01)*
- 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):
 - 1. M031MM031-07-UL Deformed and Plain Carbon Steel Bars for Concrete Reinforcement (ASTM A615/A615M-09)
 - 2. M055MM055-09-UL Steel Welded Wire Reinforcement, Plain, for Concrete (ASTM A185)
 - 3. M147-65-UL Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 2004)
 - 4. M148-05-UL Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309)
 - 5. M171-05-UL Sheet Materials for Curing Concrete (ASTM C171)
 - 6. M182-05-UL Burlap Cloth Made from Jute or Kenaf and Cotton Mats
 - 7. M213-01-UL Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)
 - 8. M233-86-UL Boiled Linseed Oil Mixer for Treatment of Portland Cement Concrete
 - 9. T099-09-UL Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
 - 10. T180-09-UL Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- C. California Department of Transportation Standard Specifications (Caltrans). ^(Add#01)
- D. American Society for Testing and Materials (ASTM):
 - 1. C94/C94M-09 Ready-Mixed Concrete
 - 2. C143/C143M-09 Slump of Hydraulic Cement Concrete

1.8 Deleted ^(Add#01)

PART 2 - PRODUCTS

2.1 GENERAL

- A. Concrete shall be 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:

TYPE	MAXIMUM SLUMP*
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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.	

- B. Concrete pedestrian and vehicular pavements: 3,000 PSI 28 day strength, 3/4" x #4 aggregate size. ^(Add#01)
- C. Concrete landscape walls: 4,000 PSI 28 day strength, 3/4" x #4 aggregate size. ^(Add#01)

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 Resident Engineer.

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 COLOR ADDITIVES ^(Add#01)

- A. ~~Concrete~~ All pedestrian concrete paving shall be integrally colored. ^(Add#02)
- B. Color Additives/Pigments: Insoluble minerals, light fast, at least 95 percent passing #325 sieve complying with ASTM C979: Color as indicated in Section 09 06 00 SCHEDULE FOR FINISHES.

- C. Color additives containing carbon black are not acceptable.

2.6 CURING COMPOUNDS FOR COLORED CONCRETE (Add#01)

- A. Curing Compound for Colored Concrete: Water-base acrylic type, free of permanent color, oil or wax, complying with ASTM C309 and compatible with color additive/pigment

2.7 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 2 and shall be free of paraffin or petroleum. (Add#01)
- B. Deleted (Add#01)

2.8 DAMPPROOFING (Add#01)

- A. Required where walls retain more than 18" of soil and conforming to Caltrans Standard Specifications, Section 54.

2.9 EXPANSION JOINT FILLERS

- A. Material shall conform to AASHTO M213.

2.10 Deleted (Add#01)

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- 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. 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 Resident Engineer 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 Resident Engineer 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 Resident Engineer before placing concrete.

- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Resident Engineer 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 Deleted (Add#01)

3.8 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 Resident Engineer.

3.9 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.

3.10 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.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT AND SPECIAL ED DROP OFF PAVEMENT (Add#01)

- A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces:
 - 1. Walks and Special ED Drop off pavement. Finishes as indicated on Drawings. (Add#01)
 - 2. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.

3. Brooming shall be transverse to the line of traffic.
4. Acid Etched (Acid Washed) Finish: Perform trowel finish and then apply medium level acid wash so that concrete fines are exposed slightly without revealing any of the larger aggregate fines, and resultant surface is similar to medium/heavy grit sandpaper. Finished texture shall match sample approved by Project Manager. *(Add#01)*
5. Sandblast Finish: Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish. *(Add#01)*
 - a. Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to amtch sample, as follows:
 - b. Light Cut: approximately 1/16" depth
 - c. Medium Cut: approximately 1/8" to 3/16" depth
6. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
7. 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.
8. 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.
9. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
10. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

B. Deleted *(Add#01)*

3.12 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.

3.13 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.

3.14 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.

3.15 CONTRACTION JOINTS

- A. Unless indicated on drawings as a sawcut joint, Cut joints to depth as shown with a grooving tool or jointer of a radius as shown. Sawcut joints shall be sawn with a blade producing the required width and depth. *(Add#01)*
- 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, unless indicated as sawcut. ^(Add#01)
- E. Score pedestrian pavement with a standard grooving tool or jointer.

3.16 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.

3.17 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.

3.18 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.

3.19 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 Resident Engineer.
- 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. For colored concrete, refer to CURING COMPOUNDS FOR COLORED CONCRETE above in PART 2- PRODUCTS. Apply as recommended by manufacturer. *(Add#01)*
- E. Deleted *(Add#01)*

3.20 DAMPPROOFING *(Add#01)*

- A. Mop apply one heavy coat of asphalt dampproofing to soil side of retaining walls and planter walls from top of footing to a minus 2 inches below finish soil grade.

3.21 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.

3.22 PROTECTION

- A. 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 Resident Engineer, 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 Resident Engineer.

3.23 FINAL CLEAN-UP

- A. Remove all debris, rubbish and excess material from the Station.

3.24 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 - - -

(Add#01) 18 SEP 2013, Addendum No. 01
(Add#02) 07 OCT 2013, Addendum No. 02

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. Sustainable design requirements and procedures including submittal requirements: Section 01 81 11.02, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Procedures and requirements for managing and disposing construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- C. Section 32 84 00, PLANTING IRRIGATION.
- D. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

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. Tree Soil Cells
 - 5. Iron Sulfate
 - 6. Tree Guy Material
 - 7. Filter Fabric
 - 8. Perforated Drain Pipe
 - 9. Aluminum Edging (Header)

10. Fiberglass Planter. (Add#01)

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.

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. Bioswale Mineral Component (soil) Backfill: Submit 1/2-pint sample
5. Bioswale Yard Waste Compost: Submit 1-pint sample Technical Data Sheet and STA certification.
6. Bioswale Mulch: Submit 1-pint sample
7. Imported Planting Soil: Submit 1-pint sample
8. Turf Sod Mix: Submit 1/2-pint sample
9. Bioswale Mineral Component (soil) Backfill. Submit ½ gal. sample of mineral component 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.
10. Bioswale Yard Waste Compost (organic amendment for Bioswale).
11. Tree Soil Cell Soil Backfill, with 6-20-20 fertilizer but without organic amendment.
12. Street Planting Area soil backfill
13. 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. Deleted (Add#01)

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. Sod
 4. Membranes
- H. Manufacturer's Literature and Data:
1. Metal edging
 2. Antidesiccant
 3. Erosion control materials
 4. Pre-emergent herbicide
 5. 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 sod moist and protected prior to placement.
2. Keep fertilizer in dry storage away from contaminants.
3. 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.
 - b. 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 AND TURF 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 AND TURF ESTABLISHMENT PERIOD

- A. The Establishment Period for plants and turf 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 and Turf Establishment Period the Contractor shall:
1. Water all plants and turf 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 and turf.
 2. Prune plants and replace mulch as required. Prune trees and plants as directed by the Resident Engineer and under the direct supervision of a foreman certified by Western Chapter of International Arboriculture Society (WCIAS) and in accordance with WCIAS standards.
(Add#02)
 3. Replace mulch as needed to maintain required depth. (Add#02)
 - ~~3-4.~~ Replace and restore stakes, guy wires, and eroded plant saucers as required.
 - ~~4-5.~~ In all planting areas, remove grass, weeds, and other undesired vegetation, including the root growth, before they reach a height of 75 mm (3 inches).
 - ~~5-6.~~ Spray with approved insecticides and fungicides to control pests and ensure plant survival in a healthy growing condition, as directed by the Resident Engineer.
 - ~~6-7.~~ Provide the following turf establishment:

- a. Eradicate all weeds. Water, fertilize, overseed, and perform any other operation necessary to promote the growth of grass.
- b. Replant areas void of turf 0.1 m2 (one square foot) and larger in area.
- c. Mow the new lawn at least three times prior to the final inspection. Begin mowing when grass is 100 mm (4 inches) high. Mow to a 65 mm (2-1/2 inch) height.

~~7.8.~~ Remove plants that die during this period and replace each plant with one of the same size and species.

1.12 PLANT AND TURF 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 and Turf 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 and turf according to the plans and specifications. All plants and turf 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 and any areas void of turf immediately. A one year warranty for the plants and turf 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 and turf at the end of the One Year Warranty. The Contractor will replace any dead, missing, or defective plant material and turf 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 and turf survival.
 - e. Repair damage caused while making plant or turf 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 and turf 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 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 Top
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 SOD

A. Sod shall be certified sod Grown on Sand base as classified in the TPI Guideline Specifications to Turfgrass Sodding. The composition of the grass species in the sod shall be as follows:

(Botanical and Common Name)	Percent
Dwarf-type Fescue and Tall-type Fescue <u>(Grown on Sand)</u>	80% to 90%
Blue Grass	10% to 20%

B. Quality shall conform to ASPA Guideline Specifications for Sodding.

2.4 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
- C. Sod Fertilizer: Provided by grower

2.5 ORGANIC AMENDMENT FOR IN SITU SOILS (ON-GRADE. Note Tree Soil Cell Backfill does not receive Organic Amendment):

- A. Ground Redwood or Ground Fir Bark with the following properties:

1.	<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.

2.6 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:

Percent Passing by weight	Sieve Designation	
90		1/2"
85-100	9.51 mm	3/8"
50-80	2.38 mm	No. 8 8 mesh
0-40		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.

2.7 IRON SULFATE

- A. Type: Dry form.

2.8 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:

Size	Rate
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

1. 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.

2.9 MULCH

- A. Organic Mulch: Fir tree or pine tree bark, dark gray or black in color; 3/4-inch to 1-inch size.
- B. Rock Mulch: Hard, durable smooth, river washed stone, la paz, gray, 1-2" in size. Refer to Drawings.
- C. Submit samples of organic and rock mulches to the Resident Engineer for approval within two weeks of award of Contract. Resubmit until acceptable to Resident Engineer, at no extra cost.

2.10 TREE SUPPORT POLES:

- A. Support Poles for trees up to 36" box size
- B. 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.

2.11 TIES

- A. Rubber strap, 24-inch minimum length without sharp edges adjacent to trunk.

2.12 TREE GUYING:

- A. If subgrade does not accept poles sufficiently to stabilize the tree, guy trees per these specifications and plans.
- B. For trees up to 3" caliper, 3/16" galvanized steel cable, with rubber tree collar, 12" minimum long, and secured with cable clamp, and attached to anchor for below-grade location.
- C. For trees 3" to 6" caliper, 1/8" galvanized steel cable with rubber tree collar, 21" minimum long, and secured with cable clamp, 3" take-up eye to eye turnbuckle, and attached to anchor for below-grade location.
- D. For trees in raised planters, provide expansion bolt anchors into concrete planter walls and secure cables to anchor bolts.

2.13 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.

2.14 PLANTING SOIL (TOPSOIL):

- A. Planting soil is defined as two types:
 - 1. Planting Area Soil Backfill (soil exposed to surface) is defined as planting soil to be placed over acceptable existing site soil where it exists. Existing acceptable site 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. Tree Soil Cell Backfill, with 6-20-20 fertilizer but without added organic amendment.

2.15 PLANTING SOIL BACKFILL

- A. The silt and clay content of imported Planting Area planting soil backfill shall not exceed that of the existing native subsoil it is to be placed over. It shall be of similar texture, or courser, "Sandy Loam" as classified in accordance with USDA Standards. Provide Native Existing Site Soil Sample Analysis Report for comparison with the Imported Soil Report.

2.16 TREE SOIL CELL SOIL BACKFILL

- A. The silt and clay content of Tree Soil Cell Soil Backfill material shall be a "Loamy Sand" with silt and clay content of 5% to 15% and less than 1% organic material. The Tree Soil Cell Soil Backfill shall be thoroughly blended with 1 1/2 pounds of 6-20--20 fertilizer.

2.17 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.

2.18 PRE-EMERGENCE WEED KILLER

- A. Clean non-staining as recommended by a licensed pest control specialist.

2.19 VINE TIES:

- A. For vines that require supports in order to climb, install anchor bolts with clear vinyl coated 3/16" galvanized steel cable, secured and taut with cable clamps, on structure in configuration approved by Resident Engineer. Train vine branches to supports with green nursery tape.

2.20 BIOSWALE PLANTING SOIL BACKFILL MIX:

- A. Bioswale backfill mix to receive planting shall be as specified below and as shown in Drawings:

BIOSWALE SPECIFICATION GUIDELINES

(Courtesy of Soil & Plant Laboratory, Inc. Santa Clara, CA)

For the filtration of runoff water before it enters the storm drain system

The mineral component shall be classified as USDA sand or loamy sand and shall conform to the following particle size and characteristics.

US Sieve	Size (mm)	Class	% Wt. retained
#10	2.0	Gravel	0-10
#35	2.0-.05	Coarse Sand	20-35
#270	<0.05	Silt & Clay	6-12

Rock ½ inch - 1 inch = 0-5% by volume with none > 1 inch
Organic = 0-3% by weight for below 6 inches

B. PERCOLATION RATE

1. Must fall in the range of 10 inches per hour Initial Rate and 5 inches Sustained rate as determined by SPL method A06-2.

C. CHEMISTRTY SUITIBILITY CONSIDERATIONS

1. Salinity: Saturation Extract Conductivity (ECe) Less than 3.0 dS/m @ 25° C.
Sodium: Sodium Adsorption Ratio (SAR) Less than 6.0
Boron: Saturation Extract Concentration Less than 1.0 ppm
Reaction: pH of Saturated Paste: 5.5 - 7.8 without high lime content.
2. To insure conformance submit 1/2 gallon sample for analytical packages; A06-2, A05-1 to Soils & Plant Laboratory, Santa Clara, CA.

D. PROFILE PREPARATION

1. NOTE: If organic content of the mineral component is less than 0.6% weight, then it should be blended with *compost in volume proportions of 5% compost to 95% mineral.
2. After placement the top 6 inches should be blended with *compost. If bulk blended, proportions should be 1 part compost to 4 parts of the above mineral component. If blended in place this would be equivalent to 4-1/2 cubic yards per 1000 square feet for blending to 6 inches.
3. * Compost to comply with Yard Waste Compost specifications on the enclosed form #415.

E. YARD WASTE COMPOST -FORM #415 SPECIFICATIONS GUIDELINES
(Courtesy of Soil & Plant Laboratory, Inc. Santa Clara, CA)

1. Gradation: A minimum of 90% of the material by weight shall pass a 1/2" screen. Material passing the ½" screen shall meet the following criteria.
2. Percent Passing Sieve Designation
85 - 100 9.51 mm (3/8")
50 - 80 2.38 mm (No. 8)
0 - 40 500 micron (No. 35)
 - a. Organic content: Minimum 50% based on dry weight and determined be ash method. Minimum 250 lbs. organic matter per yard of compost.
 - b. Carbon to nitrogen ratio: Maximum 35:1.
 - c. pH: 5.5 - 8.0 as determined in saturated paste.
 - d. Soluble salts: Soluble nutrients typically account for most of the salinity levels but sodium should account for less than 25%

of the total. To avoid a leaching requirement, 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.

3. Use the following table to determine the maximum allowable ECe (dS/m of saturation extract) of compost at the desired use rate.

Desired Use Rate		Salinity (ECe) of On-Site Soil		
Cu. Yds. Amendment per 1000 sq. ft. for incorporation to 6" depth	Volume Percentage of Amendment	3 dS/m	2 dS/m	1 dS/m
		Maximum ECe of Compost		
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

4. Example: Specification calls for 4 cu. yds. Compost per 1000 sq. ft. to a 6" depth, and site soil has an ECe of 2.0.
5. In order to avoid exceeding an ECe of 4 in the final blend, compost ECe should be less than 5.5 dS/m.
- a. Contaminants: The compost shall be free of contaminants such as glass, metal and visible plastic. Heavy metals, fecal coliform, and Salmonella sp shall not exceed levels outlined in California Integrated Waste Management regulation/
- b. Maturity characteristics:
- 1) Color: dark brown to black
 - 2) Odor: Acceptable = none, soil-like, musty or moldy
Unacceptable = sour, ammonia or putrid
 - 3) Particle characterization: Identifiable wood pieces are acceptable but the balance of material should be soil-like without recognizable grass or leaves. (3/5/07)

2.21 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%.

2.22 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.

2.23 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.

2.24 AGGREGATE SUB BASE (DRAIN ROCK) BELOW TREE SOIL CELL FRAME

- A. Aggregate subbase below Soil Cell frame: 3/4" X 1/4" clean, crushed, hard durable virgin aggregate rock meeting Caltrans Section 68 to provide subsurface drainage and comply with Specification Section 32 94 53, TREE SOIL CELLS. Submit Sample along with material analysis for approval.

2.25 ALUMINUM EDGING

- A. 3/16" X 4" by 8' black anodized finish with 12" min long stakes set 1/2" below grade at each joint and maximum 4' spacing, in-line joints without offset or double thickness.

2.26 DELETED (Add#01)

2.27 FIBERGLASS PLANTER (Add#01)

- A. All parts shall be constructed of glass fiber reinforced polyester resin, using either the hand-layup or spray-layup methods.
- B. Fibers shall be PPG or equivalent. For hand layup fibers should be uniform chopped strand mat, minimum 3 oz. density. Smaller round containers will use one layer of mat (or spray equivalent), smaller squares and larger round containers must use two layers (or spray equivalent), larger square and rectangular containers must use min. 3 layers (or spray equivalent).
- C. Polyester resin shall be compounded by a reputable manufacturer. All planters and planter liners will be fabricated of 100% resin - inorganic fillers will not be acceptable.

- D. Architectural parts shall be fabricated by hand-layup, spray laminate, or resin transfer method using suitable molds to attain the desired surface finish. The finished reinforced plastic material shall be not less than 5/32" thick and thicker in those areas requiring additional structural strength.
- E. Where ribs or stiffeners are to be fastened to liner sections by spray laminating over premolded forms, the stiffeners or ribs shall be located and spray laminated into position so that the finished joint shall conform to performance specifications below.
- F. For vertical surface reinforcement, an inorganic honeycomb strengthening layer using double-veiled, bonded material shall be located and hand- or spray-laminated into position prior to the wall material setting. The entire honeycomb panel must be subject to pressure during curing to ensure proper bonding to wall. Honeycomb thickness will be minimum 1/4", or thicker as required for larger spans. Marine-grade plywood may be substituted for bottom panels to be penetrated with drainage or irrigation holes.
- G. Interior of planter or planter liner to be waterproofed with additional layer of black gel coating, additional waterproofing available as specified.
- H. Finish: Standard Black.
- I. Submit Shop Drawings for review.

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 Tree Openings, 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 turf, 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 1 inch and larger in size in turf areas and 2 inches or larger in shrub and ground cover areas. Secure approval of the grade by the Resident Engineer before any planting.

3.2 BIOSWALE PLANTING SOIL BACKFILL MIX

- A. Install the above specified bioswale backfill mix as shown in Drawings after approval of the drainage material installation.

3.3 SODED TURF

- A. Lightly roll surface and re-shape to level humps and hollows. Secure Resident Engineer's approval prior to sodding. Do not sod on dry soil.
- B. Lay first strip of sod along a straight line (use a string in irregular areas). Butt joints tightly, do not overlap edges. On second strip, stagger joints. Use a sharp knife to cut sod to fit curves, edges and sprinkler heads.
- C. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to sod and to water until installation is complete.
- D. After laying all sod, roll lightly to eliminate irregularities and to form good contact between sod and soil. Avoid a heavy roller and excessive initial watering.
- E. Thoroughly water the completed sod surface to at least 8 inches deep. Repeat sprinkling at regular intervals to keep sod moist at all times until rooted. After sod is established, decrease frequency and increase amount of water per application.
- F. Protect turf areas by erecting fences, barriers and signs necessary to prevent trespass. Keep barriers neat and well maintained.

3.4 ALUMINUM EDGING

- A. Install in continuous strips as indicated and in accordance with manufacturer's recommendations with stakes spaced 48 inches on center maximum and at all joints.

3.5 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. Break and loosen the sides and bottom of the pit to ensure root penetration and water test hole for drainage as required above.

- D. 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:

Size	Rate
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

- E. 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.
- F. 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.
- G. Build 6" high watering basin berms around trees and shrubs to drain through rootball. Basins are not required around trees in turf areas.
- H. 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.
- L. Trees damaged during installation, including broken branches, shall be brought to the attention of the Resident Engineer. Contractor shall replace damaged tree as determined by the Resident Engineer. If replacement is not necessary, Contractor shall prune damaged branches as directed by the Resident Engineer and under the direct supervision of a foreman certified by Western Chapter of International Arboriculture Society (WCIAS) and in accordance with WCIAS standards. ^(Add#01)

3.6 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.

3.7 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 turf areas, bioswales, or bioretention basins.
- B. Install rock mulch to a minimum 3-inch depth where shown.

3.8 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.

3.9 FIBERGLASS PLANTER *(Add#01)*

- A. Install per Manufacturer's recommendation and as shown on Drawings.

3.10 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.

3.11 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.

3.12 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 and turf 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.

3.13 ENVIRONMENTAL PROTECTION

- A. All work and Contractor operations shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

3.14 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 - - -

(Add#01) 18 SEP 2013, Addendum No. 01

(Add#02) 07 OCT 2013, Addendum No. 02