MOUNT UMUNHUM SUMMIT PROJECT / BID SET PS+E SPECIFICATION INDEX
MROSD / 10 MAY 2016

TECHNICAL SPECIFICATION SECTIONS

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SECTION 02230 - SITE CLEARING

PART 1    GENERAL

1.1    RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2    SUMMARY

A. This Section includes the following:

1. Protecting existing trees and vegetation to remain and providing Vegetation Protection Fencing

2. Installing Temporary Site Construction Fencing (if required or deemed necessary)

3. Pruning existing vegetation near site improvements

4. Clearing and grubbing vegetation above and below grade near site improvements

5. Removing above and below-grade site improvements and site features encountered in the grading work

6. Demolishing and removal of pavements and drainage structures

7. Disconnecting, capping or sealing, and abandoning site utilities, and removing site utilities as encountered

8. Temporary erosion and sedimentation control measures as prescribed by the SWPPP

9. Removing debris and litter throughout site and extending outward (up and down slopes) beyond the project limit of work as noted on the plans

10. Note that all debris shall be considered to be "hot" and potentially hazardous material requiring special handling and disposal. Refer to Division 1 specifications regarding hazardous materials.

11. Hauling and disposing of site debris (hazardous and clean) and vegetation under this Specification Section to an MROSD approved transfer station.

12. Tree and Plant Loss Compensation
13. Traffic and parking control

B. Related Sections include the following:

1. Division 1 Section "Handling, Transport, and Disposal of Hazardous Materials"

2. Division 2 Section "Earthwork and Grading"

1.3 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

B. Existing Soil, Site Soil, and Native Soil: Existing site soils, either undisturbed in native condition or previously graded site soils. Typically consisting of rocky material, low in organic matter.

C. Vegetation Protection Zone: Area surrounding individual trees or vegetation to be protected during construction by Vegetation Protection Fencing, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

D. Temporary Site Construction Fencing: Fencing used to secure Project Limit of Work and/or Staging Areas, Fencing includes footings, gates, and locks.

1.4 MATERIAL OWNERSHIP

A. Artifacts, works of art, or materials indicated on the plans or in the specifications to remain MROSD property, cleared materials shall become Contractor’s property and shall be removed from Project Site and disposed of in a legal manner. Any artifacts found on the site, whether noted or not on the plans, shall remain MROSD property unless otherwise determined. If MROSD or O.R. or agent chooses to relinquish ownership of any found element(s), it shall be the responsibility of the Contractor to dispose of the element(s) in a legal manner off-site.

1.5 SUBMITTALS

A. District will obtain and submit all required local permits to complete the Work. Regulatory permits from Santa Clara County, and Regional Water Quality Control Board will be obtained and paid for by MROSD.
B. Proposed Erosion Control Plan or SWPPP utilizing BMP’s (Best Management Practices) which meet the lead permitting agency’s requirements for Project Site construction erosion control. If agency requirements conflict the most stringent requirements shall be incorporated and met unless the permitting agency determines otherwise.

C. Proposed truck tire wash, dust control, and construction noise abatement plan.

D. Approval from MROSD noting that trees indicated to remain have been protected during construction according to recognized standards and project specifications and that trees were promptly and properly treated and repaired when damaged.

E. Construction Staging Plan noting parking, stockpiling, and haul routes

1. Traffic Control: The Contractor shall submit three copies of proposed traffic control plan to Santa Clara County and MROSD at least five (5) working days prior to commencement of any project work. No work shall be started unless the Traffic Control Plan is approved. This plan shall be submitted in the form of a drawing locating the project area and all major and minor access and exits to and out of this area. The plan shall also include the immediate neighboring areas where the traffic shall be directly or indirectly affected as a result of construction in the project area.

2. The Traffic Control Plan shall be developed for various traffic situations in the Project Site and surrounding areas in full conformance with the California Department of Transportation-California Manual on Uniform Traffic Control Devices-MUTCD, dated 2003 Revision 1, as amended to use in California, Part 6 Temporary Traffic Control for Construction and Maintenance Work Zone hereinafter referred to as Traffic Control Manual.

3. At main entry and exit points for construction access, the Contractor shall provide a 30” x 30” sign advising the public of the anticipated period of time that traffic delays may be anticipated. This sign shall also include name and telephone number of the Contractor along with starting and completion dates of the contract. Sign shall be erected 7 days in advance of initiating any work.

4. If traffic is to be detoured over a centerline or detoured in advance of the Work, detour plan must be incorporated in the traffic control plan. County Police, Fire, and Public Works Department and agencies involved shall be notified at least 48 hours in advance of any work which will interfere with the normal flow of vehicular or pedestrian traffic. Intersection closure may only occur if, in the traffic plan, the two adjacent intersections remain open, unless otherwise approved by the O.R.
5. All signs and devices proposed to warn, direct, and control traffic in the vicinity of the Work shall conform in size, shape, and color to the requirements set forth in the Traffic Control Manual mentioned above and approved by County Engineer in accordance with the Traffic Control Plan.

6. The full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays, designated legal holidays, after 3:00 P.M. on Fridays and the day preceding designated legal holidays, and when construction operations are not actively in progress.

7. Cost of traffic controls, including flag person, shall be included and spread among appropriate bid items as determined by the Contractor.

8. If required, Contractor shall furnish, erect, and maintain all signs including "No Parking" signs. All "No Parking" signs shall be placed as directed by the County Engineer and posted no later than 48 hours or as directed by the Engineer(s) in advance of the time of need. "No Parking" signs shall bear the name of the Contractor and shall also specify the "No Parking" dates and locations.

9. The Contractor shall replace within a 24 hour period any sign that has been damaged, lost, or worn out.

10. The responsible County Engineer shall have authority to change the Traffic Control Plan and make recommendations after the project has started and throughout the project.

F. The Contractor shall comply with County traffic engineering recommendations within a 24 hour period or immediately if requested. Failure to comply with this item shall be enough reason for the County Engineer or O.R. to stop the project.

G. Digital photographs submitted by the Contractor on CD(s), sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

H. Record drawings, prepared by the Contractor shall identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: Conduct meeting at Project site with Agency and MROSD representatives to comply with specified requirements.
1. Before vegetation protection and vegetation pruning operations begin, meet with representatives of authorities having jurisdiction, MROSD, O.R., consultants, and other concerned entities to review and receive approval for all vegetation protection and pruning procedures and responsibilities.

1.7 PROJECT CONDITIONS

A. General:

1. No representation is made as to the accuracy or completeness of the information describing existing conditions, including information describing hazardous materials. The contract shall inspect the site and buildings and shall verify to his/her own satisfaction the conditions thereof.

2. Hazardous materials are known to have previously been present in the buildings and on the site. Undocumented debris, detritus, and other materials from prior work shall assumed to contain hazardous materials. The removal, handling, transport, and disposal of these materials is included in the contract for construction. See specifications and other documents included in the contract for construction. See specifications for specific requirements pertaining to lead, asbestos, refrigerants, oils, fuels, batteries, creosote treated wood and other materials that have special removal or disposal requirements.

B. Demolition Notes:

1. Hazardous materials are known to have previously been present on the site. See specifications and other documents included in the contract for construction for requirements for removal, handling, transport, and disposal of hazardous materials and removal, handling, transport, and disposal of construction debris that contains hazardous materials.

2. Naturally occurring asbestos (NOA) may be present on the site. The contractor is responsible for worker awareness training, controlling dust emissions, worker exposure monitoring, and protection, and notifications and applications.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from MROSD or O.R. and/or other authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Engineer and/or authorities having jurisdiction.
D. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining MROSD property shall be obtained by MROSD before award of Contract.

1. Do not proceed with work on adjoining property until confirming with O.R. that all conditions of MROSD permit for right of entry and construction have been satisfied.

E. Salvable Items: Carefully relocate items to be salvaged and store on Project Site until directed otherwise.

F. Tree and Plant Loss Compensation: Any tree to remain, damaged or destroyed due to the Contractor’s negligence or failure to provide adequate protection shall be compensated for in accordance with the following schedule of values, using "tree-caliper" method (greatest trunk diameter measured 30-inches above ground):

1. For trees or shrubs with diameters up to and including 4 inches, actual cost of replacement with items similar in species, size and shape, including:
   a. Actual cost of item boxed out of ground.
   b. Transportation or delivery of boxed item to the Project site.
   c. Planting and staking.
   d. Maintenance in watering, fertilizing, pruning, pest control and other care to bring replacement to same general conditions as original item. As a note irrigation is not allowed on site so all new planting will need to be hand watered.

2. For trunks up to:

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<td>16 and over, add for each caliper inch:</td>
<td>600.00</td>
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G. Utility Locator Service: Verify locations of existing utilities with utility locator service and as otherwise necessary before commencing site clearing.

H. Do not commence site clearing operations until all BMP’s (Best Management Practices for erosion and sediment control) and SWPPP measures are in place and approved by O.R.

PART 2  PRODUCTS

2.1  MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork and Grading."

   1. Obtain approved borrow materials off-site.

B. Chain-Link Fence: Temporary Site Construction Fencing and Vegetation Protection Fencing. Metallic-coated steel chain-link fence fabric of 0.120-inch-diameter wire; a minimum of 72-inches high; with 1.9-inch-diameter line posts; 2-3/8-inch diameter terminal and corner posts; 1-5/8-inch diameter top rail; and 0.177-inch diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system. Provide standard precast concrete fence footings

   1. Temporary Site Construction Fencing: If requested by MROSD shall include the addition of (3) strands of tensioned barb wire and cantilevered post top braces. At gates, provide minimum 12-foot clear with, two hinged gates with industrial strength steel keyed locks. Provide MROSD with (e) complete sets of keys.

C. Mulch: See Earthwork and Grading Section for Soil Amendment specification.

PART 3  EXECUTION

3.1  PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide three (3) days notice and allow one day for O.R. to locate and clearly flag trees and vegetation to remain or to be salvaged.

C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to O.R.

3.2 UNIDENTIFIED MATERIALS

A. If the Contractor, in the course of normal periodic inspections, identifies any unidentified items, including materials that may contain asbestos or any other potentially hazardous substances that will [or may] require additional demolition and removal other than as required by the Contract Documents, the Contractor shall immediately report any such discrepancies to the Owner as they proceed with demolition or construction operations.

3.3 BMP’S—BEST MANAGEMENT PRACTICES

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal at the completion of the project.

3.4 VEGETATION PROTECTION AND FENCING

A. Temporary Fencing: Install temporary fencing around vegetation protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete. Install chain-link fence according to ASTM F 567 and manufacturer’s written instructions.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by construction operations.

C. Mulch construction affected areas inside Vegetation Protection Zones with 6-inch thick layer of mulch. Hold mulch back 12-inches from tree trunks.

D. Do not store construction materials, debris, or excavated material inside Vegetation Projection Zones. Do not permit vehicles or foot traffic within Vegetation Projection Zones; prevent soil compaction over root systems.
E. Maintain Vegetation Projection Zones free of all weeds, debris, and materials.

3.5 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within Vegetation Projection Zones, unless otherwise indicated.

C. Where excavation for new construction is required within Vegetation Projection Zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

D. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3-inches back from new construction.

E. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

F. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

G. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.6 RE-GRADING ADJACENT TO EXISTING TREES

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist, unless otherwise indicated.

B. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

C. Minor Fill: Where existing grade is 6-inches or less below elevation of finish grade, fill with existing site soil or Soil Amendment (Earthwork Section). Place in a single, un-compacted layer and hand grade to required finish elevations.
3.7 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction.

B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

C. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

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

E. Chip removed tree branches and spread over areas identified by O.R.

3.8 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist’s written instructions.

B. Remove and replace trees indicated to remain that die or are damaged during construction operations that an arborist and/or O.R. determines are incapable of restoring to normal growth pattern.

3.9 UTILITIES

A. There are no known utilities on site that would be affected by this work.

B. If unknown utilities are discovered, locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off any utilities affected by the Work.

2. MROSD shall arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by MROSD or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify O.R. not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without O.R.’s written permission.

D. Excavate for and remove underground utilities indicated to be removed.
E. Contractor shall verify that the utilities indicated to be removed on the Plans are not live by dye testing, smoke testing, television cameras and electronic locators from the outfalls to the plumbing fixtures. Obtain permission from MROSD to enter and search for existing active connections to the drainage outlets or outfalls. Review results of investigation with O.R. prior to plugging or abandoning utility structures.

3.10 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated. Do not remove vegetation in areas outside proposed improvements.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps of trees removed to 8-inches below finish grade on plans and leave roots intact.

4. Use only hand methods for grubbing within Vegetation Protection Zones.

5. Chip all vegetation removed and place on project site as directed by O.R.

B. Remove debris and litter as noted on Plans.

1. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding a loose depth of 8-inches and compact each layer to a density equal to adjacent original ground, maximum 85% relative compaction.

3.11 SITE IMPROVEMENTS

A. Remove existing above and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Address utilities as noted on the Plans.

C. Remove slabs, paving, curbs, gutters, piping, aggregate base, and debris and litter as indicated, and as required to complete the proposed improvements.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length and depth of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of all exposed steel reinforcement in concrete to remain.

3.12 DISPOSAL

A. Disposal: Remove unsuitable and/or surplus soil material, topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off MROSD’s property.

1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile MROSD approved recyclable materials without intermixing with other materials and transport them to recycling facilities or use on site as directed.

END OF SECTION 02230
SECTION 02300 - EARTHWORK AND GRADING

GENERAL

1.1 SUMMARY:

A. This section describes general requirements, products, and methods of execution relating to on-site earthwork. Any work within the public right-of-way shall be constructed to the standards of Santa Clara County and State of California Department of Transportation. Work includes, but is not limited to, the following:

1. Grading.
3. Excavation.
5. Soil Sterilant.
6. Soil Amendment.

B. Provide labor, material and equipment and services necessary to complete the excavations, re-compaction and finish grading as specified and indicated on Drawings.

1. Obtain permit from local authorities.
2. Provide surveying for grading operations.
3. Provide shoring design for temporary construction excavations.
4. Provide dewatering operations.
5. Provide site grading, cut, fill and finish.
6. Provide excavation and backfill for filling construction, including trenches within building lines.
7. Preparation for subgrade for building slabs, walks, pavements, and restoration areas.

8. Provide distribution of stockpiled native topsoil.

9. Provide sub-base course for walks and pavements.

10. Provide engineered fills for building slabs and foundations.

11. Provide sand and gravel for capillary break/moisture barrier under building slabs.

12. Provide sub-surface drainage backfill for walls and trenches.

C. The work includes removal and legal disposal off the site of debris, rubbish and other materials resulting from clearing and grubbing operations.

D. Work specified in Related Sections:

1. Section 02230 – SITE CLEARING.

2. Section 02315 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 DEFINITIONS:

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

B. Engineered Fill:

1. Soil or soil-rock material approved by Owner’s Representative based on recommendations from the project Geotechnical Engineer of Record (GEOR) used by the Contractor in order to raise grades or to backfill excavations.

2. The GEOR will be retained by the Owner and will make sufficient tests and/or observations for the purpose of issuing a written statement that material meets or exceeds the specification requirements.

C. On-site Material: Soil, Bedrock or earth material obtained from required on-site excavation.

D. Existing Soil: Existing graded site soils, typically rocky
E. Soil Amendment: Imported green waste compost and wood chips

F. Dewatering soil (Sandy Loam): Planting soil material for surface dewatering in bio-swales

G. Excavation: Consists of the removal of material encountered to subgrade elevations and the re-use or disposal of materials removed.

H. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, rock base course, or topsoil materials.

I. Treatment soil (sandy loam); planting soil material for treatment of surface storm water in bio-retention areas.

J. Import Material: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

K. Base Course: The layer placed between the sub-base and surface pavement in a paving system.

L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557

M. Over excavation: Removal of material below required subgrade elevations as determined by the GEOR.

1.3 SUBMITTALS:

A. Comply with provisions of Section 01300 – SUBMITTAL PROCEDURES.

B. Product Data: Manufacturer’s literature and data, including, where applicable, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:

1. Imported materials.

2. Class II aggregate base (Caltrans Section 26).


4. Cement Treatment.

5. Geotextiles.

C. Test Reports: Submit following reports for import material directly to Owner’s Representative from the Contractor’s testing services:

1. Test reports on borrow material.

2. Density test reports.

3. One optimum moisture-maximum density curve for each type of soil encountered (perform tests in accordance to ASTM 1557, latest edition).

4. Soil percolation rate test for soils to be used in Storm water treatment zones.

D. Shoring Design: Where shoring is required by State Law or determined by the Contractor to be necessary, provide proposed excavation shoring method for review prior to commencement of excavation requiring shoring. Include the following information:

1. Basic design assumptions.

2. Design Calculations.

3. Describe materials or shoring system to be used.

4. Indicate whether or not any components will remain after filling or backfilling.

5. The shop drawings for the proposed shoring system.

6. Coordinate with the Construction Documents and identify any proposed modifications or deviations.

7. Certification of the above by a registered professional civil or structural engineer licensed by the State of California.

8. Submittal will be reviewed for general conformance with project plans, but no review of calculations will be provided.

E. Dewatering Plan: Based upon site surface and subsurface conditions, including available geotechnical and hydrological data, provide a system to perform the following:

1. Lower the ground water level below bottom of excavation.
2. Relieve the hydrostatic pressure below the subgrade to prevent uplift.

3. Prevent surface drainage from accumulating within work area.

4. Legally discharge and dispose of excess water.

5. Submit description of basic components of proposed dewatering system and its planned method of operation.

F. Samples:

1. Two five gallon buckets of soil and/or rock samples sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow/import sources. Provide to Geotechnical Engineer as requested.

2. 20-lb samples sealed in air tight containers of specialty soils for submission to a plant and soil testing facility for analysis. Include perc test and sieve analysis.

G. Pad Certification

1. Submit a pad certification stamped by a California Licensed Land Surveyor.

H. Storm Water Pollution Prevention / Erosion Control Plans.

I. Permit/Notice of Intent (N.O.I.), for discharge of storm run-off from the construction site.

J. Haul Routes.

1.4 ASSURANCE:

A. Requirements of Regulatory Agencies:


5. BCBG, ACOE, Fish and Game, if relevant.

B. Soil Testing:

1. The GEOR will be engaged by the Owner to include testing soil materials proposed for use in the work and for quality control observation and testing during excavation and fill operations.

2. Test results will be distributed in compliance with Section 01410 – TESTING AND INSPECTION SERVICES.

C. Codes and Standards:

1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

2. Statewide General Permit to Discharge Storm Water associated with construction activity.

3. The project Storm Water Pollution Prevention and Monitoring Plan.

D. Comply with the latest editions of the following Standards and Regulations:

   a. Concrete Aggregates.
   d. C566: Total Evaporable Moisture Content of Aggregate by Drying.
   e. D421: Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
   f. D422: Particle Size Analysis of Soil.
   g. D854: Specific Gravity of Soils.
   h. D1556: Density of Soil by the Sand Cone Method.
   i. D1557: Laboratory Compaction Characteristics of Soil Using Modified Effort

k. D2487: Classification of Soils for Engineering Purposes.

l. D2922: Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

m. D2937: Density of Soil in Place by Drive Cylinder Method.

n. D3017: Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

o. D4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soils.


3. California Department of Transportation (Caltrans) Standard Specifications:
   a. Section 17: Watering.
   b. Section 18: Dust Palliative.
   c. Section 19: Earthwork.

4. CAL/OSHA, Title 8.

5. Santa Clara County Standard Plans and Specifications

6. Other authorities having jurisdiction

E. Geotechnical Engineering Services:
   1. Geotechnical Engineer shall be provided by the Owner or Contractor, as the Owner Representative to observe grading observations during preparation offsite, excavation, and compaction of fill materials.
   2. Make visits to site to familiarize him generally with progress and quality of work.
   3. Make field observations and tests to enable him to form opinions regarding adequacy of site preparation, acceptability of fill materials and extent to which earthwork construction and relative compaction comply with specifications requirements.
4. Examine conditions exposed in foundation excavations.

F. Site Information:

1. Geotechnical Investigation Reports are available for examination by Contractor.

2. Additional soil borings and other exploratory operations may be made by Contractor at no cost to Owner. Submit proposed boring locations for review prior to performing the work.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Protect materials of this section before, during and after installation; objects designated to be retained; and the installed work of other trades.

B. In the event of damage to any of these items, immediately make repairs or replacements necessary to the acceptance of the Owner’s Representative and at no additional cost to the Owner.

C. Comply with provisions of Section 01500 – TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

1.6 PROJECT CONDITIONS:


1. The character of the material to be excavated or used for subgrade is not necessarily as indicated.

2. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

B. Environmental Requirements:

1. Comply with the project SWPPP.
2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water.

3. Provide adequate temporary drainage to prevent erosion.

4. After interruption, reestablish compaction specified in last layer before resuming work.

5. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to Owner.

6. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes, filter fiber dams, or other methods as approved by the SWPPP.

C. Protections of open excavations.

1. Barricade open excavations and post with warning lights.

2. Comply with requirements of Section 01500 –TEMPORARY FACILITIES AND CONTROLS.

3. Operate warning lights as recommended by authorities having jurisdiction.

4. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards.

D. Protection of Subgrade

1. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

2. At Contractor’s option, a working pad of granular material may be laid to protect footing and floor subgrade soils from disruption by traffic during wet conditions, if approved by the geotechnical engineer.

E. Transport of soil materials.

1. Transport all excess soils materials by legally approved methods to disposal areas noted on plans.

2. Coordinate with the Owner’s Representative.
3. Sufficient fill material shall be retained from the site to complete project requirements.

4. Any additional fill requirements shall be the responsibility of the Contractor.

F. Blasting and use of explosives will not be permitted.

G. Dust Control Requirements: At all times during earthwork operations and until final completion and acceptance of the earthwork, the Contractor shall prevent the formation of an airborne dust and dirt nuisance from interfering with the surrounding normal operations. The Contractor shall effectively stabilize the site of work in such a manner that it will confine dust particles to the immediate surface of the work and to obtain a minimum of 40 percent emissions reduction by applying a dust palliative except in areas of active cut and fill. The dust palliative shall be non-petroleum based. Water alone is not considered to be a dust palliative. The dust palliative shall be applied at the rate and method in conformance with Section 18, “Dust Palliative,” of the Caltrans Standard Specifications and as recommended and/or specified by the manufacturer. Contractor shall assume liability for all claims related to dust and dirt nuisances.

1.7 EXISTING UTILITIES

A. The Owner will contact local utility agencies prior to construction and arrange for the shut-off of all utilities serving the buildings to be demolished. Coordinate work required to abandon active lines with the Program Manager and the Owner.

B. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during excavation operations.

C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner’s Representative immediately for directions.

1. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.

2. Repair damaged utilities to the satisfaction of the Owner’s Representative.

D. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Owner’s Representative and then only after acceptable temporary utility services have been provided.
1.8 **SEQUENCING AND SCHEDULING:**

A. The schedule of operations shall be reviewed by the Owner’s Representative prior to commencement of any work.

B. Coordinate operations with other construction activities, such as relocation of existing utilities.

**PART 2 – PRODUCTS**

2.1 **MATERIALS:**

A. **General:**

1. Fill material will be subject to approval of the Geotechnical Engineer.

2. For approval of imported fill material, notify the Owner’s Representative at least 7 days in advance of intention to import material, designated proposed borrow area, and permit the Geotechnical Engineer to sample as necessary from borrow area for purpose of making acceptance tests to prove quality of material.

3. The Geotechnical Engineer’s report on acceptability shall be final and binding.

4. During grading operations, soil types other than those analyzed in the geotechnical report for the project, may be encountered.

5. Consult the Geotechnical Engineer to determine the suitability of these soils.

B. **Engineered Fill Material:** Soil and bedrock (including gravels, cobbles, and boulders) excavated from site (native) or imported conforming to requirements for fill material contained in geotechnical report for this project.

C. **General Fill Requirements:**

1. For site improvement areas: Approved existing soil materials (soils and bedrock) with an organic content less than 3 percent by weight. The General Fill shall not have lumps, clods or cobble pieces larger than 8 inches in diameter and 75% of the fill shall be smaller than 4 inches in diameter. Minor amounts of oversized material (smaller than 12 inches in diameter) may be
allowed provided the oversized pieces are not allowed to nest together and the compaction can occur for loosely placed lifts not exceeding 12 inches.

D. Imported Fill Requirements: Imported fill, where required, shall be non-expansive granular soil, free of organic matter and deleterious substances. Imported fill material shall conform to the following requirements:

1. Grading:
   
<table>
<thead>
<tr>
<th>U. S. Sieve Size</th>
<th>Percentage Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ½ inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 8</td>
<td>25-45</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

2. Be thoroughly compactable without excessive voids.

3. Not contain recycled AC when used beneath the footprint for the trailhead shelter, summit shelter, pit toilets and any other enclosed structure.

4. Import shall not be more corrosive than the on-site soils.

5. Meet the following plasticity requirements:
   
   a. Maximum Plasticity Index of 15, as determined by ASTM D4318.
   
   b. Maximum Liquid Limit of 35, as determined by ASTM D4318.

E. Soil Amendment (Restoration Areas)

1. Amendment for use in restoration areas shall be sandy loam weed free soil. Submit analysis from certified Soil and Plant Lab. Coordinate with Landscape Architect.

2. Soil Amendment for amending Restoration Areas shall be produced from a City of San Jose certified waste diversion facility or equal approved by O.R. The fine or coarse compost materials shall be derived from composted green / yard waste debris only and shall otherwise conform to Caltrans 2015 Standard Specification section 21-2.02K. Wood chip materials shall be derived from clean recycled construction wood debris only and shall otherwise conform to Caltrans 2015 Standard Specification 20-5.03E(2)(c)#3. All materials shall be free of Phytophthora and canker pathogens. Caltrans 2015 Standard Specification source:

3. The soil amendment material may be composed of 100% Coarse Compost as specified in Caltrans 2015 Standard Specification section 21-2.02K.

4. Alternatively the soil amendment material may be composed of a mixture of one quarter (volume basis) of Fine Compost as specified Caltrans 2015 Standard Specification section 21-2.02K mixed uniformly with three quarters Wood Chips as specified in Caltrans 2015 Standard Specification 20-5.03E(2)(c)#3.

F. Sand: Clean, well-graded fine to coarse sand with not more than 2 percent passing the #200 sieve based on wet sieve analysis.

Provide at locations indicated in the construction documents.

Where coarse sand is required, provide sand no finer than No. 40 sieve.

G. Dewatering Soil (Sandy Loam):

1. Soil material (no gravel) with a percolation rate between 2 and 10 inches per hour.

2. Material shall be free of trash and debris, expansive clays, seeds, and other deleterious materials.

3. The dewatering planting soil material shall have documentation from the supplier showing conformance to the following gradation guidelines:

<table>
<thead>
<tr>
<th>Screen Information</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Maximum particle size</td>
<td>2 mm (0.078 in)</td>
</tr>
<tr>
<td>b. Percent passing No.10 screen (2 mm)</td>
<td>100 (coarse sand or finer)</td>
</tr>
<tr>
<td>c. Percent passing No.200 screen (0.074 mm)</td>
<td>10 to 15%</td>
</tr>
<tr>
<td>d. The overall dry weigh percentages shall be 85-90% sand, less than 5% clay, and less than 5% silt. The range of clay and silt and organics should be 10-15% of total volume.</td>
<td></td>
</tr>
</tbody>
</table>

H. Bioretention and Treatment Soil (Loamy Sand):

1. General Requirements:

   a. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour (i.e. the life of the facility).
b. Material shall support vigorous plant growth.

c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
   - 60%-70% Sand
   - 30%-40% Compost

d. Follow Attachment L of the NPDES Stormwater Permit for sand and composted material requirements.

I. Drain Rock (3/4-inch crushed rock):

   1. Washed, uniformly graded mineral aggregate ASTM D448 with percentage composition of dry weight conforming to following limits:
      a. Passing 1-inch Sieve: 100 percent.
      b. Passing 3/4-inch Sieve: 90-100 percent.
      c. Passing No. 4 Sieve: 0-10 percent.

   2. Base at Slab-on-Grade: As specified in the geotechnical report for this project.

   3. Absorption of water to saturated-surface dry condition shall not exceed 3 percent of oven-dry weight of a sample.

J. Backfill material for use behind retaining walls shall be a granular material consisting of sand, broken rock, or a mixture of sand and gravel containing no size larger than 2½ inches and not more than 15 percent passing the No. 200 sieve. GEOR should review and approve proposed retaining wall backfill materials prior to placement and compaction.

K. Pea Gravel: 3/8 inch to ½ inch washed, uncrushed gravel. Use at drainage pipe and at other locations indicated on the project plans and specifications.

L. Filter Fabric: Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4759 and the referenced standard test method in parentheses.

   3. Permeability (ASTM D4491): 135 gallons per minute per square foot.
M. Drainage Pipe:

1. Perforated corrugated plastic drainage tubing meeting ASTM F405, with continuous integral nylon filter screen.


3. Provide couplings, elbows and other fittings as recommended by pipe manufacturer.

N Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

2.2 SOIL STERILANT:

A. Soil Sterilant shall be Treflan E.C. or approved equivalent. Shall be used under vehicular pavements only.

PART 3 – EXECUTION

3.1 GENERAL:

A. Prior to commencement of earthwork, become thoroughly familiar with site conditions.

B. If event discrepancies are found, immediately notify the Owner’s Representative in writing, indicating the nature and extent of differing conditions.

C. Requirements:

1. Grades and elevations are to be established with reference to bench marks referenced on Drawings.

2. Maintain engineering markers such as monuments, bench marks and location stakes. If disturbed or destroyed, replace.

D. No earthwork shall be performed without physical presence or acceptance of the Geotechnical Engineer unless waived in writing by the GEOR.

E. The Geotechnical Engineer’s acceptance is required by these specifications; notify the Owner’s Representative at least 48 hours prior to commencing any phase of earthwork.
1. No phase of work shall proceed until prior phase has been accepted by the Geotechnical Engineer.

2. Work shall not be covered up or continued until acceptance of the Geotechnical Engineer shall give written notice of conformance with the specifications upon completion of grading.

F. Compacting:

1. Compact by power tamping, rolling or combinations thereof as accepted by the Geotechnical Engineer.

2. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.

3. Scarify and re-compact any layer not attaining compaction until required density is obtained.

4. Compaction by flooding, ponding or jetting will not be permitted, unless specifically accepted by the Geotechnical Engineer in writing.

5. Ensure Restoration Areas are amended and then graded but not compacted beyond 85% relative compaction

G. Hazardous Materials

1. If any materials are encountered that may be hazardous (as defined in Section 25117 of the California Health and Safety Code), inform the Owner’s Representative verbally within 24 hours and in writing within 2 business days. Upon discovery, material is to remain undisturbed until investigation by the owner’s representative is complete. The removal and disposal of hazardous materials, if discovered, is not part of the scope of work of this Division for this project.

3.2 SITE PREPARATION:

A. Protect structures, utilities, sidewalks, pavements, and other facilities which are to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Set up tree protection measures prior to commencing grading or demolition operations.

B. Clearing and Grubbing: Coordinate with section 02300 – SITE CLEARING
C. Topsoil:

1. Strip topsoil to whatever depths encountered in manner to prevent intermingling with the underlying subsoil or other objectionable material.

2. Remove heavy growths of grass from areas before stripping. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.

3. Stockpile topsoil in storage piles to freely drain surface water.

4. Cover storage piles if required to prevent windblown dust.

3.3 EXISTING UTILITIES:

A. Protect existing utilities that are to remain in operation as specified.

B. Demolish and completely remove from the site existing underground utilities indicated to be removed. See Section 02200 – SITE PREPARATION AND DEMOLITION.

C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at contractor’s risk.

D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.

1. Use hand or light equipment for excavating immediately adjacent to or for excavations exposing a utility or buried structure.

2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.

3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.

4. Report damage of utility line or subsurface structures immediately to Owner’s Representative.

3.4 PREPARATION OF SUBGRADE:

EARTHWORK AND GRADING
A. Undocumented fill exists in various locations.

1. Provided the excavated fills meet the General Fill requirements they may be reused when backfilling the excavations. If materials are encountered that do not meet the requirements, such as debris, wood and trash those materials shall be screened out and removed from the site.

2. Turnaround: The existing southern slope shall be overexcavated and recompacted as an engineered fill slope. The fill slope shall be overbuilt and trimmed back, exposing engineered fill when complete. Permanent cut slopes in soil shall have a maximum inclination of 1.5:1 (horizontal:vertical). Fill placed for the turnaround shall be benched into the existing slope (per geotechnical recommendations) and a keyway constructed per the geotechnical recommendations and approved by the GEOR during construction. The contractor shall place geogrid consisting of Miragrid 10XT or approved equal as shown on the project plans. The contractor shall prepare a submittal on the type of geogrid to be used on this project prior to delivery to the project site. This work is to be observed and tested by the GEOR.

3. Stairways: Remove all fill material from the footprint of any proposed stairways (approximately 0-7 feet in depth) and recompact as engineered fill. Establish Keyways and Benches into bedrock as shown on the Mitigation Plans prepared by the GEOR. The undocumented fills shall be removed down to the bedrock beneath and to a lateral distance of two feet beyond the stairway footprint or greater as shown on the Mitigation Plans. The sides of the over-excavation shall be sloped at a minimum of 1.5:1 (H:V) or benched up to existing grade. The filled slope shall be overbuilt and trimmed back, exposing engineered fill when complete at the subgrade level for the stairway. Along the length of the stairway, benches and a keyway shall be cut into the bedrock beneath the removed fill prior to material being placed and compacted as engineered fill. Benches and keyway shall be per the geotechnical recommendations and approved by the GEOR in the field at the time of construction. In locations where bedrock is exposed at the existing ground surface and no undocumented fill removal is required, additional fill may be required to be placed as engineered fill in order to raise grades up to the proposed stairway subgrade. If the existing slopes are 6:1 (H:V) or greater, the existing slope shall be benched and a keyway constructed per the geotechnical recommendations. This work is to be observed and tested by the GEOR.

4. Shelter structures and toilet structures: All fills shall be removed from beneath foundations and slabs-on-grade to a lateral distance of at least equal
to fill depth below the footing or slab-on-grade. The trailhead shelter will likely require a minimum 6-foot overexcavation to mitigate undocumented fill. The summit shelter and pit toilet by the lower parking lot will likely require little or no overexcavation as bedrock is exposed at the surface.

5. Helicopter pad and flatwork: fills may be left in place provided they are determined to be low risk for future differential settlement and that the upper 12 inches of fill below subgrade is re-worked and compacted per the requirements below.

B. Scarify soil subgrades to a depth of 6 to 12 inches as determined by the GEOR and moisture condition or dry to near optimum moisture conditions. As an alternative option, the unstable soils can be overexcavated and replaced with dry on-site or import materials (pending review and recommendations from the geotechnical engineer).

3.5 DEWATERING:

A. Do not allow water from surface drainage or underground sources to accumulate in excavations, unfinished fills, or other low areas.

B. Provide and maintain ample means and devices to remove water promptly and dispose properly of water entering excavations or other parts of the work to prevent softening of exposed surfaces.

C. Dewater by methods which will ensure dry excavation and preservation of finish lines and grades of excavation bottoms.

D. Prior to excavating below ground water level, place dewatering system in operation.

1. Lower the ground water level a minimum of 1 foot below the bottom of the excavation.

2. Relieve the hydrostatic pressure in pervious zones below the subgrade elevation to prevent uplift.

3. Use screens and gravel packs as necessary to prevent removal of fines from the soil.

E. Operate the dewatering system continuously, 24 hours a day, 7 days a week until construction work below existing ground water level is completed.

1. Measure and record the performance of the dewatering system.
2. After placement of initial slabs and backfill, the ground water level may be allowed to rise.

3. At no time allow ground water to rise higher than 1 foot below the prevailing level of excavation or backfill.

4. Have a back-up pump and system available for immediate use.

F. Dispose of water away from the work in suitable manner without damage to adjacent property or menace to public health.

G. Do not drain water into work being built or under construction without prior acceptance of the Owner’s Representative.

H. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.6 SITE EXCAVATION:

A. General

1. All supports, shoring, and sheet piling required for the sides of excavations or for protection of adjacent existing improvements shall be provided and maintained by the Contractor. The adequacy of such systems shall be the complete responsibility of the Contractor.

2. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of side forms, except at slab perimeters. Contractor is advised that hard rock excavation and drilling conditions will be encountered at the site and shall include in his scope of work and bid the costs of performing such excavation and drilling without further change orders to the Owner.

3. Large rocks, pieces of concrete or other obstructions, if encountered during the excavation/scarifying operations, shall be removed and disposed of by the Contractor off the site in a legal manner.

4. Where footing excavation is too deep, backfill shall be concrete. Where footings are over dug laterally, side forms shall be employed for backfill with rock fill or concrete backfill shall be used (Contractor’s option).
5. Where forming is required, only that excavation necessary to permit placing and removal of forms shall be done.

6. Bottoms of all footings and foundations trenches shall be subject to observation and/or testing by the Geotechnical Engineer. Corrective measures as directed by the State’s representative shall be executed promptly.

7. Contractor is advised that excavations into on-site soils will encounter Sands and Gravels that will be subject to caving and/or raveling. Even shallow cuts may not stand vertical; contractor is advised that these soil types are OSHA Soil Type C materials and they are responsible for temporary slopes and/or shoring. The Contractor should anticipate additional concrete due to overbreak and/or caving; additional cleaning of excavations during initial excavation, rebar placement, and prior to concrete pouring should be anticipated. Additionally, the Contractor is advised that sloping excavations for footings and grade beams and forming concrete may be necessary; after forms are removed, placement of compacted backfill using hand operated Whacker’s or equal should be anticipated. Submission of a bid for this project constitutes acknowledgement that the above conditions have been considered in the bid price for the construction of the project elements; no additional compensation for these items will be allowed by the project owner.

B. Excavate subgrade as required to allow for finish grades shown on drawings, as required for structural fill or otherwise required for proper completion of the work.

C. Remove and replace subgrade materials designated by Geotechnical Engineer as unsuitable.

3.7 FILL AND COMPACTING:

A. General Requirements:

1. Backfill excavations as promptly as work permits.

2. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the District’s Representative.

3. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
4. In excavations, use satisfactory excavated or borrow material.

5. Under grassed areas, use satisfactory excavated or borrow material.

B. After subgrade compaction has been approved by the Geotechnical Engineer, spread the engineered fill materials in lifts not exceeding 8 inches and uniformly mixed during the spreading operation. See the following table for compaction and moisture conditioning requirements:

<table>
<thead>
<tr>
<th>Description</th>
<th>Material Description</th>
<th>Minimum Relative Compaction (percent)</th>
<th>Moisture Content (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Fill (within upper 5 feet)</td>
<td>On-Site Soils</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>General Fill (below a depth of 5 feet)</td>
<td>On-Site Soils</td>
<td>95</td>
<td>1</td>
</tr>
<tr>
<td>Turnaround and Stairway Fill Backfill</td>
<td>On-Site Soils</td>
<td>95</td>
<td>1</td>
</tr>
<tr>
<td>Wall Backfill Without Surface Improvements</td>
<td>Clean Crushed Rock</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>Wall Backfill With Surface Improvements</td>
<td>Clean Crushed Rock</td>
<td>95</td>
<td>1</td>
</tr>
<tr>
<td>Trench Backfill</td>
<td>On-Site Soils</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>Trench Backfill (upper 6 inches of subgrade)</td>
<td>On-Site Soils</td>
<td>95</td>
<td>1</td>
</tr>
<tr>
<td>Crushed Rock Fill</td>
<td>¾-inch Clean Crushed Rock</td>
<td>Consolidate In-Place</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Expansive Fill</td>
<td>Imported Non-Expansive Fill</td>
<td>90</td>
<td>Optimum</td>
</tr>
<tr>
<td>Flatwork Subgrade</td>
<td>On-Site Soils</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>Flatwork Aggregate Base</td>
<td>Class 2 Aggregate Base</td>
<td>90</td>
<td>Optimum</td>
</tr>
<tr>
<td>Pavement Subgrade</td>
<td>On-Site Soils</td>
<td>95</td>
<td>1</td>
</tr>
<tr>
<td>Pavement Aggregate Base</td>
<td>Class 2 Aggregate Base</td>
<td>95</td>
<td>Optimum</td>
</tr>
<tr>
<td>Asphalt Concrete</td>
<td>Asphalt Concrete</td>
<td>95</td>
<td>NA</td>
</tr>
</tbody>
</table>

1 – Relative compaction based on maximum density determined by ASTM D1557 (latest version)
2 – Moisture content based on optimum moisture content determined by ASTM D1557 (latest version)
3 – Class 2 aggregate base shall conform to Caltrans Standard Specifications, latest edition, except that the relative compaction should be determined by ASTM D1557 (latest version)
4 – Using light-weight compaction or walls should be braced

1. Do not compact the top 12 inches of soil in the planting areas.

C. Repeat compaction procedure until proper grade is attained.

D. Rocks generated during site earthwork may be used in fill when conforming to material specifications.

3.8 MOISTURE CONTROL:

A. Do not place, spread or roll fill material during unfavorable weather conditions or when fill material is excessively wet.
B. Do not resume operations until moisture content and fill density are satisfactory to the Geotechnical Engineer.

C. Provide berms or channels to prevent surface water from flooding excavations. Promptly remove water collecting in depressions.

D. Where soil has been softened or eroded by flooding or by placement during unfavorable weather, remove damaged areas and re-compact as described for fill and compaction.

E. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material.
   1. Prevent free water appearing on surface during or subsequent to compaction operation.
   2. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
   3. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.9 GRADING:

A. General: Uniformly grade areas of work including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
   1. All areas covered by the project, including excavated and filled areas and adjacent transition areas, shall be uniformly graded so that finished surfaces are at the elevations established by the plans. Planter areas to receive future topsoil shall be graded below finished grade to allow for such material.
   2. Finished surfaces and surfaces to receive paving and aggregate base shall be smooth, compacted, and free from irregular surface drainage.
   3. Ditches, gutters, and swales shall be finished to permit proper surface drainage.
   4. All surface areas, except paved and sloped embankments exceeding 8:1, shall be hydroseeded in accordance with specifications in Landscaping Sections.
B. Grading Tolerances:

1. Excavations shall not exceed 0.10-foot variation from dimensions and elevations shown or noted, unless otherwise approved by Owner’s Representative.

2. Fill and backfill shall be placed with tolerance of plus or minus 0.10 foot if placed in layers.

3. Grading shall be done within plus or minus 0.10 foot typically; areas under slabs, walks or pavements shall be graded within tolerance of 0 to 0.10 foot.

4. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

5. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

6. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation.

C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.10 SOIL AMENDMENT FOR RESTORATION AREAS

A. Flag (visually delineate) soil amendment restoration area (SARA) onsite (See Restoration plan)

B. Install Soil Amendment to all restoration areas at the rate of either: 1) a 3 inch surface-applied layer of Wood Chips plus an additional 3/4 inch layer of Fine Compost or 2) a single 3 inch surface layer of Coarse Compost (a.k.a. compost overs).

C. Mix Soil Amendment into the existing soil with excavators or backhoes to incorporate the specified Soil Amendment into the top 18 inches of existing soil by digging at intervals of one- to two-feet with a 12 inch bucket or such that, after incorporation, a quarter of the surface is remains covered with organic materials.

D. Fine grade the surface of the SARA under the direction of Owner’s Representative to original grade to shed surface water and to not erode onto adjacent pavements, drainage inlets, or structures. Site should have smooth, non-furrowed, and de-compacted appearance at completion.
E. Leave non-SARA sites untracked and uncompacted.

F. Provide fencing for SARA sites per Site Furnishings specification 02870

3.11 SOIL STERILIZATION:

A. General: Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base as recommended by the Project Botanist and manufacturer. Sterilant shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath asphalt concrete pavement, brick pavement, concrete pavement, or on-grade concrete slabs including sidewalks, curbs, and gutters and areas between the inner and outer security fences. In addition to ground areas treated, sterilant shall be applied below expansion or control joints, and at all areas where pipe, ducts, or other features penetrate slabs.

3.12 STORM WATER TREATMENT SOIL

A. General: Soil material installed in bio-retention and bio-swales shall be tested in-site to verify the field conditions meet performance requirements.

B. Installation: Place soil material in lifts not exceeding 8-inches. Compact to between 83 and 87 percent relative compaction.

C. Testing: Demonstrate in-site percolation by the following method. One test shall be performed for each treatment measure.

1. Drive a 1 foot diameter pipe 2.5 feet long into the treatment soil until the end is 6 inches above the under drainage (typically 12-inches down).

2. Wet treatment zone then fill pipe with water to 12 inches above ground elevation.

3. Pipe should empty 12 inches of water within the following time periods:

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewatering</td>
<td>1hr 12min</td>
<td>6hrs</td>
</tr>
<tr>
<td>Treatment</td>
<td>1hr 12min</td>
<td>2hrs 24min</td>
</tr>
</tbody>
</table>

4. If the in-situ test fails the soil within the treatment measures shall be removed and re-instated.
3.13 DISPOSAL OF EXCESS AND WASTE MATERIALS:

A. Removal of Excess Excavated Material: Excess material shall be removed by the Contractor off the site in a legal manner.

3.14 FIELD QUALITY CONTROL:

A. Testing Agency Services: Allow GEOR to observe and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D2167 (Rubber Balloon Method), or ASTM D2937 (Drive Cylinder Method), as applicable.

   a. Field in-place density tests may also be performed by the nuclear method according to ASTM D2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D1556. With each density calibration check, check the calibration curves furnished with the moisture gauges according to ASTM D3017.

   b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work on each different type of material encountered, and at intervals as directed by the Architect.

2. Footing Subgrade: At footing subgrades, GEOR to observe each soil or rock stratum to verify design bearing capacities. Subsequent verifications and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Architect.

3. Paved and Building Slab Areas; At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 square feet or less of paved area or building slab, but in no case fewer than three tests unless waived by the GEOR in writing.

4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one filed in-place density test for each 150 feet or less of trench, but not fewer than two tests.

B. Number and location of test shall be at option of the Geotechnical Engineer.

C. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

D. After grading is completed and the testing agency has completed observation of the work, permit no further excavation or filling, except as approved by Owner’s Representative.

3.15 PROTECTION:

A. Protect newly graded areas from traffic and erosion. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer’s recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completion of construction. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

3.16 CLEAN-UP:

A. Comply with requirements of Section 01700 – CLEANING.

END OF SECTION
SECTION 02315 - TRENCHING, BACKFILLING, AND COMPACTING

GENERAL

1.1 SUMMARY:

A. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:

1. Initial Backfill Material.
2. Subsequent Backfill.
3. Detectable Tape.
4. Trench Excavation.
5. Pipe Bedding.
6. Trench Backfill.
7. Trench Surfacing.

B. Work specified in Related Sections include:

1. Section 02300 – EARTHWORK AND GRADING.
2. Section 02630 – STORM DRAINAGE.

1.2 DEFINITIONS:

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

B. Engineered Fill:

1. Soil or soil-rock material approved by the Geotechnical Engineer and transported to the site by the Contractor in order to raise grades or to backfill excavations.
2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.

C. Excavation: Consists of the removal of material encountered to subgrade elevations.

D. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

E. Base: The layer placed between the subgrade and surface pavement in a paving system.

F. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557.

1.3 SYSTEM DESCRIPTION:

A. Requirements:

1. Comply with the recommendations of the Geotechnical Engineer.

2. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.

3. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.

4. Unless otherwise indicated in the Drawings, all excavation for pipelines shall be open cut.

1.4 SUBMITTALS:

A. Comply with provisions of Section 01300 – SUBMITTAL PROCEDURES.

B. Test Reports: Submit the following report for import material directly to the Owner’s Representative from the Contractor’s testing services:

1. Compaction test reports for aggregate base.
C. Submit description of compactors proposed for use when requesting placement of base material.

1.5 QUALITY ASSURANCE:

A. Requirements of Regulatory Agencies:


B. Soil Testing:

1. Contractor shall engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.

2. Test results will be submitted to the Owner’s Representative.

C. Codes and Standards:

1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

2. Storm Water Pollution Prevention Plan to comply with Section 01520 – STORM WATER POLLUTION PREVENTION.

   a. Section 19: Earthwork.

   a. D1556: Density of Soil by the Sand Cone Method.
   b. D1557: Moisture Density Relations of Soils and Soil-Aggregate Mixtures.
1.6 DELIVERY, STORAGE AND HANDLING:

A. Protect materials before, during and after installation.

B. Comply with provisions of Section 01500 – TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during construction activities.

1.7 PROJECT CONDITIONS:

A. Environmental Requirements:

1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

2. Protect existing streams, ditches and storm drain inlets during work on this project.

B. Barricade open excavations and post with warning lights.

1. Comply with requirements of Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

2. Operate warning lights and barricades as required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.

C. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

D. Transport all excess soils materials by legally approved methods to disposal areas.

1. Coordinate with the Owner’s Representative.

2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES:
A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility agency immediately for directions.
   1. Cooperate with the Owner’s Representative and public and private utility companies in keeping their respective services and facilities in operation.
   2. Repair damaged utilities to the satisfaction of the utility owner.

C. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner’s Representative and then only after acceptable temporary utility services have been provided.

1.9 SEQUENCING AND SCHEDULING:

A. The sequence of operations shall be reviewed by the Owner’s Representative prior to commencement of any work.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. General:
   1. Backfill materials will be subject to approval of the Engineer.
   2. For approval of backfill fill material, notify the Owner’s Representative at least 7 days in advance of intention to import material.
   3. Consideration shall also be given to the environmental characteristics as well as the corrosion potential of backfill materials. Laboratory testing, including pH, soluble sulfates, chlorides, and resistivity shall be reviewed. Backfill materials shall not be more corrosive than the native materials.

B. Trench Sand:

C. Trench Gravel:

1. Granular material free from clay, organic materials, and other deleterious substances and conforming to Class 1 Type A Permeable Material, per Caltrans Standard Specification Section 68-2.02F.

D. Approved Native Fill:

1. See Section 02300 – EARTHWORK AND GRADING.

E. Imported Fill:

1. See Section 02300 – EARTHWORK AND GRADING.

F. Class II Aggregate Base: ¾” maximum, Class II AB, free from organic matter and other deleterious substances and conforming to Caltrans Standard Specification Section 26-1.02A.

G. Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

1. Warning Tape Color Codes.
   Red: Electric.
   Yellow: Gas, Oil; Dangerous Materials.
   Orange: Telephone and Other Communications.
   Blue: Water Systems.
   Green: Sewer Systems.
   White: Steam Systems.
   Gray: Compressed Air.
2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 – EXECUTION

3.1 GENERAL:

A. Prior to commencement of work, become thoroughly familiar with site conditions.

B. In the event discrepancies are found, immediately notify the Owner’s Representative in writing, indicating the nature and extent of differing conditions.

C. Backfill excavations as promptly as work permits.

D. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner’s Representative.

E. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
F. In excavations, use satisfactory excavated or borrow material.
G. Under grassed areas, use satisfactory excavated or borrow material.

3.2 COMPACTING:

A. Compact by power tamping, rolling or combinations thereof.
   1. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.
   2. Scarify and re-compact any layer not attaining compaction until required density is obtained.

3.3 SITE PREPARATION:

A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.4 EXISTING UTILITIES:

A. Identity the location of existing utilities.
   1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Drawings, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
   2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
   3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Owner’s Representative to clear the utility.
B. Protect all existing utilities to remain in operation.
C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor’s risk.

D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
   1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
   2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
   3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
   4. Report damage of utility line or subsurface structures immediately to the Owner’s Representative.

E. Backfill trenches resulting from utility removal in accordance with this section.

3.5 TRENCH EXCAVATION

A. General:
   1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
   2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
   3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
   4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:
1. Existing pavement over trench shall be saw cut, removed, and hauled away from the job. Existing pavement shall be neatly saw cut a minimum of 6-inches beyond the limits of excavations.
2. Existing concrete over the trench shall be saw cut to a full depth in straight lines either parallel to the curb or right angles to the alignment of the sidewalk.
3. Boards or other suitable material shall be placed under equipment out rigging to prevent damage to paved surfaces.

C. Trench Width:

1. The maximum allowable trench widths at the top of the pipe shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Type</th>
<th>Trench Width (Maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Outside diameter of barrel plus 18 inches</td>
</tr>
<tr>
<td>Plastic</td>
<td>&quot;</td>
</tr>
<tr>
<td>Vitrified Clay</td>
<td>&quot;</td>
</tr>
<tr>
<td>Cast-Iron</td>
<td>Outside diameter of barrel plus 24 inches</td>
</tr>
<tr>
<td>Concrete Cylinder</td>
<td>&quot;</td>
</tr>
<tr>
<td>Ductile-Iron</td>
<td>&quot;</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

a. The maximum trench width shall be inclusive of all shoring.

b. If the maximum trench width is exceeded, the Owner’s Representative or Inspector of Record may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.

2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Open Trench:

1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.

2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.

E. Excavation Bracing:
1. The excavation shall be supported and excavation operations shall be conducted in accordance with the California Industrial Accident Commission and CAL/OSHA.

2. The Contractor shall, at his/her own expense, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below the pipe grade), and to prevent any movement which could in any way diminish the required trench section or otherwise injure or delay the work. The sheeting and bracing shall be withdrawn in a manner such as to prevent any earth movement that might overload the pipe.

F. Excavated Material:

1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.

2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.

3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.6 PIPE BEDDING

A. Bedding Excavation: The trench shall be excavated below the grade of the pipe bottom to the following minimum depths:

<table>
<thead>
<tr>
<th>Pipe Type</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>3 inch</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>3 inch</td>
</tr>
<tr>
<td>Plastic: 2 inch diameter and smaller</td>
<td>3 inch</td>
</tr>
<tr>
<td>Cast/Ductile Iron</td>
<td>6 inch</td>
</tr>
<tr>
<td>Plastic: over 2 inch diameter</td>
<td>6 inch</td>
</tr>
</tbody>
</table>

1. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The Inspector of Record will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.
2. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing pipe bedding material. Pipe bedding shall be trench sand or trench gravel, as defined in these specifications. Sufficient pipe bedding material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe, plus 1/8th of the pipe diameter. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.7 TRENCH BACKFILL

A. Initial Backfill:

1. Prior to trench backfill, the condition of the trench and lying of pipe must be inspected and approved by the Inspector of Record.

2. Trench Sand and Trench Gravel shall be used for initial backfill. After the pipe has been properly laid and inspected, initial backfill material shall be placed on both sides of the pipe and compacted to final depth as follows:

<table>
<thead>
<tr>
<th>Pipe Type</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>6 inches above top of pipe</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>6 inches above top of pipe</td>
</tr>
<tr>
<td>Plastic: less than 3 inches diameter</td>
<td>6 inches above top of pipe</td>
</tr>
<tr>
<td>Plastic: 3 inches diameter and larger</td>
<td>12 inches above top of pipe</td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>12 inches above top of pipe</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>½ outside diameter of pipe (pipe spring line)</td>
</tr>
</tbody>
</table>

3. Compaction: Initial backfill compaction shall be by mechanical means. The initial backfill material shall be hand tamped in layers not exceeding 4 inches in un-compacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortional stress. After hand tamping, the relative compaction of the initial backfill material shall be not less than 90 percent.

4. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.

B. Subsequent Backfill:
1. Subsequent backfill material shall consist of approved native material, imported fill, or Class II AB conforming to these specifications.

2. Structure and utility trench backfill should be moisture conditioned, placed in lifts eight inches or less in loose thickness, and mechanically compacted to at least 90 percent relative compaction except the relative compaction shall not be less than 95 percent within 2-1/2 feet of finished permanent surface grade or 1-1/2 feet below the finished subgrade, whichever is greater; jetting will not be permitted. The moderately expansive clay soils exposed in trenches should not be allowed to dry out prior to placement of trench backfill materials.

3. It must be the contractor’s responsibility to select equipment and procedures that will accomplish the grading as described above. He/she must organize his/her work in such a manner that the Soil Engineer can test and/or observe each element of grading.

C. Jetting and Ponding:

1. Jetting of trench backfill is not permitted.

D. Compaction Testing:

1. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.8 TRENCH SURFACING

A. Unpaved Areas:

1. In unimproved areas, the trench surface shall be restored to its original condition. No mounds of earth shall be left along the trench. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

2. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

B. Temporary Surfacing:
1. Temporary surfacing shall be a minimum of 2 inches of cutback asphalt on 10 inches of Class 2 aggregate base and shall be placed at all trench locations subject to vehicular or pedestrian traffic.

2. Temporary surfacing shall be laid within one day after backfilling (except where the Contractor elects to place permanent surfacing within this time period).

3. Before the trenching area is opened for traffic, all excess dirt, rock, and debris shall be removed, the street surface shall be swept clean and the pavement shall be washed down with a water truck and pressure nozzle.

4. Temporary surfacing shall be maintained to prevent the occurrence of mud holes and prevent the surface from settling below 1 inch or rising more than 1 inch from the existing pavement grade.

3.9 MOISTURE CONTROL:

A. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS:

A. Testing Services: Allow testing agency to test each backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

B. When testing agency reports that backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

3.11 PROTECTION:

A. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.
3.12 CLEAN-UP:

A. Remove all debris, equipment, tools and materials upon completion prior to final inspections to the satisfactions of the engineer.

B. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer’s recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completions of construction.

END OF SECTION
SECTION 02380 – STONEWORK

PART 1   GENERAL

1.1   RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2   SUMMARY

A. This Section includes the following: Supply skilled experienced labor, materials, and equipment required to install:
   1. Stone for Stonework and Site Boulders
   3. Site Boulder placements throughout the site
   4. Native Rock Mulch
   5. Native Rock Outfalls

B. Related Sections include the following:
   1. Division 2 Section “Earthwork and Grading”
   2. Division 2 Section “Paving and Surfacing”
   3. Division 2 Section “Site Furnishings”
   4. Division 3 Section "Cast-in-Place Concrete-Summit Stair"
   5. Division 5 Section “Metalwork and Metal Fabrications”

1.3   DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.
B. Competent Rock: solid, unyielding bedrock that can be drilled without fracturing.

1.4 SUBMITTALS

A. Provide samples of all proposed stone types, sizes, color, quantities, gradation, and sources to O.R. office prior to ordering. Boulder samples shall be submitted as photographs clearly depicting the size, form, and surface texture and tone.

B. Boulders and stone for stonework shall be selected by O.R. either at destination quarry or stone purveyor.

C. Mock-ups: Provide on-site mock-ups for the following, for review and approval prior to installation. Successfully approved mock-up elements can be incorporated into the final site products if the installation meets the Plans and Specifications and if prior approval for incorporation of the mock-up is received from O.R.:

1. Ceremonial Wall (Stone Wall at Ceremonial Space)—8'-0" complete wall section in freestanding setting on concrete footing. If successful can be used for Stone Wall (Seatwall on West Summit and East Viewpoint) if prior approval is received from O.R.

2. Ceremonial Wall with Cardinal Point Marker—add metal Marker to Ceremonial Wall mock-up. Marker can be plywood for mock-up.

3. Stone Steps—four riser and tread area with 6-8 large scale boulders.

4. Vehicular Stone Paving—6 x 6 foot with wooden edge frame

5. Pedestrian Stone Paving—3 x 4 foot with wooden edge frame

6. Site Boulder Placements—Typical Site Boulder settings in three different site areas selected by O.R. Assume 9 Site Boulders per site area for total of 20 tons per setting. The intent of this mock-up is to have it become part of the final site work if approved by O.R., and installation meets the Plans and Specifications.

7. Native Rock Mulch and Native Rock Outfall

1.5 INSPECTION

A. The Contractor shall obtain approval of the following prior to proceeding with construction:

1. Preparation of the sub-grade and prior to forming footings or placement of Site Boulders
2. Approval of Concrete Footings for all Stone Walls and Stonework.

3. Approval of metalwork elements associated with Stonework (Cardinal Point Marker and Ceremonial Space Metal Edge)

1.6 QUALITY ASSURANCE

A. Comply with California Department of Transportation (Caltrans) Standard Specifications, latest edition.

B. Pre-construction Meeting: Conduct meeting at Project Site to comply with specified requirements.

C. Ensure stone placement personnel and equipment meet the requirements of the Specifications for type and experience level. Personnel shall be expert stone masons with a minimum of 5 years of fitted, mortared stone work. Contractor shall provide necessary equipment, per Specifications, to stage and supply the materials, and complete the specified work in this remote setting away from power and easy access.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project site in undamaged condition.

B. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping and other causes.

C. Store cementitious and steel materials off the ground, under cover, free from moisture.

D. Store aggregates and stone in an O.R. approved site area where no damage to existing soils or vegetation to remain will occur.

1.8 PROJECT CONDITIONS

A. Protect stones and completed stonework each day. Cover all work with waterproof sheeting. Prevent staining of stonework from grout, mortar, cement, and other materials and work.

B. Weather:

1. Cold—Do not initiate work if temperatures drop or are projected to drop below 40 degrees F.
2. Hot—Protect work when high temperatures reach 100 degrees F, and humidity conditions produce excessive evaporation. Provide artificial shade and wind breaks and use cooled materials as required to complete the work. Do not apply mortar to substrates with temperatures of 100 degrees F and above.

PART 2 MATERIALS

2.1 GENERAL MATERIALS

A. Mortar: Portland Cement ASTM C 150, Type I or II. Natural cement color.
   1. Low-alkali Cement: Portland cement shall not contain more that 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTAM C 207, Type S below grade, Type N above grade.

C. Aggregate: ASTM C 144 and as indicated below:
   1. For joints narrower than 1/4 inch and for pointing mortar use aggregate graded with 100 percent passing No. 16 sieve.

D. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142

E. Corrugated metal ties for use on vertical concrete surfaces to accept specified stone, as required to complete the work and as directed by O.R. Size as required to allow for anchoring to footing and embedding into natural stone veneer at outside face of footing.

F. Stone Anchors and Epoxy: Minimum 1/2-inch by 6-inch length, up to 6-inch length if required to secure stone. Stainless steel or galvanized steel dowel pins, Holo-Krome International or approved equal.

G. Epoxy for Anchors: Red Head, C6, Fast Curing epoxy, or G5 High Strength epoxy. Long working and curing time epoxies are recommended.

H. Concrete Grout: See Specification Section, Cast-in-Place Concrete-Summit Stair

I. Water: Potable
2.2 STONE FOR STONEWORK (WALLS, STEPS, AND PAVING)

A. Stone shall be hand selected Napa Syar Basalt from either the Syar Quarry or American Soil and Stone, Richmond, CA. Stone shall be selected by Contractor under observation by the O.R. (O.R. reserves right to limit quarry visits) at either quarry or stone supply yard if requested by O.R.

B. Stone shall be select quality stone. Color shall be variable, from light brown to tan and grey, matching the native stone on the site, as determined by the O.R.

C. Broken stone, stone with sharp edges, friable stone, or scarred stone shall not be accepted.

D. Stone Sizes and Quantities:

1. Stone type, size and form, texture and tone as determined and as approved by O.R. and Contractor to match the native stone in character, in sizes as noted.

2. Sizes shall range widely from small stone pieces (2x3 inches) to large (2x3 foot) flat faced boulders. Forms shall be square to rectangular, and angular stones of varying thickness. Stone sizing and form shall be varied to produce a fitting natural stone face as detailed and specified.

3. Final Stone selection shall be determined through the on-site Mock-up/ approval process.

4. Stone Quantity shall be sufficient to complete the stonework as noted in the Plans and Specifications. Contractor is responsible for procuring and transporting all stone to the site and completing the work as specified.

2.3 SITE BOULDERS

A. Site Boulders shall be a direct match from same source quarry to Stone specified in 2.2. Procuring stone from more than one source quarry or stone supply yard is not acceptable.

B. Site Boulders shall tend to smooth angular and rounded forms and shall be selected for suitability at the quarry by O.R. Sharply angular, scarred, spalled, chipped, or broken boulders shall not be used. No sharp edges will be allowed to be exposed. Site Boulders shall be integrated into some of the stonework (seatwalls) as noted on Plans and per O.R. direction.

C. Site Boulders shall be hand selected from either the source quarry. O.R. may elect to review stone at stone supply yard, such as American Soil and Stone, Richmond, CA.
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Stone shall be selected by Contractor under observation by the O.R. at either source quarry or stone supply yard.

D. Site Boulders shall be selected by O.R. with support from Contractor and at least three workers at either quarry or local stone supply yard as determined by O.R. Contractor shall provide sufficient time to select Site Boulders at Quarry. Assume at a minimum 3 days of time with O.R. and additional time without O.R. to procure the Site Boulders alone. Transportation of the Site Boulders is not included in this time allotment.

E. Site Boulder sizes and quantities shall be set by the Plan and Specification requirements. General Site Area breakdowns are noted in the table below. O.R. reserves right to adjust locations and quantities of Site Boulders both within General Site Areas and between General Site Areas. Total tons shall not change. Site Boulder size ranges (as noted below) shall be determined by O.R. at source quarry.

<table>
<thead>
<tr>
<th>GENERAL SITE AREA</th>
<th>SITE BOULDERS IN TONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower/Turnaround/ Landform Area</td>
<td>144</td>
</tr>
<tr>
<td>East Summit</td>
<td>72</td>
</tr>
<tr>
<td>West Summit</td>
<td>222</td>
</tr>
<tr>
<td>Parking Area</td>
<td>54</td>
</tr>
<tr>
<td>Trailhead Area</td>
<td>20</td>
</tr>
<tr>
<td>Summit Stair Upper</td>
<td>93</td>
</tr>
<tr>
<td>Summit Stair Lower</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL TONS</strong></td>
<td><strong>625</strong></td>
</tr>
</tbody>
</table>
2.4 STONE STEPS

A. Stone quantities for Stone Steps shall be determined by Contractor based on information in Plans and Specifications, specifically the Stone Step detail. Note that in the Stone Step detail the Site Boulders call for are accounted for in the quantities noted in the table above.

B. Total number and size of Stone Step flights on site are noted below:

1. Total Stone Step flights (8) for total of 340 LF
   a. East Summit, (4) Stone Step flights for subtotal of 145 LF
   b. West Summit, (4) Stone Step flights for subtotal of 195 LF

C. Riser Stones, within the Stone Step detail are not quantified. The detail notes their size and weight and the range of stones specified for a typical section installation. Contractor shall determine necessary quantity of Riser Stones based on Plans and LF flight length noted above.

D. Provide other miscellaneous stone and Native Rock Mulch required to complete the installation as noted on the Plans.

2.5 NATIVE ROCK FOR NATIVE ROCK MULCH

A. Native Rock found on site within graded areas of the site. Rock tends to angular forms from 3-inch to 18-inch and larger. Contractor shall select and screen native rock of debris and fines prior to placement.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Refer to Earthwork and Grading Specification

B. Areas where stone is to be placed shall be graded to elevations shown on the Plans. The soil surface shall be smooth and free from any obstructions to provide adequate contact area between the soil and stone or stone base.

3.2 STONEWORK GENERAL

A. Prepare subgrade and site for acceptance of stonework site improvements.
B. Complete concrete footing and allow to cure prior to initiating any stonework.

C. Stonework Finishing

1. Specified stonework finishing, layout, and detailing shall be addressed and approved through the O.R. approved Mock-up.

2. Battered or vertical wall faces per details and O.R. direction.

3. Stone shall be laid so that pressure is always perpendicular to natural bed. Courses shall be built perpendicular to the pressure which the masonry will bear.

4. Ensure free draining and smooth top of wall condition, appropriate for seating. Set horizontal surfaces at 1/4-inch/foot slope for drainage.

5. Stonework shall be constructed with solid concrete grout fill.

6. Mortared stonework shall be set on concrete footing per details and per O.R. direction.

7. Manually split face all stone (split with sedge on vein lines) for use in stonework.

8. Stone shall all be carefully fitted and hammer dressed on all exposed surfaces. Projections shall be not more than 3/4-inch, unless authorized by O.R.

9. Finish all stones with flat faced finish. Construct stonework (walls and paving and stairs) with tight jointed, flat faced finish.

10. Joints shall be raked or hidden per O.R. direction while mortar is green. Joint width shall vary, 1/4” maximum. Joints shall be staggered and set in a rusticated, irregular pattern. No mortar shall be exposed. Clean all excess mortar from stone.

11. Bond shall be obtained by fitting in closely the adjacent stones. Transverse bonds shall be provided by the use of bond stones extended from the front to the back of the wall. At angular junctions the stones at each alternate course shall be well bonded into the respective courses of the adjacent wall.

12. Face stones shall extend and bond well in the back. These shall be arranged to break joints as much as feasible, and to avoid continuous vertical or horizontal lines. The depth of stone from the face of the wall inwards shall not be less that the height or breadth of the stone at the face.

13. Bond or through stones running across the thickness of the wall shall be provided. Provide a minimum of (4) bond stones in the Stone Seatwall.
14. Use hearting stones in the interior wall fill. Use limited number of stone chips for joint fill per direction on O.R. approved Mock-up.

15. Where a break in the masonry work is required the vertical (or horizontal) joint shall be raked into an irregular joint, facilitating joining old with new work.

16. All stones shall be wetted prior to mortaring in place.

D. Stone Steps and Stone Paving shall be set per Plans and Specifications. Ensure flat finish and tight jointing, maximum 1/4 inch.

E. Dry set stonework shall be set on compacted Aggregate Base per details and per O.R. direction.

F. Do not apply sealant or other finish to stone work.

G. Clean stonework to ensure that mortar, concrete, or grout staining is removed.

3.3 STONE DOWEL PINS (IF REQUIRED TO PIN TO BEDROCK)

A. Drill out the underside of each stone slated to be set at the railing edge of the Concrete Guardrail Footing. Drill a minimum of (6) stones at Footing to accept epoxied pins. Ensure pins are set minimum 2-inches into underside of stone and extend a minimum of 4-inches from bottom face of stone.

B. Epoxy pins to underside of stones and then dry set marking locations of pins at Concrete Guardrail Footing. Follow manufacturer’s recommendations.

C. Drill out concrete footing to accept pins.

D. Dry set stones for final field fit and make any necessary revisions, re-drilling and pinning as required.

E. Epoxy pin holes and mortar stone in place and set, per manufacturer's recommendations.

3.4 SITE BOULDER PLACEMENTS IN FIELD

A. Work shall proceed only under direct observation by O.R. Observation by O.R. shall be scheduled and facilitated for the setting of all Site Boulder placements noted on the Plans and specified in these Specifications.

B. Contractor shall assume a minimum of 15 working days of observation by O.R., if Contractor pre-stages Site Boulders throughout site and implements the work with
multiple crews. Additional days will be required if insufficient worker or machinery are staged for the placement work.

C. Prepare site to accept Site Boulders as described on the Plans and as directed by O.R. Verify placement and boulder type and size with O.R. prior to installation. Site Boulders shall be placed during rough site grading, before fine grading is initiated.

D. Contractor shall provide experienced and skilled stoneworkers/boulder setting operator and crew (min. four men).

E. Contractor shall be required to use appropriate mechanical and manual equipment sufficient to set specified boulders. For the majority of the Site Boulders an excavator with a fully articulating thumb, and the capacity to lift, spin, position, and place 6 ton boulders shall be provided. Excavator or other machinery capable of lifting and placing a lesser number of up to 10 ton boulders shall be provide for Site Boulders exceeding 6 tons.

F. Site Boulders shall be expertly set to ensure a high quality “garden level” of workmanship. Ensure tight, permanent fit between adjacent boulders and any existing bedrock.

G. Site Boulder placement work shall not disturb existing site unless approved by O.R. Protect the existing site and vegetation as noted in the specifications.

3.5 SITE BOULDER PLACEMENTS AT STONEWORK

A. Prepare site and stone seatwalls to accept boulders as described on the Plans and as directed by O.R. Verify placement and boulder type and size with O.R. prior to installation. Site Boulders shall be placed after rough site grading has been completed and before paving or fine grading is initiated.

B. See other conditions above in 3.4.

3.6 STONE STEPS AND STONE PAVEMENTS

A. Install per Plans and Specifications. Contractor to layout Step flights, supporting Site Boulder placements and Riser Stone locations in field with O.R. for review and approval.

B. Installation shall follow required mock-up.
3.7 NATIVE ROCK MULCH

A. Select hand work using Native Rock to create a native rock surface for pedestrian use on the East and West Summits as well as fronting the Restroom Screen at the Parking Area.

B. Install by excavating out selected areas (see Plans) for Native Rock Mulch. Proceed with hand placement of screened native rock and soil and compact in place.

3.8 CLEAN-UP

A. Keep site in a clean, orderly state throughout the work.

B. Prepare wash-out area away from project site as directed on-site with O.R. No wash-out or material dumping of any kind shall be allowed in an area designated for revegetation.

C. Maintain site per Owner's requirements and as noted in the project Specifications.

END OF SECTION 02380
SECTION 02510 - WATER SYSTEMS

GENERAL

1.1 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to on-site domestic water and fire water systems serving all buildings and appurtenances. Unless otherwise noted, this section does not apply to irrigation water systems and water systems inside and within 5 feet of buildings. This section applies to:

1. Domestic water distribution and services.

2. Fire water distribution and services.

3. Water storage tanks.

B. Contractor shall provide all labor, equipment, materials, and testing services unless otherwise noted.

C. Related Sections:

1. Section 02315 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 SUBMITTALS

A. Comply with requirements of Section 01300 – SUBMITTAL PROCEDURES.

B. Product Data: Manufacturer’s literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following:
1. Piping and fittings.
2. Gaskets, couplings, sleeves, and assembly bolts and nuts.
3. Gate valves and ball valves.
5. Check valves.
6. Pressure reducing valves.
8. Valve boxes, frames and covers.
11. Fire department connections and wet stand pipes.
12. Fire hydrants.
13. Thrust block concrete mix and/or restrained joints and fittings.
15. Service saddles and corporation stops.
16. Identification materials and devices.
17. Corrosion protection.
18. Water sampling stations.
19. Domestic water booster pumps.
20. Fire water booster pumps.
C.

Shop Drawings and Calculations: Where an on-site fire water system is required, Contractor shall provide shop drawings for engineer and agency approval prior to construction. Coordinate with the Contract Documents and identify any proposed modifications or deviations. Shop Drawings and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of California.

1. Include the following information:
   
a. Design assumptions.

b. Thrust block sizing and calculations.

c. Materials to be used.

d. Available water pressure.

e. Required water pressure.

2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded by the Contractor to the local fire marshal for further review and approval.

D. Test Reports:

1. Water Pressure Report: Contractor shall engage the public utility agency, or a qualified testing service to conduct a flow test of the existing water main(s). Provide date and location of test, type and method of test performed, static pressure and residual pressure in psig, observed flow in gpm, and orifice size.

2. Bacteriologic Testing: Provide copies of the test results indicating water sample meets California Drinking Water Standards.

E. Samples: None specified. Provide as necessary.

1.4 QUALITY ASSURANCE
A. Comply with the latest edition of the following Standards and Regulations:

1. American Water Works Association (AWWA) and American National Standards Institute (ANSI):
   


   j. C500 Metal-Seated Gate Valves for Water Supply Service.

   k. C502 Dry-Barrel Fire Hydrants.

   l. C503 Wet-Barrel Fire Hydrants.

   m. C504 Rubber-Seated Butterfly Valves.

   n. C507 Ball Valves, 6 inches - 48 inches.
o. C508 Swing-Check Valves for Waterworks Service, 2 inches - 24 inches NPS.


q. C510 Double Check Valve Backflow Prevention Assembly.

r. C511 Reduced-Pressure Principle Backflow Prevention Assembly.

s. C512 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

t. C550 Protective Epoxy Interior Coating for valves and Hydrants.

u. C600 Installation of Ductile-Iron Water Mains and their Appurtenances.

v. C602 Cement- Mortar Living of water Pipelines in place- 4 inches and larger.

w. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

x. C651 Disinfecting Water Mains

y. C652 Disinfection of Water-Storage Facilities

z. C800 Underground Service Line Valves and Fittings for 1/2 inches - 2 inches.

aa. C900 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 inches - 12 inches, for Water Distribution.

bb. C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inches through 3 inches, for Water Service.

c. C905 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inches - 48 inches.

dd. C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 inches - 63 inches, for Water Distribution and Transmission.

ee. C907 Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4 inches - 8 inches.

gg. D103 Factory-Coated Bolted steel Tanks for water Storage.

2. National Fire Protection Association (NFPA):
   d. NFPA 22 Standard for Water Tanks for Private Fire Protection.
   e. NFPA 24 Private Service Mains and their Appurtenances.

   a. PUB 3 PVC Pipe – Technology Serving the Water Industry.
   b. PUB 7 External Corrosion of Underground Water Distribution Piping Systems.
   c. PUB 8 Tapping Guide for AWWA C900 Pressure Pipe.
   d. PUB 9 Installation Guide for PVC Pressure Pipe.
   e. B-8 Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 inch).

   b. ASTM A674 Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
c. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.


g. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.


l. ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.


p. ASTM A865 Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.


5. American Society of Mechanical Engineers (ASME).
   a. ASME B16 series for valves, fittings, flanges, and gaskets applicable for use in water systems.
   b. ASME B1.20.1 American Standard Tapered Pipe Threads for factory-threaded pipe and pipe fittings.

6. National Sanitation Foundation (NSF).

7. Underwriters Laboratories, Inc. (UL).
   a. UL 157 Standard for Safety for Gaskets and Seals.
   c. UL 213 Rubber Gasketed Fittings for Fire-Protection Service.
   d. UL 246 Standard for Safety for Hydrants for Fire-Protection Service.
   e. UL 262 Standard for Safety for Gate Valves for Fire-Protection Service.
   f. UL 312 Standard for Safety for Check Valves for Fire-Protection Service.
   g. UL 405 Standard for Safety for Fire Department Connections.
   h. UL 448 Standard for Safety for Pumps for Fire-Protection Service.
   i. UL 789 Standard for Safety for Indicator Posts for Fire-Protection Service.
j. UL 860 Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service.

k. UL 1091 Standard for Safety for Butterfly Valves for Fire-Protection Service.

l. UL 1285 Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service.

m. UL 1468 Direct Acting Pressure Reducing and Pressure Restricting Valves.

n. UL 1478 Standard for Safety for Fire Pump Relief Valves.

8. FM Global (FM).

a. FM 1020 Automatic Water Control Valves.

b. FM 1045 Waterflow Detector Check Valves.

c. FM 1110 Indicator Posts.

d. FM 1111 Post-Indicator-Valve-Assembly.

e. FM 1112 Indicating Butterfly Valves.

f. FM 1120 and FM 1130 Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves).

g. FM 1210 Swing Check Valves.

h. FM 1221 Backflow Preventers (Reduced Pressure Principle and Double Check Valve Types).

i. FM 1311 Centrifugal Fire Pumps (Horizontal, Split-Case Type).

j. FM 1312 Centrifugal Fire Pumps (Vertical-Shaft, Turbine Type).

k. FM 1319 Centrifugal Fire Pumps (Horizontal, End Suction Type).

l. FM 1361 Water Pressure Relief Valve.
m. FM 1362 Pressure Reducing Valves.

n. FM 1371 Centrifugal Fire Pumps (In-Line Type).

o. FM 1510 Fire Hydrants (Dry Barrel Type) for Private Fire Service.

p. FM 1511 Fire Hydrants (Wet Barrel Type) for Private Fire Service.

q. FM 1530 Fire Department Connections.


s. FM 1620 Pipe Joints & Anchor Fittings for Underground Fire Service Mains.

   a. Underground Installation of Polyethylene Pipe.
   b. Polyethylene Joining Procedures.
   c. Inspections, Test and Safety Considerations.

10. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.

11. American Concrete Institute (ACI).
    a. ACI 348 - Meter Pit Construction.

12. Santa Clara County Fire Department Regulations.

13. Office of Statewide Health Planning and Development.

14. Other authorities having jurisdiction.

B. System Description: Grades and elevations are to be established with benchmarks referenced on Plans.

C. Comply with County of Santa Clara Standards and authorities having jurisdiction for the installation and testing of potable water piping and fire protection systems.
D. All testing of systems specified in this section shall be witnessed by representatives of the local water department or local authority. Provide at least 7 days notice.

E. The Contractor shall prepare shop drawings and calculations, and obtain all required approvals for the fire water system of the proposed project. Contractor shall have shop drawings and calculations stamped and signed by a fire protection engineer, licensed by the State of California, as required by the County of Santa Clara.

PART 2 – PRODUCTS

2.1 PIPING

A. Water Distribution Main (pipe size 4 inches and larger).


   a. Flanged ends shall conform to AWWA/ANSI C115/A21.15.

   b. Rubber-gasket joints shall conform to AWWA/ANSI C111/A21.11.

2. Polyvinyl Chloride Pipe (PVC): Pressure Class 235, DR 18, spigot and gasket bell end, conforming to AWWA C900 or AWWA C905, with equivalent cast-iron pipe outer diameter (O.D.). J-M Manufacturing, PW Pipe, North American Pipe Company, or approved equivalent.

3. Polyethylene Pipe (PE): PE 3408/3608, ASTM F714, Pressure Class 200, DR 9, conforming to AWWA C906, or approved equivalent.

B. Water Service Line (pipe size 3 inches and smaller)

1. Copper (Cu): Provide Type K soft or hard copper pipe conforming to ASTM B88.
2. High Density Polyethylene Pipe (HDPE): PE3408, Pressure Class 200, DR 9 conforming to AWWA C901. J-M Manufacturing PIPE or approved equivalent.

2.2 FITTINGS, GASKETS, COUPLINGS, SLEEVES, AND ASSEMBLY BOLTS AND NUTS

A. For DIP: Provide fittings with pressure rating greater than or equal to that of the pipe. Provide flanged joints, mechanical joints, push-on joints, and insulating joints where indicated. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide ends of pipe and fittings suitable for the specified joints. Fittings shall have cement-mortar lining conforming to AWWA/ANSI C104/A21.4.


   a. Provide flange for set screwed flanges of ductile iron, ASTM A536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250.

   b. Provide setscrews for set screwed flanges of 190,000 psi tensile strength, heat treated and zinc-coated steel.

   c. Gaskets for set screwed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA/ANSI C111/A21.11.

   d. Design of set screwed gaskets shall provide for confinement and compression of gasket when joint to adjoining flange is made.

   e. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot-pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.

2. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.
3. Push-on Joints: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA/ANSI C111/A21.11. Modify bell design fittings, as approved.

4. Insulating Joints: Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
   
a. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.

b. Provide gasket of the dielectric type, full face, as recommended in AWWA/ANSI C115/A21.15.

c. Provide bolts and nuts as recommended in AWWA/ANSI C115/A21.15.

d. Fittings shall be epoxy lined and coated with a thickness not less than 6-mils.

B. For PVC: Fittings shall be DIP or PVC.

   1. DIP fittings: Provide gray-iron or ductile-iron conforming to AWWA/ANSI C110/A21.10, with cement-mortar lining conforming to AWWA/ANSI C104/A21.4, and standard thickness, with equivalent cast-iron pipe O.D.
      
a. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except the bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe.

b. Provide push-on joints, compression joints and mechanical joints where indicated between pipe and fittings, valves, and other accessories.

c. Mechanical joints, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.

d. Fittings shall be epoxy lined and coated with a thickness not less than 6-mils.

   2. PVC fittings: Provide fabricated PVC fittings for pressure pipe conforming to AWWA C900, C905, or C907.
a. PVC fittings shall conform to ASTM D2466.

b. Push-on joints shall conform to ASTM D3139.

c. Compression joints shall conform to ASTM D3139.

d. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets shall conform to ASTM F477.

C. For PE: Fittings shall conform to AWWA C901 or AWWA C906. Driscopipe, or approved equivalent.

1. Socket type fittings shall conform to ASTM D2683.

2. Butt fusion fittings shall conform to ASTM D3261.

3. Electrofusion fittings shall comply with ASTM F1055.

D. For Cu:

1. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.

2. Wrought copper solder-joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22.


5. Compression connections shall be Mueller 110, Ford or approved equivalent.

E. For HDPE:

1. Cast Copper Fittings shall conform to ASME B16.18.

2. Cast Copper Compression Fittings and connections shall be Mueller 110 Ford or approved equivalent.

2.3 GATE VALVES AND BALL VALVES
A. Gate Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.

1. Stuffing boxes shall have O-ring stem seals. Provide stuffing boxes bolted and constructed so as to permit easy removal of parts for repair.

2. Valves (2-1/2 inches and larger):
   a. Provide valves conforming to AWWA C500 or AWWA C509 and of one manufacturer. Valves shall have a non-rising stem, a 2-inch square nut, and double-disc gates. Valves shall be rated for 250 psi maximum working pressure. Mueller 2360 series, ACIPCO, or approved equivalent.
   b. For the domestic water system, valves shall also conform to ANSI/NSF 61.
   c. For the fire water system, valves 2 inches through 16 inches in size shall also conform to UL 262 and FM 1120 or FM 1130 to a working pressure of 200 psi.

3. Where a post indicator is shown, provide valve with an indicator post flange.

B. Ball Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.

1. Valves (2-inches and smaller):
   a. Provide valves conforming to AWWA C800 and of one manufacturer. Mueller 300 Series, Ford, or approved equivalent.

2. Provide valve with operating nut or handle as shown on the Construction Documents.

2.4 BLOW-OFF VALVES, AIR RELEASE AND VACUUM VALVES, AND COMBINATION AIR VALVES

A. Blow-off valves: Provide valve and service size as shown in the Contract Documents. Provide 2-inch valves at low points of the piping system, and 4-inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.
1. 2-inch blow-off shall have a 2-inch vertical female iron pipe (FIP) inlet and a 2-inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equivalent.

2. 4-inch blow-off shall have a 4-inch vertical FIP inlet and a 4-inch male iron pipe (MIP) outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF800, or approved equivalent.

B. Air release and vacuum valves: Provide valve and service size as shown on the Contract Documents, and where there is an increase in the downward slope or a decrease in the upward slope of the piping system. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin Model UL, Apco, or approved equivalent.

C. Combination air valves: Provide valve and service size as shown on the Contract Documents, and at high points and sharp changes in gradient of the pipe system. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Crispin Model C, Apco, or approved equivalent.

2.5 CHECK VALVES

A. Valves: Valves shall have clear port opening and a cast-iron body. Provide spring-loaded or weight-loaded valves where indicated on the Construction Documents.

1. For the domestic water system, provide swing-check type valves conforming to AWWA C508. Provide valves of one manufacturer. Mueller, Apco, or approved equivalent.

2. For the fire water system, provide swing-check type valves conforming to FM 1210 and UL 312. Mueller, Watts, or approved equivalent.

2.6 POST INDICATORS
A. Posts Indicators shall withstand up to 900 ft-lbs of operating torque, be free-standing, and tamper-proof.

B. Post Indicators shall conform to UL 789 and FM 1110. Mueller, ACIPCO, or approved equivalent.

2.7 VALVE BOXES, METER BOXES, FRAMES AND COVERS

A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked “WATER.” Christy Model G5 with G5C cover or approved equivalent.

B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Contract Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H20 loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equivalent.

2.8 BACKFLOW PREVENTERS

A. Provide backflow preventers as shown on the Contract Documents. Subject to local water department approval. Backflow preventers on the fire water system shall be subject to approval by the local office of the Fire Marshal.

B. Reduced Pressure Principle Assemblies (RPPA): Provide a cast-iron body RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Febco 860, Watts, or approved equivalent.

C. Double Check Detector Assemblies (DCDA): Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. Febco 806, Watts, or approved equivalent.

2.9 FIRE DEPARTMENT CONNECTIONS AND WET STAND PIPES
A. Fire Department Connections (FDC): Provide FDC’s with 2-1/2 inch female hose connections, sidewalk or free-standing type. Number of inlets shall be as shown on the Contract Documents. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm, and be furnished with Knox FDC plug. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded “AUTO SPKR”.

1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equivalent.

2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equivalent.

3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equivalent.

4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equivalent.

B. Wet Stand Pipes (WSP): Provide 2-Way WSP’s with valves and two (2) 2-1/2 inch male hose connections free-standing type, with a 4” inlet. Each outlet shall each have a minimum capacity of 250 gpm, and be furnished with a Knox cap. Water to the WSP shall be controlled with a remote valve. Connection shall be branded “HYDRANT.” Subject to approval by the local water department or fire marshal. Croker, Elkhart, Potter-Roemer or approved equivalent.

2.10 FDC AND WET STAND PIPE CAPS AND PLUGS

A. Provide Knox caps or plugs for all new FDC and wet-stand pipes included in the project. Coordinate the number of Knox keys as well as the key signage location with the local Fire Marshal.

2.11 FIRE HYDRANTS

A. Provide two 2-1/2 inch and one 4-1/2 inch outlets with a 6-inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to AWWA C502 or C503, and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow 800 series, Mueller, ACIPCO, or approved equivalent, subject to approval by the local water department and Fire Marshal.
2.12 THRUST BLOCKS AND PIPE RESTRAINTS

A. Blocks: Provide thrust blocks in accordance with NFPA 24 Standards. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

B. Pipe Restraints: Provide thrust restraint systems for fittings and joints as required or as indicated on the Plans.

1. For mechanical joint fittings and joints: Pipe restraints shall be “Mega-Lug” pipe restraint system by EBBA Iron, Inc., or approved equivalent.

2. For push-on joint fittings and joints: Pipe restraints shall be “Field-Lok” gaskets by U.S. Pipe, or approved equivalent.

C. Thrust blocks, gravity blocks, or mechanical pipe restraints may be used at Contractor’s option, unless otherwise indicated on the Plans.

D. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.

E. Where depth or location of water piping, existing utilities, or other structures prohibit the use of standard thrust blocks, gravity blocks or mechanical pipe restraints may be used. Conform to NFPA 24 Standards.

2.13 TAPPING SLEEVES AND TAPPING VALVES

A. Sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equivalent.

B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equivalent.

2.14 SERVICE SADDLES AND CORPORATION STOPS
A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.

1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi maximum working pressure. Mueller BR2 Series, Ford, or approved equivalent.

2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equivalent.

3. For PE:

B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi. and suitable for the working pressure of the system.

1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.

2. Threaded ends shall conform to AWWA C800.


4. Mueller H-15000 Series with “CC” threads and a copper flare straight connection outlet, Ford, or approved equivalent.

2.15 IDENTIFICATION MATERIALS AND DEVICES

A. Marker Tape: Provide marker tape consisting of metallic foil bonded to plastic film not less than 2-inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1-mil. thick. The tape shall be identified with lettering, not less than 3/4-inch high, “CAUTION: WATER MAIN BELOW,” repeated at approximately 24-inch intervals.

B. Tracer Wire for Nonmetallic Piping: Provide 12 gage, coated copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

2.16 CORROSION PROTECTION
A. In soils with high resistivity, high sulfides, high/low ph, redox potential and/or poor surrounding drainage conditions, or as indicated in the Contract Documents, encase underground pipe and appurtenances in 4-mil, high-density cross-laminated (HDCL) polyethylene film or 8-mil linear low-density (LLD) polyethylene film in accordance with AWWA/ANSI C105/A21.5. U.S. Pipe, ACIPCO, or approved equivalent.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where water service is being installed.

B. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 LOCATION OF WATER LINES

A. Where the location of the water line is not clearly defined by dimensions on the Plans, do not lay water line closer than 10 feet horizontally from any sewer line.

B. Where water lines cross under gravity sewer lines, encase sewer line in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing.

C. Where water lines cross sewer force mains and inverted siphons, install water line at least 2 feet above these sewer lines.

D. When joints in the sewer line are closer than 3 feet horizontally from the water line, encase sewer line joints in concrete.

E. Do not lay water lines in the same trench with other utilities.

F. Install water lines at 3’-0” minimum depth or as detailed on Plans.

3.3 INSTALLATION OF PIPING
A. Inspection:

1. Before placing in position, inspect pipe for noticeable defects. Clean the pipe, fittings, valves, and accessories, and maintain in a clean condition.

2. Remove fins and burrs from pipe and fittings.

B. Pipe laying and jointing:

1. Provide proper facilities for lowering sections of pipe into trenches.

2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.

3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.

4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of lying.

5. Grade the pipeline in straight lines; avoid the formation of dips and low points.

6. Support pipe at proper elevation and grade.

7. Provide secure firm, uniform support. Wood support blocking will not be permitted.

8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.

9. Provide anchors and supports where indicated and where necessary for fastening work into place.

10. Make proper provision for expansion and contraction of pipelines.

11. Keep trenches free of water until joints have been properly made.
12. Do not lay pipe when conditions of trench or weather prevent proper installation.

13. All fittings shall be blocked with appropriately sized thrust blocks as shown in the Contract Documents.

C. Installation of Tracer Wire:
   1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
   2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

D. Connections to Existing Lines:
   1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
   2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

E. The end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads to keep out debris and contamination.

3.4. INSTALLATION OF DUCTILE-IRON PIPING

A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

B. Jointing:
   1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
   2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
   
   a. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
   
   b. Align bolt holes for each flanged joint.
   
   c. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
   
   d. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
   
   e. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
   
   f. Use set screwed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the set screwed flange manufacturer.
   
4. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.

5. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8-mil linear low-density polyethylene (LLD) film or 4-mil high-density cross-laminated (HDCL) film per manufacturer’s recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.

D. Pipe Anchorage:

1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.
2. Pipe anchorage shall be in accordance with NFPA 24 Standards.

3.5 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Install pipe and fittings in accordance with the requirements of UNI B-3 for the following:

1. The laying of pipe, joining PVC pipe to fittings and accessories.

2. The setting of hydrants, valves, and fittings.

B. Comply with the recommendations for pipe joint assembly and appurtenance installation in AWWA Manual M23, Chapter 7, “Installation.”

C. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

D. Jointing:

1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.

2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.

3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.

4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.

5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UNI B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.

7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

E. Pipe Anchorage:

1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.

2. Anchorage shall be in accordance with the requirements of UNI B-3 and in accordance with NFPA 24 Standards for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated on the Construction Documents.

3.6 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with PPI and Manufacturer’s Recommendations.

B. Jointing:

1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.

2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.

3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.

4. Butt fusion:
   a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
   b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
c. Heat the ends of the pipe to the pipe manufacturer’s recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.

d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer’s instructions.

e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the Manufacturer’s recommendations for temperature, pressure, holding, and cooling times.

f. Remove the inside bead from the fusion process using Manufacturer’s recommended procedure.

5. Socket fusion:

a. Mixing manufacturers’ heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.

b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.

c. Clamp the cold ring on the pipe at the proper position using a depth gauge.

d. Heat the tool to the pipe manufacturer’s recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.

e. Follow manufacturer’s recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.

f. Simultaneously remove the pipe and fitting from the tool.
g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.

h. Hold or block the pipe in place during cooling.

6. Electrofusion:

a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.

b. Clamp the pipe and fitting at the proper position in the fixture.

c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer’s instructions.

d. Allow the joint to cool before removing the clamping fixtures.

3.7 INSTALLATION OF VALVES

A. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.

B. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.

C. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23, Chapter 7, “Installation.”

D. Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

E. Provide and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

3.8 INSTALLATION OF VALVE AND METER BOXES
A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown in the Construction Documents. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxed shall be excavated, plumbed, and backfilled at no additional cost to the Owner.

3.9 INSTALLATION OF HYDRANTS

A. Install hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.

B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replace if needed.

C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.10 SERVICE LINE CONNECTIONS TO WATER MAINS

A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.

B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

C. Connect service lines to PVC plastic water mains in accordance with UNI-B-8 and the recommendations of AWWA Manual M231, Chapter 9, “Service Connections.”

3.11 INSTALLATION OF BACKFLOW PREVENTERS

A. Devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.
3.12 WATER TANKS

A. Install water tanks per Manufacturer’s recommendations in conformance with AWWA D103.

3.14 HYDROSTATIC PIPELINE TESTING

A. Requirements:

1. After the pipe has been laid and backfilled, perform hydrostatic pressure tests.

2. Do not conduct tests until at least 12 hours have elapsed since pipe lying and at least 5 days have elapsed since placing of concrete thrust blocks.

3. Fill the pipe with water which shall remain without external application of pressure for 24 hours before tests are conducted.

4. Prior to hydrostatic testing, flush pipe system with fresh water until piping is free of dirt and foreign matter.

5. Apply pressure by a pump and measured by a test gage. All necessary apparatus and labor for conducting the pressure and leakage tests shall be furnished by the Contractor.

6. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.

7. For pressure test, use a hydrostatic pressure not less than 200 psi for fire water or combined water systems and 1 ½ times operating pressure for domestic water systems. The duration of the test shall not be less than 4 hours with the variation in pressure of not more than 5 psi for the duration of the test.

B. Leakage Tests:

1. At Contractor’s option, leakage tests can be performed at the same time as hydrostatic pressure tests.
2. Leakage rate shall be measured for at least 4 hours with a certified water meter, or other approved method. If requested, meter certification shall be submitted to the Owner for approval prior to testing.

3. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

4. Leakage at mechanical couplings and joints, tapping sleeves, saddles, flanged joints, and copper piping will not be accepted. Correct any visible leaks.

5. Push-on joints: Test ductile iron pipe for leakage in accordance with AWWA C600 as shown in the following table:

<table>
<thead>
<tr>
<th>Average Test Pressure (psi)</th>
<th>Nominal Pipe Diameter - Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>300</td>
<td>0.39</td>
</tr>
<tr>
<td>275</td>
<td>0.37</td>
</tr>
<tr>
<td>250</td>
<td>0.36</td>
</tr>
<tr>
<td>225</td>
<td>0.34</td>
</tr>
<tr>
<td>200</td>
<td>0.32</td>
</tr>
</tbody>
</table>

6. When the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

7. Test polyvinyl chloride pipe for leakage in accordance with the recommendations of the Uni-Bell Plastic Pipe Association (UNI) as shown in the following table:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Average Test Pressure in Line (psi.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Nominal Pipe Size (inches)</td>
<td>Average Test Pressure in Line (psi.)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>0.38</td>
</tr>
<tr>
<td>6</td>
<td>0.57</td>
</tr>
<tr>
<td>8</td>
<td>0.76</td>
</tr>
<tr>
<td>10</td>
<td>0.96</td>
</tr>
<tr>
<td>12</td>
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<tr>
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<td>1.53</td>
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<tr>
<td>18</td>
<td>1.72</td>
</tr>
<tr>
<td>20</td>
<td>1.91</td>
</tr>
</tbody>
</table>

8. Should any section of new pipe fail to pass either test, locate and repair the defective pipe and repeat the test.

3.15 STERILIZATION AND FLUSHING

A. General:

1. Domestic water lines, mains, and branches by chlorination in accordance with AWWA C601 and as herein specified.

B. Sterilization Methods:

1. Liquid Chlorine Solution Method:

   a. Flush all foreign matter from mains, branch runs, hydrant runs, and installed services.

   b. Introduce liquid chlorine solution at appropriate locations to assure uniform distribution through the facilities at the proper concentration.

   c. Do not use installed copper service lines to convey the concentrated chlorine solution to the mains.

   d. The sanitizing solution shall be retained in the facilities for a period of 24 hours after which each service, hydrant run, branch run and dead end shall be flushed until:

   i. Residual chlorine is less than 1 part per million.
ii. Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.

e. Chlorine shall be a 1 percent solution (containing 10,000 parts per million available chlorine) or shall be obtained by use of dry chlorine in tablet form firmly attached to inside tope of the pipe.

f. The required concentration of chlorine in the pipe is 50 parts per million. This concentration may be attained by adding 5 gallons of the chlorine solution to 1,000 gallons of water.

g. The weight of chlorine or chlorine compound required to make a 1 percent chlorine solution is as follows:

TABLE 3
One-Percent Chlorine Solution Mix

<table>
<thead>
<tr>
<th>AMOUNT OF PRODUCT COMPOUND</th>
<th>QUANTITY OF WATER (in gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Test Calcium Hypochlorite (65-70% Cl)</td>
<td>1 pound</td>
</tr>
<tr>
<td>Chlorinated Lime (32-35% Cl)</td>
<td>2 pounds</td>
</tr>
<tr>
<td>Liquid Laundry Bleach (5.25% Cl)</td>
<td>1 gallon</td>
</tr>
<tr>
<td>Liquid Chlorine (100% available chlorine)</td>
<td>0.62 pounds</td>
</tr>
</tbody>
</table>

2. HTH Tablet Method:

a. The required concentration of chlorine in the mains may be obtained by the use of HTH tablets as produced by Olin Mathieson in the following quantities or approved equivalent:

<table>
<thead>
<tr>
<th>Length of Section</th>
<th>DIAMETER OF PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inches</td>
<td>6 inches</td>
</tr>
<tr>
<td>8 inches</td>
<td>10 inches</td>
</tr>
<tr>
<td>12 inches</td>
<td></td>
</tr>
</tbody>
</table>
b. Tablets are to be fastened to the inside top surface of each length of pipe using “Permatex No. 1” no earlier than the day pipe is laid.

c. Tablets shall not be installed in the pipe and left overnight before laying and shall not be accessible at any time for casual pilferage by the general public or by children. Tablets shall be stored in a hermetically sealed container.

d. The new water lines are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run, and installed service.

e. Water shall be retained for a period of 24 hours, after which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until:

i. Residual chlorine concentration is less than 1 part per million

ii. Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.

C. Bacteriological Testing:

1. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory certified by the California Department of Health Services as an Environmental Testing Laboratory (ELAP).

2. Samples are to be taken at representative points as required by the Owner and authorities having jurisdiction.
3. The new water lines shall remain isolated and out of service until satisfactory test results have been obtained that:

   a. Meet the requirements of the California Department of Health Services, Drinking Water Standards.

   b. Owner has accepted the results as indicative of the bacteriological condition of the facilities.

   c. If unsatisfactory or doubtful results are obtained from the initial sampling, repeat the chlorination process until acceptable test results are reported.

END OF SECTION
SECTION 02630 - STORM DRAINAGE

GENERAL

1.1 SUMMARY

A. This section describes general requirements, products, and methods of execution relating to on-site storm drainage excluding portions within five feet of buildings unless otherwise noted. Any work within the public right-of-way shall be constructed to the standards of Santa Clara County and State of California Department of Transportation; as may be appropriate.

   1. Storm drain piping.

   2. Storm drain structures including curb inlets, catch basins, area drains, and manholes.

B. Contractor shall provide all labor, equipment, and materials, unless otherwise noted.

C. Related Sections:

   1. Section 02315 – TRENCHING, BACKFILLING, AND COMPACTING.

   2. Section 02300 – EARTHWORK AND GRADING

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 SUBMITTALS

A. Comply with the requirements of Section 01300 – SUBMITTAL PROCEDURES.

B. Product Data: Manufacturer’s literature and data, including, where applicable, pressure rating, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:
1. Piping and fittings.
2. Jointing material.
3. Gaskets, couplings, and sleeves.
4. Precast concrete structures, including manholes and drainage inlets.
5. Concrete mix design for precast and cast-in-place structures.
6. Manhole lids and frames.
7. Manhole steps.
8. Pipe to Structure Connection Seal.
9. Drainage inlet grates and frames.

1.4 QUALITY ASSURANCE

A. Comply with the latest editions of the following Standards and Regulations:

   b. A615: Deformed and Plain Billet-Steel Bars for Reinforcement.
   c. B32: Solder Metal.
   d. C76: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   f. C478: Precast Reinforced Concrete Manhole Sections.
   g. C494: Chemical Admixtures for Concrete.
   h. C920-02: Elastomeric Joint Sealants.
   i. D2241-00: Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   j. D2680-01 Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
k. D2729: Perforated PVC Drain Pipe.

l. D3034-00: Type PSM Polyvinyl Chloride (PVC) Sewer pipe and Fittings.

m. F1336-02: Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

2. California Department of Transportation (Caltrans): Standard Specifications:

a. Section 51: Concrete Structures.

b. Section 52: Reinforcement.

c. Section 55: Steel Structures.

d. Section 66: Corrugated Metal Pipe.

e. Section 70: Miscellaneous Facilities.

f. Section 72: Slope Protection.

g. Section 75: Miscellaneous Metal.

h. Section 90: Portland Cement Concrete.


4. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.

5. American Concrete Institute (ACI).

6. Other authorities having jurisdiction.

B. System Description: Grades and elevations are to be established with reference to the benchmarks referenced on the Drawings.

PART 2 – PRODUCTS

2.1 PIPING

A. Polyvinyl Chloride (PVC) Pipe: PVC pipe conforming to ASTM D3034, SDR 26 with bell-and-spigot type of rubber gasket joints. Bells shall be integral with pipe. Spigot end pipe with separate double hub couplings is not acceptable. PVC is allowed only at locations explicitly shown in the plans.
B. Perforated PVC Pipe: Perforated pipe shall conform to ASTM D2729.

C. Corrugated Metal Pipe: CMP shall conform to Caltrans specification for Corrugated Steel Pipe. Material shall be zinc-coated and comply with AASHTO M 36, and AASHTO M218. The coating shall conform to ASTMA123/A123M and A153/A153M.

2.2 MANHOLES

A. Manholes shall be pre-cast concrete of the size and shape shown on the Drawings and shall conform to Sections 70-1.02H of the Caltrans Standard Specifications and to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor’s option. Concrete shall consist of Type II cement.

B. Frames and covers shall be cast iron conforming to Section 55-2.03 and 75-1.02 of the Caltrans Standard Specifications. Manhole covers shall have the words “STORM DRAIN” in letters not less than 2-inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

C. All interior concrete surfaces shall be coated with Xypex Concentrate or approved equivalent. Use of a water-resistant admix such as “Xypex Crystalline” is acceptable, at Contractor’s option.

D. Frames and grates for manholes and catch basins shall be match-marked in pairs before delivery to the job site. The grates shall fit into their frames without rocking. Grates shall have a maximum opening of one-half inch between bars, unless otherwise noted in the Drawings. All drainage inlets shall be marked with a stencil or permanent label reading “NO DUMPING FLOWS TO BAY.”

E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Drawings. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.

F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Section 90 and as herein specified. The concrete shall be Class 2. The grading of the combined aggregate shall conform with the Caltrans requirements of the 1/2-inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by Test Method No. Calif. 520. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.
2.3 PIPE TO STRUCTURE CONNECTOR/SEAL

A. A flexible pipe to manhole connector shall be used for all pipe penetrations and/or cast-in-place concrete structures.

1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.

2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C-923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C-923.

3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.

4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.4 CLEAN-OUTS

A. A box shall be provided for each clean-out. Boxes shall be pre-cast concrete with cast iron frame and cover marked “STORM DRAIN”; Christy G5C or equal.

2.5 CULVERT AND OUTFALL HEADWALLS

A. All headwalls shall be constructed in conformance with Caltrans Standard Plans and as indicated in the plans.
PART 3 – EXECUTION

3.1 PIPE INSTALLATION

Pipe shall be installed in conformance with Section 02315 – TRENCHING, BACKFILLING AND COMPACTING, and manufacturer’s recommendations.

A. Pipe laying:

1. No pipe shall be laid until the Geotechnical Engineer inspects and approves the conditions of the bottom of the trench.

2. Pipe lying shall proceed “up grade” with the spigot section of the bell-and-spigot pipe pointing in the direction of the flow.

3. Each section of pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line.

4. Pipe shall not be laid when the condition of the trench or the weather is unsuitable.

B. Debris Control:

1. The interior of the sewer pipe shall be kept clean of dirt and debris at all times. When work is not in progress, open ends of pipe and fittings shall be plugged.

2. Where clearing after lying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and bulled forward past every joint immediately after joining has been completed.

3.2 POURED-IN-PLACE CONCRETE

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of the Caltrans Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Drawings, exposed surfaces of structures shall be Class 1 surface finish.
C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Construction Manager has approved the forms and reinforcement.

D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.3 PIPELINE FLUSHING

A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning. Reclaimed water shall be used where available.

3.4 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:

1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.

   a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.

   b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable
requirements specified in this paragraph, including those for diameter of the device.

2. Ball, cylinder, or circular sections shall conform to the following:

   a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

   b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.

   c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.

   d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

3. Pull-Through Device:

   a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.

   b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

E. Deflection measuring Device:

1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.

2. Obtain approval of deflection measuring device prior to use.

F. Deflection Measuring Device Procedure:

1. Measure deflections through each run of installed pipe.

2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.5 CLEANING

A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.6 VIDEO INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the storm drainage line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original DVD and log sheets shall be provided to the Owner.

1. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:

   a. Low spot (1 inch or greater - mainlines only).

   b. Joint separations (3/4 inch or greater opening between pipe sections).

   c. Cocked joints present in straight runs or on the wrong side of pipe curves.

   d. Chips in pipe ends.

   e. Cracked or damaged pipe.

   f. Dropped joints.

   g. Infiltration.

   h. Debris or other foreign objects.
i. Other obvious deficiencies.

j. Irregular condition without logical explanation.

END OF SECTION
SECTION 02750 - PAVING AND SURFACING

1.1 SUMMARY

A. Section Includes (but is not necessarily limited to):
   1. Asphalt Concrete Paving.
   2. Site Concrete Paving (except Summit Stair).
   3. Permeable Concrete Paving.
   4. Liquid Asphalt and Asphalt Emulsion.
   5. Aggregate Base
   6. Resin Pavement (NaturalPAVE XL or equal).
   7. Ceremonial Space Surfacing (Specialized Unpaved Surface).

B. Section does not cover concrete work at the Summit or Trailhead Shelters (see Architectural Specifications) or Summit Stair (see Structural Specifications).

C. Related work furnished under other sections but conforming to the provisions of this section:
   2. Aggregate Base installation.

D. Related Sections:
   1. Section 02230 – SITE CLEARING.
   2. Section 02300 – EARTHWORK AND GRADING.
   3. Section 02780 – PAVEMENT MARKING.

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to
Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. D1557: Moisture Unit Weight Relations of Soils and Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18 in. (457 mm) Drop.

B. California Code of Regulations (CCR): Title 24, Chapter 2-71, Site Development Requirements for ADA Accessibility.

C. California Department of Transportation (Caltrans):
   1. Standard Specifications:
      a. Section 26: Aggregate Bases.
      b. Section 37: Bituminous Seals.
      c. Section 39: Asphalt Concrete.
      d. Section 51: Concrete Structures.
      e. Section 52: Reinforcement.
      f. Section 73: Concrete Curbs and Sidewalks.
      g. Section 90: Portland Cement Concrete.
      h. Section 92: Asphalts.
      i. Section 93: Liquid Asphalts.
      j. Section 94: Asphaltic Emulsions.
   3. Highway Design.
D. Institute of Transportation Engineers: Transportation and Traffic Engineering Handbook.

1.4 SUBMITTALS

A. Requirements: Refer to Section 01300 – SUBMITTAL PROCEDURES.

B. Asphalt Concrete Paving:
   1. Provide copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with or exceeds specified requirements.
   2. The Contractor shall furnish a certified weight or load slip for each load of material used in the construction of the asphalt concrete pavement.

C. Concrete Paving: The Contractor shall furnish mill test reports on the cement, reinforcement bars, lampblack, and aggregates, showing compliance with the respective specifications. The Testing Engineer may make concrete test cylinders and slump tests as deemed necessary to determine compliance with the Specifications.

D. Liquid Asphalt.

E. Lamp black and Davis Color samples and data.

F. Pavement Reinforcement Fabric.

G. Tack Coat.

H. Pavement Reinforcement Mesh.

I. Structural Geotextile Fabric.

J. Joint Sealant.

K. Resin Pavement (NaturalPAVE XL or equal) product data, manufacturer's sample and specifications (also included in Appendix), sample of specified aggregate, photographs of specified product (and color) installed.

L. Ceremonial Space Surfacing material data and sample (one 5 gallon bucket).

M. Mock-ups for each pavement type and pavement tone and color, include mock-up of the Ceremonial Space Surfacing. Provide mock-ups on-site for O.R. review. Mock-ups shall each be flat work 6’x6’ finished pavement or surfacing.
samples held with 2x6 wood edging. Mock-up shall all be installed on compacted Aggregate Base if requested by O.R

1. Note that Mock-up for Resin Pavement shall be provided well in advance of the anticipated installation date. Coordinate with manufacturer’s 30 day ordering schedule. Mock-up for Resin Pavement does not require staging pavement subcontractor and can be created by project Contractor. Intent is to create and informal installation of the pavement for color and texture review only, not performance.

2. Mock-up shall remain on site after review and approval until the project is completed. Contractor shall dispose of mock-up off-site at the close of the project. Approved mock-ups shall serve as quality control benchmarks for concrete work. Construct mock-up only after approval of mix design, finish, and jointing. Coordinate location of mock-up with O.R.

3. Provide mock-up in sufficient time for concrete to cure, be reviewed, and for additional mock-up(s) to be poured and cured before placement of various concrete types and elements are required to be poured to meet the project schedule.

1.5 PROJECT CONDITIONS

A. Liquid Asphalt and Asphalt Emulsion:

1. Seal coat and paint binder shall be applied only when the ambient temperature is above 50°F Fahrenheit and when temperature has not been below 35°F Fahrenheit for 12 hours immediately prior to application.

2. Fog coat, seal coat, and paint binder shall not be applied when base or surfaces are wet or contain excess moisture.

B. Asphalt Concrete Paving: Asphalt concrete surfaces shall be constructed only when ambient temperature is above 50°F Fahrenheit and when base is dry.

PART 2 – PRODUCTS

2.1 PAVING MATERIALS

A. Aggregate Base: Aggregate base shall conform to Caltrans Class 2 (R value 78 min) aggregate base, 3/4” maximum size, as specified in Section 26 of the Caltrans Standard Specifications.

B. Asphalt Concrete Paving:
1. Paving asphalt to be mixed with aggregate shall be performance-graded asphalt, PG64-10, conforming to Section 92 of the Caltrans Standard Specifications.

2. Mineral aggregate shall be Type A mineral aggregate as specified in Section 39 of the Caltrans Standard Specifications.

3. Aggregate size shall be as follows:

<table>
<thead>
<tr>
<th>Total AC Thickness</th>
<th>Min # of AC lifts</th>
<th>Aggregate Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch – 1-1/2 inch</td>
<td>1</td>
<td>1/2” max, medium</td>
</tr>
<tr>
<td>2 inch – 2-1/2 inch</td>
<td>1</td>
<td>1/2” max, medium</td>
</tr>
<tr>
<td>3 inch or greater</td>
<td>2</td>
<td>1/2” max, medium for top lift and 3/4” max, medium for initial lifts</td>
</tr>
</tbody>
</table>

4. Asphaltic emulsion for paint binder, fog coat, and seal coat shall be emulsified asphalt, Type SS-1h, conforming to Section 94 of the Caltrans Standard Specifications.

C. Portland Cement Concrete:

1. Concrete shall conform to Section 90 of the Caltrans Standard Specifications for Caltrans “Minor” Concrete.

2. Pavement shall contain 505 lbs/yard of cementous material.

3. Curbs and sidewalk shall contain 505 lbs/yard of cementous material.

4. Cement shall be Type II cement conforming to ASTM C150 as modified by Section 90 of the Caltrans Standard Specifications.

5. Aggregate grading shall meet the requirements for 1/2-inch maximum combined aggregate grading per Section 90-3.04 of the Caltrans Standard Specifications.

6. Water shall be potable and free of organic matter and injurious amounts of oil, acid, alkali, or other deleterious substances.

7. Reinforcing bars shall be deformed and shall conform to ASTM A615.

8. Filled joints, unless noted otherwise on the Drawings, shall be 1/4-inch thick, the full depth of the concrete section and conforming to Section 51 of the Caltrans Standard Specifications.
9. Joint filler shall conform to Section 51 of the Caltrans Standard Specifications for pre-molded expansion joint filler and expanded polystyrene joint filler.

10. Joint Sealant: Sonneborn / BASF, NP-1, one-component, gun-grade, elastomeric polyurethane sealant. Color to match concrete, obtain approval of color from O.R. from site mock-up of concrete and jointing (see Submittals) prior to installing. Provide closed cell backer rod if joint depth is beyond 1/2 inch.


12. Site concrete shall be toned with Davis Color, Sierra 61078 or other as determined by Owner through Mock-up process.

13. Should Owner determine Site concrete shall not be toned with Davis Color, Lamp Black may be utilized. Provide up to 2 pounds per cubic yard as directed by Owner’s Representative.

14. No admixtures will be allowed without prior approval of the Owner’s Representative.

D. Resin Pavement (NaturalPave XL or other—See Appendix for manufacturer’s specification).

1. Resin Pavement: NaturalPave XL specification or approved equal. Color, Sierra per SSPCo. Final color and tone per MROSD review and approval based on specified Mock-up. Manufacturer is Soil Stabilization Products Company, Inc., (SSPCO), (800) 523-9992. Provide material in quantities as recommended by the manufacturer to complete the work.

2. Resin Pavement section shall include Aggregate Base.

E. Ceremonial Space Surfacing

1. Custom specialized surfacing for ceremonial use. Compacted but unstabilized finished product composed of:
   a. Aggregate: crushed, angular aggregate (3/8” minus) unwashed with fines. Color, light brown tone—40%
   b. Coarse sand, light brown-tan color—40%
   c. Silty clay screened soil—20%
   d. Blend materials on-site in mixer before installing.
F. Pavement Reinforcement Fabric: Pavement reinforcement fabric shall meet Caltrans Section 88-1.02, BP Petromat or approved equivalent.

G. Crack Sealant:
   1. Crack sealant shall be rubberized hot-pour type and shall meet ASTM D 3405, Husky 1611 or approved equivalent.
   2. Blotting Agent shall be one of: Screened sand, cement, or fly ash.

H. Tack coat: Tack coat shall meet Caltrans Section 39-4.02.

I. Pavement reinforcement mesh: Pavement reinforcement mesh for use in Type 2 Overlay shall be Glasgrid Model 8501 or approved equivalent.

J. Structural geotextile fabric: Structural geotextile fabric shall be Mirafi 500X or approved equivalent.

K. Slurry seal: Slurry seal shall meet Caltrans Section 37-2.02

PART 3 – EXECUTION

3.1 PREPARATION

A. Subgrade and Aggregate Base:
   1. Prepare subgrade and over excavate per Section 02300 – EARTHWORK AND GRADING.
   2. Aggregate base shall be compacted to 95 percent ASTM D 1557. Sections 26-1.04B and 26-1.05 of the Caltrans Standard Specifications shall apply.
   3. As directed by the Project Botanist, soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

B. Crack Sealing:
   1. Before sealing, cracks shall be cleared of dirt, dust, and all other deleterious materials to a depth of 1/4-inch to 1/2-inch.
   2. Cracks 1/8-inch in width and greater shall be sealed.
3. Application of crack sealer shall be in accordance with the manufacturer’s recommendations unless otherwise directed.

3.2 ASPHALT CONCRETE PAVING

A. General:

1. Asphalt concrete shall be proportioned, mixed, placed, spread, and compacted in conformance with Section 39 of the Caltrans Standard Specifications.

2. Before placing asphalt concrete, an asphalt emulsion tack coat shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints, and all existing pavement to be surfaced, in conformance with Section 39 of the Caltrans Standard Specifications.

3. Spreading and compacting asphalt concrete shall be performed in accordance with Section 39 of the Caltrans Standard Specifications.

4. Fog seal shall be applied to all finished surfaces of asphalt concrete pavement at a rate of 0.05 gallons per square yard, in accordance with Section 37 of the Caltrans Standard Specifications.

5. After fog seal has been applied, ample time shall be allowed for drying before traffic is allowed on the pavement or paint striping is applied.

3.3 CONCRETE CONSTRUCTION

A. General:

1. All concrete shall be mixed in accordance with applicable provisions of Section 90 of the Caltrans Standard Specifications.

2. Construction of concrete substructures shall conform to applicable provisions of Section 51 of the Caltrans Standard Specifications. Unless noted otherwise in the Specifications, all exposed surfaces of structure shall have Class 1 surface finish. Finish shall match adjacent existing concrete paving.

3. For Architectural Concrete or Structural Concrete for Summit Stair see Architectural and Structural concrete specifications, Division 3.

4. Schedule of Locations for Site Concrete Finish Types:

   a. Slabs to receive toppings and fills: Scratched.

   b. Exterior Paved Areas: Light Broom.
c. Concealed Concrete Surfaces: Rough Formed.

5. Curing shall conform to provision of Caltrans Section 90-7. No pigment shall be used in curing compounds for construction of concrete curbs, gutters, and structures.

6. All work shall be subject to field inspection. No concrete shall be placed until the Owner’s Representative has approved the forms and reinforcement.

7. Expansion Joints:
   a. Install expansion joints as noted on the Plans and/or directed by O.R. Expansion joints required at minimum 20'-0" O.C and maximum 15'-0" O.C. as determined in the field by the O.R.
   b. Unless otherwise noted, expansion joints on curbs and gutters shall be placed 20 feet on centers maximum, or closer as determined on-site by O.R. Expansion joints shall be placed adjacent to structures, and at all returns, and shall be filled with joint filler. Control (or Score) joints shall be as noted on Plans or formed at a minimum of 4 feet on center.
   c. Extend pre-formed joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   d. Furnish joint fillers in one-piece lengths for full width being placed. Lace or clip joint filler sections where more than one is required to meet the conditions.

8. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than 6 feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.4 RESIN PAVEMENT

A. Ensure Resin Pavement subcontractor has direct project installation experience with NaturalPAVE XL or other Owner selected Resin Pavement product. Subcontractor shall have installed at least three public agency projects of at least 2,000 SF.

B. Ensure that the Resin Pavement subcontractor has successfully completed the manufacturer’s one-day on-site technical assistance session.

C. Refer to NaturalPAVE XL manufacturer’s specifications, PART 1, 1.5, Quality Assurance, and all other sections of manufacturer’s specification (See Appendix).
D. Resin Pavement section, including the Aggregate Base, shall be excavated into, not placed atop, the excavated or graded, compacted subgrade.

E. Beneath Resin Pavement, compact subgrade to 95 percent of maximum dry unit weight. Compact shoulders on each side of path or paving area edge as noted and as directed by Owner’s Representative in field.

F. Entire sectional area of the pavement (Resin Pavement and Aggregate Base), required shoulders, and adjacent finish grades shall be compacted to 95% of maximum dry unit weight prior to excavation.

G. Once compaction is approved, excavate area for Resin Pavement from compacted finish and subgrade with vertical sides. Over excavate only to the extent necessary to install Stabilized Aggregate Paving.

H. Install Resin Pavement per NaturalPAVE XL (SSPCo) Specifications and Installation Procedures.

I. Install only after Owner’s Representative review and approval of subgrades, aggregate, and materials and methods.

J. Install as noted on the Plans and per Manufacturer’s specifications and recommendations

3.5 CEREMONIAL SPACE SURFACING (SPECIALIZED SURFACE)

A. Ceremonial Space Surfacing shall be installed on the prepared aggregate base.

B. Compact subgrade beneath Ceremonial Space Surfacing area to 95 percent.

C. Premix aggregate and sandy loam mix in equal quantities before bringing to Ceremonial Space site.

D. Install aggregate/sandy loam mix in (2) 2-inch lifts for total of 4 inches of surface depth.

E. Use lightweight grade rakes to smooth grade surface and compact to 90% relative compaction with weighted machine roller.

3.6 SLURRY SEAL

A. General:

1. Mixing, spreading and placing shall be in accordance with applicable provisions of Section 37 of the C.D.T Standard Specifications.
3.7 FIELD QUALITY CONTROL

A. Asphalt Concrete Paving:

1. Contractor shall perform a flood test in the presence of the engineer and/or Owner’s representative. Location of ponding greater than 1/8” in depth may impact proper drainage and shall be marked and remedied by the contractor.

2. The specified thickness of the finished pavement shown on the plans and specifications shall be the minimum acceptable.

3. Conforms shall form a smooth, pond-free transition between existing and new pavement.

4. Depressions in paving between high spots are not to exceed 1/8-inch when measured below a 10 feet long straight edged placed anywhere on surface in any direction.

5. The finished asphalt pavement shall have positive drainage without ponding.

3.8 CLEANUP

A. General:

1. Surplus material remaining upon completion of paving operations shall become the property of the Contractor, to be removed from the work site and disposed of in a lawful manner.

2. Surfaces shall be left in a clean, neat, and workmanlike condition, and all construction waste, rubbish, and debris shall be removed from the work site and disposed of in a lawful manner.

END OF SECTION
SECTION 02760 - PERVIOUS CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. The Work to be completed under this contract includes the furnishing of all labor, materials and equipment necessary for construction of Portland Cement Pervious Concrete Pavement for streets, parking & pedestrian areas in conformance with the plans and specifications.

B. Drawings and general provisions of the Contract, including Contract General Conditions and Supplementary General Conditions, Contract Special Conditions and Division 1 Specification Sections, apply to this Section.

C. Work specified in Related Sections;

   1. Section 02300 – EARTHWORK AND GRADING.

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 REFERENCES

A. American Concrete Institute

   1. ACI 305 “Hot Weather Concreting”
   2. ACI 522 “Report on Pervious Concrete”
   3. ACI Flatwork Finisher Certification Program
   4. ACI Field Technician Certification Program

B. American Society for Testing and Materials

   1. ASTM C29 “Test for Bulk Density (Unit Weight) and Voids in Aggregate”
   2. ASTM C33 “Specification for Concrete Aggregates”
3. ASTM C42 “Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.”

4. ASTM C94 Specification for Ready-Mixed Concrete


6. ASTM C138 “Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete.”

7. ASTM C150 “Specification for Portland Cement”

8. ASTM C172 “Practice for Sampling Freshly Mixed Concrete”

9. ASTM C260 “Specification for Air-Entraining Admixtures for Concrete”

10. ASTM C494 “Specification for Chemical Admixtures for Concrete”

11. ASTM C595 “Specification for Blended Hydraulic Cements”

12. ASTM C618 “Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.”

13. ASTM C989 “Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.”

14. ASTM C1077 “Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.”

15. ASTM C 1602 “Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete”

16. ASTM D1557 “Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).”

17. D3385 “Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.”


1.4 QUALITY ASSURANCE
A. Prospective contractors shall attend a pre-bid meeting where the pervious concrete pavement process will be described by industry representatives from the Pacific Southwest Concrete Alliance.

B. Prior to award the contractor shall submit evidence of two successful Pervious Concrete Pavement projects including but not limited to the following:

1. Project name and address, owner name and contact information

2. Test results including density (unit weight), void content and thickness.

C. The Pervious Concrete Contractor shall meet, at the time of bidding, one of the following criteria and submit verification of NRMCA certification.

1. The crew shall employ no less than one NRMCA Certified Pervious Concrete Craftsman who must be onsite, overseeing each placement crew during all pervious concrete placement.

2. The crew shall employ no less than two NRMCA Certified Pervious Concrete Installers who must be onsite, overseeing the placement of pervious concrete.

3. The crew shall employ no less than three NRMCA Pervious Concrete technicians and one Pervious Installer who shall be onsite, overseeing each placement crew during all Pervious Concrete placement.

D. At least one member of the crew should be a Certified Concrete Finisher in accordance with the criteria of the American Concrete Institute.

1.5 SPECIAL EQUIPMENT: Pervious concrete requires specific equipment for compaction and jointing. The pavement shall be jointed and compacted using the methods listed.

A. Rolling compaction shall be achieved using a minimum 10-inch diameter steel pipe that spans the width of the section placed (and exerts a vertical pressure of at least 10 psi on the concrete).

B. Plate compaction shall be achieved using a standard soil plate compactor that has a base area of at least two square feet and exerts a minimum of 10 psi vertical pressure on the pavement surface.

C. When joints are placed in pervious pavements, they may be constructed by rolling, forming or sawing. Rolled joints shall be formed using a “salt roller” to which a beveled fin with a minimum depth of 1/4 the thickness of the slab has been welded around the circumference of a steel roller. Score joints shall be constructed using an early entry or wet saw.
1.6 SUBMITTALS: Prior to commencement of the work the contractor shall submit the following:

A. Concrete materials:
   1. Proposed concrete mixture proportions including all material weights, volumes, density (unit weight), water cement ratio, and void content.
   2. Aggregate type, source and grading.
   3. Cement, fly ash and admixture manufacturer certifications

B. Qualifications: Evidence of qualifications listed under Quality Assurance.

C. Project details: Specific plans, details, schedule, construction procedures and quality control plan.

D. Subcontractors: List all materials suppliers and subcontractors to be used on the project.

1.7 MOCK-UP: Prior to construction, mock-up(s) shall be placed and approved by the Owner. The Owner is permitted to waive this requirement based on contractor qualifications.

A. Mock-up(s) shall be constructed in accordance with the plans and specifications. A minimum 225 sq. ft. panel size shall be placed, jointed and cured using materials, equipment, and personnel proposed for the project.

B. Mock-up(s) cost and removal shall be the responsibility of the Contractor.

C. Quality: Mock-ups shall have acceptable surface finish (as determined by the Owner's Representative), joint details, thickness, porosity and curing procedures and shall comply with the testing and acceptance standards listed in the Quality Control section of this specification.

D. If mock-ups placed at the site are found to be deficient in thickness, density (unit weight) or percentage of voids, or of an unacceptable appearance, they shall be removed at the contractor's expense and taken to an approved landfill or recycling facility. If mock-ups are found to be satisfactory, they may be left in-place and included in the completed work.

PART 2 – MATERIALS

2.1 CEMENT
A. Cement Type II or V conforming to ASTM C150 or Portland cement Type IP or IS conforming to ASTM C595.

2.2 SUPPLEMENTARY CEMENTITIOUS MATERIALS:
A. Class F Fly ash conforming to ASTM C618.
B. Ground Iron Blast-Furnace Slag conforming to ASTM C989.

2.3 ADMIXTURES:
A. Air entraining agents shall comply with ASTM C260.
B. Chemical Admixtures shall comply with ASTM C494.
C. Hydration stabilizers are permitted to be used when it is necessary to increase concrete placement time to 90 minutes and improve finishing operations.

2.4 COLOR AND FINISH: what do we need via lamp black on site concrete and perm concrete to tone down the light finish of untreated concrete? We have 1 lb in Paving and Surfacing
A. Pervious concrete shall be toned with 2 pounds per cubic yard Lamp Black as determined by Owner through Mock-up process.

2.5 AGGREGATES:
A. Coarse aggregate shall comply with ASTM C33. Size 8 (3/8” to No. 16) or Size 89 (3/8 in. to No. 50) shall be used unless an alternate size is approved for use based on meeting the project requirements. Fine aggregate complying with ASTM C33, if used, shall not exceed 3 cu. ft.
B. Larger aggregate sizes may increase porosity but can decrease workability. Avoid well graded aggregates as they may reduce porosity, and may not provide adequate void content.
C. Where available, natural rounded aggregates are recommended.

2.6 WATER
A. Water shall comply with ASTM C 1602.

2.7 MIXTURE PROPORTIONS: The composition of the proposed concrete mixtures shall be submitted to the owner’s representative for review and/or approval and shall comply with the following provisions unless an alternative composition is demonstrated to comply with the project requirements.
A. Cementitious Content (combination of cement and supplementary cementitious content): The concrete producer shall determine the cement content based upon the available aggregate gradation. For vehicle pavements, total cementitious content shall exceed 630 lbs/cy. For pedestrian pavements, total cementitious content shall not exceed 600 lbs/cy.

B. Supplementary cementitious content: Fly ash: 25% maximum. Slag: 50% maximum

C. Water/Cementitious Ratio: Shall range between 0.27 lb/lb and 0.31 lb/lb.

D. Aggregate Content: The bulk volume of aggregate per cubic yard shall be equal to 27 cubic foot when calculated from the dry rodded density (unit weight) determined in accordance with ASTM C29 jigging procedure.

E. Admixtures: Admixtures shall be used in accordance with the manufacturer’s recommendations and dosage determined by the pervious contractor and concrete producer.

F. Mix Water: The quantity of mixing water shall be established to produce a pervious concrete mixture of the desirable workability to facilitate placing, compaction and finishing to the desired surface characteristics.

2.8 SUBBASE: Subbase shall be ¾ inch washed crushed rock.

PART 3 – EXECUTION

3.1 SUBGRADE:

A. Subgrade preparation per Section 02300 – EARTHWORK AND GRADING.

B. Permeability: Subgrade shall have a minimum permeability of 0.1 inch per hour determined in accordance with ASTM D3385.

3.2 FORMWORK:

A. Form materials are permitted to be of wood or steel and shall be of width to the depth of the pavement. Forms shall be of sufficient strength and stability to support mechanical equipment without deformation of plan profiles following spreading, strike-off and compaction operations. When a mechanical vibratory screed is used for placement, forms shall have a removable spacer of 1/2” thickness placed above the depth of pavement. The spacers shall be removed following placement and vibratory strike-off to allow roller compaction.
3.3 MIXING AND HAULING:

A. Production: Pervious concrete shall be manufactured and delivered in accordance with ASTM C 94.

B. Mixing: Mixtures shall be produced in central mixers or in truck mixers. When concrete is delivered in agitating or non-agitating units, the concrete shall be mixed in the central mixer for a minimum of 1.5 minutes or until a homogenous mix is achieved. Concrete mixed in truck mixers shall be mixed at the speed designated as mixing speed by the manufacturer for 75 – 100 revolutions.

C. Transportation: The pervious concrete mixture may be transported or mixed on site and discharge of individual loads shall be completed within one (1) hour of the introduction of mix water to the cement. Delivery times may be extended to 90 minutes when a hydration stabilizer is used.

D. Discharge: Each truckload will be visually inspected for consistency of concrete mixture. Job site water additions are permitted to obtain the required mix consistency. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practical and such that discharged concrete is incorporated into previously placed plastic concrete.

3.4 PLACING AND FINISHING:

A. The Contractor shall provide equipment to place the pervious concrete. Internal vibration shall not be permitted. Placement procedures shall utilize a motorized hydraulic roller screed or a mechanical vibratory truss screed. Except for inaccessible areas, strike-off by non-vibratory means. Wooden 2x4 screeds shall not be permitted. In small inaccessible areas, strike-off by non-vibratory means shall be permitted.

1. Hydraulic Roller Screed Construction: The hydraulic roller screed is a metal tube that is hydraulically spun counter-clockwise to the direction of travel. The concrete shall be placed on grade in front of the roller screed from either a mixer truck or a belt conveyor.

2. Compaction shall be achieved by successive passes of the roller screed over the concrete. Placed concrete shall not be disturbed while in the plastic state. Low spots after the screeding operation shall be filled and rolled.

a. The compacted concrete shall be cross rolled to remove any screeding and compaction marks on the concrete surface.
b. Hand tampers shall be used to compact the concrete along the slab edges immediately adjacent to the forms. After edging with a ½” radius edger, no further finishing shall be performed on the concrete. The pervious concrete pavement shall be compacted to the required cross-section and shall not deviate more than +/- 3/8 inch in 10 feet from profile grade.

c. The pervious concrete pavement shall be compacted to the required cross-section and shall not deviate more than +/- 3/8 inch in 10 feet from profile grade.

3. Mechanical Vibratory Screed Construction: A conventional vibratory truss screed shall ride on a ½” spacer placed on top of the pavement form. The concrete shall be placed on grade in front of the vibratory screed from either a mixer truck or a belt conveyor.

a. After the concrete has been screeded to the top of the spacer, the spacer shall be removed and the concrete compacted to the top of the form with a steel pipe spanning the section being placed. The steel pipe shall be a minimum of 10” diameter exerting a minimum pressure of 10 psi on the concrete. Low spots after the screeding operation shall be filled and rolled. Care shall be taken during the compaction process to not seal the pervious concrete surface.

b. The compacted concrete shall be cross rolled to remove any screeding and compaction marks on the concrete surface.

c. Hand tampers shall be used to compact the concrete along the slab edges immediately adjacent to the forms. After edging with a ½” radius edger, no further finishing shall be performed on the concrete.

d. The pervious concrete pavement shall be compacted to the required cross-section and shall not deviate more than +/- 3/8 inch in 10 feet from profile grade.

B. Temperature at time of placement shall be between 40°F and 80°F.

3.5 JOINTING

A. Joints shall be placed at regular intervals equivalent to the width of the pavement.

B. Control (contraction) joints shall be installed at regular intervals not to exceed 20 feet, or two times the width of the pavement. The control joints shall be installed to a depth of T/4. These joints shall be installed in the plastic concrete.
C. Jointing plastic concrete: Joints installed in the plastic concrete shall be constructed utilizing a joint cross-roller. Rolled joints shall be installed in the plastic concrete immediately after compaction and prior to curing.

D. Jointing hardened concrete: Saw-cuts shall be made as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking. The curing cover in the vicinity of the joint shall be removed and the surface kept misted to prevent moisture loss during the sawing operation. After sawing the curing cover shall be securely replaced for the remainder of the curing cycle.

E. Transverse construction joints: Transverse construction joints shall be installed whenever placing is suspended for 20 minutes or whenever concrete is no longer workable.

F. Longitudinal joints between successive placements shall not be dowelled.

G. Isolation joints: Isolation joints shall be used when abutting fixed vertical structures such as light pole bases, building foundations, existing pavement, etc. Isolation material shall be positioned before concrete is placed and shall be the full depth of the pavement section.

3.6 CURING

A. Immediately after screeding, if the pervious concrete is susceptible to plastic shrinkage according to ACI 305, the surface shall be kept moist and evaporation prevented using a spray applied curing compound and/or evaporation retarder.

B. Final curing procedures shall begin no later than 20 minutes after the concrete has been discharged from the mixer. The pavement surface shall be covered with a minimum of six (6) mil thick white or clear polyethylene sheets or other approved covering material. The cover shall overlap all exposed edges and shall be secured to prevent dislocation due to winds or adjacent traffic conditions.

C. The curing cover shall remain securely in place for a minimum of 7 days if 15% fly ash is used, 10 days if more than 15% fly ash is used. No vehicular traffic shall be permitted on the pavement until curing is complete and no truck traffic shall be permitted for at least 14 days. In cold weather black plastic may be used to aid in heat retention.

3.7 QUALITY CONTROL

A. The Owner’s representative shall employ a testing laboratory that conforms to the requirements of ASTM E329 and ASTM C1077. All personnel engaged in testing shall be certified by the American Concrete Institute as ACI Concrete
Field Technicians or equivalent and shall be certified by NRMCA as a Pervious Concrete Technician.

B. Traditional Portland cement pavement testing procedures based on strength and slump control are not applicable to this type of pavement material.

C. Concrete tests shall be performed for each 150 cubic yards or fraction thereof with a minimum of one test for each day’s placement.

D. Plastic concrete shall be sampled in accordance with ASTM C 172 and density (unit weight) measured in accordance with ASTM C 138. The density (unit weight) of the delivered concrete shall be +/- 5 pcf of the design density (unit weight) when determined using the rodding method of ASTM C29 using a 0.25 cf container.

E. Plastic void content shall be calculated as per ASTM C138, Gravimetric Air Determination and compared to the void percentage required by the hydraulic design.

F. Hardened concrete shall be tested for in-place infiltration rate. The infiltration rate shall not be less than 100 inches per hour when tested using the procedure described in paragraph 3.7.G.1. At the Owner’s Representative option concrete shall also be tested for in-place thickness and void content. One set of three cores per 150 CY of concrete placed on one day or fraction thereof shall be drilled in accordance with ASTM C 42.

G. The infiltration test shall be performed in accordance with the following procedure:

1. The apparatus shall consist of a:
   a. One gallon, minimum size, water container with a spout. The spout shall be able to produce a stream with a circular cross-section and large enough in diameter to discharge the entire contents of the container in 20 seconds or less.
   b. Stopwatch capable of indicating elapsed time to the nearest second.
   c. Tape measure of at least 0.95 m (36 inches) that is graduated in 5 mm (1/4 inch) increments or smaller.
   d. The water shall be free of suspended solids. The volume of water shall be determined to two significant figures.
   e. The testing procedure is:
i. Place a pre-measured amount of water into the container.

ii. Pour the water onto the pervious concrete surface. Control the discharge rate by manually adjusting the angle of the spout so that the pooling of water on the concrete surface is between 25.4 cm to 76.2 cm (10 to 30 inches). Pour the entire contents of the container onto one spot and hold the spout over the spot until the pool of water vanishes.

iii. Start the stopwatch when the water initially touches the concrete surface and stop it when the pool disappears from the surface.

iv. Measure the longest dimension of the dampened area. Measure the width of the pool perpendicular to the first measurement.

v. Repeat this procedure in a minimum of 4 separate locations.

f. The calculation of the Infiltration Capacity shall be as follows:

i. The formula for SI Units is: \( IC = \frac{V}{\pi d_1 d_2 t} \) inches per hour.

ii. The formula for U.S. Standard Measures is:
\[
IC = \frac{V(3,326,400)}{(\pi)(d_1)(d_2)(t)} \text{ inches per hour}
\]
Where: IC is Infiltration Capacity, V is the volume of water in gallons or liters, and d1 and d2 are the dimensions that were determined in part iv. Pi is approximately 3.14159.

g. The test report shall include at a minimum:

i. The time and date of testing.

ii. The name and affiliation of the person performing the test.

iii. The location of the site being tested.

iv. The location of each site tested.

v. The volume of water used at each test site.

vi. The length of the two measurements taken at each site.

vii. The discharge time for the water at each location.

viii. The infiltration capacity at each location.

ix. The average infiltration capacity for the site.
H. The cores when measured for length shall not be more than ¾-inch less than the specified design thickness.

I. The cores shall be tested for void content using the following procedure:

1. Weight of saturated, surface-dry (ssd) specimen in air, B
2. Weight of ssd specimen in water, C
3. Determine bulk specific gravity (ssd), B/(B-C)
4. Weight in water of ssd specimen wrapped in parafilm or saran wrap, D
5. Volume of core wrapped in parafilm or saran wrap by displacement, B-D = Vc
6. Volume of solid part of core (aggregate), B-C = Vs
7. Percentage of permeable voids, ((Vc-Vs)/Vc)*100

END OF SECTION
SECTION 02780 - PAVEMENT MARKING

GENERAL

1.1 SUMMARY:
A. Provide requirements for materials, fabrications, and installation of traffic control and pavement markings.

1.2 DEFINITIONS
A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 SUBMITTALS:
A. Submit manufacturer’s product data describing application of products and compliance with VOC requirements.
B. Shop Drawings: Show complete layout and location of pavement markings prior to demolition or obliteration of the existing markings.
C. Submit samples as follows:
   1. Traffic paint.
   2. Pavement markers and adhesives.
   3. Reflectorized markers and posts.

1.4 DELIVERY, STORAGE AND HANDLING:
A. Comply with Division 1 requirements, specifications, and the Construction Manager.
B. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of installation.
C. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Traffic Marking and Symbol Paint:

1. Traffic Marking and Symbol Paint shall conform to the applicable requirements of Caltrans Standard Specification Section 84-2.02C.

2. Physical Characteristics shall conform to the following:
   - Volatile Organic Compounds  100 g/l max
   - Pigment (White) Content, by Weight  58-62%
   - Pigment (Yellow) Content, by Weight  56-60%
   - Total Nonvolatile Content, by Weight  75-79%

3. EF Series, Fast Dry, Waterborne Traffic Paint distributed by Ennis Flint (#985301, White); (#985302, Lead Free Yellow); or approved equivalent.

B. Accessible Symbol Background Paint: Blue Color. Glidden Co. “Glid-Guard Lifemaster Finish No. 5200 /series, Color 1/M 79”, or approved equivalent.

C. Thermoplastic Stripes and Markings:

1. Thermoplastic stripes and makings shall be hot applied conforming to CALTRANS STANDARD SPECIFICATION Section 84 and shall be Cataphote-Catatherm brand, Pavemark thermoplastic brand, or approved equivalent.

2. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

D. Pavement Markers and Adhesives:

1. Pavement markers shall be two-way retroreflective “Blue” markers and shall conform to the applicable requirements of Caltrans Standard Specification Section 85.

2. Adhesive for pavement markers shall be standard set epoxy adhesive conforming to the requirements of Caltrans Standard Specification Section 95-2.05.
PART 3 – EXECUTION

3.1 INSPECTION:
A. Examine receiving surfaces and verify that surfaces are clean and proper for installation.

B. Do not start work until unsatisfactory conditions have been corrected.

3.2 APPLICATION:
A. Preparation:

1. Clean and prepare surfaces to receive traffic paint in accordance with Caltrans Standard Specification Section 84-2.03B and these special provisions. Where required, remove existing striping and markings by wet blasting or equivalent method. Do not use dry sandblasting or other dust producing methods.

B. Traffic Paint:

1. Traffic paint shall be machine applied in accordance with Caltrans Standard Specification Section 84-2.03C.

2. No paint shall be applied until the surface has been approved by the Engineer and until at least 10 days after the slurry seal on asphalt concrete has been placed. Place markers in accordance with Caltrans Standard Specification Section 85-1.03.

C. Striping Layout:

1. Layout striping locations via “cat tracking” or chalk line for Owner approval prior to application of any markings or paint.

2. Traffic stripe shall be single and double, solid and broken, and of the color to match existing conditions.

3. Traffic striping shall be placed in patterns to match existing conditions, contractor shall document.

D. Thermoplastic Stripes and Markings:
1. Thermoplastic stripes and markings shall be applied hot in conformance with manufacturer’s recommended instructions and the applicable requirements of Caltrans Standard Specification Sections 84-2.03B and 2.03C.

E. Pavement Markers:

1. Pavement markers shall be installed to delineate the location of fire hydrants along off-site and on-site roadways. No markers shall be installed until the surface has been approved by the Engineer and until at least 10 days after the slurry seal on asphalt concrete has been placed. Place markers in accordance with Caltrans Standard Specification Section 85-1.03A.

F. Apply marking paint in accordance with approved manufacturer’s recommendations.

G. Density of paint coverage shall hide color and texture of substate.

H. Parking Stripes: Paint four inches wide unless otherwise noted.

I. Symbol Marking: Paint to match existing conditions.

3.3 CLEANING AND PROTECTION:

A. Comply with requirements of Section 01700 – CLEANING.

B. Upon completion of work, remove surplus materials and rubbish and clean off spilled or splattered paint resulting from this work.

C. Permit no surface traffic until pavement and symbol marking has dried thoroughly.

END OF SECTION
SECTION 02870 - SITE FURNISHINGS

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following site furnishings:

1. Construction Funding Sign fabrication and installation
2. Split Rail Fencing (MROSD Standard)
3. Restoration Fence
4. Timber Bench (Tower, West Summit Areas, Parking)
5. Summit Stair Bench (Summit Stair Landings)
6. Trailhead Bench (see Appendix)
7. Metal for Cardinal Point Markings and Edging at Ceremonial Space
8. Metal Edging at Resin Pavement and Guardrail in Grade
9. Call Box (See Appendix)
10. Bike Rack (See Appendix)
11. Bollard (Custom Fixed and Removable)
12. Vault Toilet installation preparation only (excavation of vault area) for Owner installed CXT Toilet (see Appendix).

Note—MROSD will install trash and recycling receptacles after the project is completed.

B. Related Sections include the following:

1. Division 2 Section “Site Clearing”
2. Division 2 Section "Earthwork and Grading"

3. Division 2 Section 'Paving and Surfacing"

4. Division 3 Section "Cast-in-Place Concrete – Summit Stair"

5. Division 5 Section "Metal Fabrications"

6. Division 5 Section "Metalwork"

1.3 DEFINITIONS

A. Owner or City refers to Midpeninsula Regional Open Space District (MROSD) which is the lead agency. Owner’s Representative (O.R.) for the project refers to MROSD project managers, associates or agents.

1.4 SUBMITTALS

A. Submittal Package: All submittals in this specification section (excluding re-submittals) shall be compiled together and submitted to O.R. as one package.

B. Product Data: Provide for each type of product indicated. Include construction and fabrication details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.

C. Shop Drawings: For all furnishings noted within Specifications and or shown on Plans, including but not limited to: Metal Edging at Resin Pavement and Guardrail in Grade, Metal for Cardinal Point Markings and Edging at Ceremonial Space, Construction Funding Signs, Split Rail Fencing, Timber and Summit Stair Benches, Bollard (Removable and Fixed), Call Box, Restoration Fence, and Bike Rack.

D. Mock-ups for Metal Edging at Resin Pavement and Guardrail in Grade, Metal for Cardinal Point Markings and Edging at Ceremonial Space, Timber Bench, Summit Stair Bench, Split Rail Fencing (sloped and faceted installation conditions shall be covered in one or more mock-ups), Restoration Fence, and Bollard (Removable and Fixed).

E. Clear sealer submittal and mock-up for Timber Bench and Summit Stair Bench redwood logs.

F. Samples for Verification: For each type of exposed finish required, prepared on Samples not less than 6-inch long for linear components and 4-inch square for sheet components.
G. Material Certificates: For site furnishings, signed by manufacturer

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing through one source from a single manufacturer.

PART 2 PRODUCTS

2.1 FURNITURE

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Construction Funding Sign: Laminated, full color, all weather sign, max. 4-1/2 feet by 8-feet. Graphic file shall be provided to Contractor by MROSD. Contractor responsible for fabrication, laminated surfing, and mounting on 4-1/2 feet by 8-feet, 3/4-inch plywood backing board.

C. Timber Bench and Summit Stair Bench

1. Fabricated from felled and cured redwoods. Remove all bark and mill all four sides and each end. Minimum finished size as noted on Plans. Available through Out of the Woods, Santa Cruz Mountains, Dave Merchant, 831-818-2260.

2. Custom milled redwood log sections shall be reviewed and approved by O.R. prior to final trimming and finishing for use as benches. Milled log sections shall be of the highest quality, without checking or splitting, warping, discoloration or scars from felling, stockpiling, storage, or handling processes.

3. Saw cuts shall be straight, even, and plumb and sanded smooth as noted.

4. Belt sand all surfaces and face cuts to complete, smooth finish which allows for no splintered surfaces. Final sanding treatment shall be with #100 grit paper.

5. Timber Benches shall include both backless and backrest versions.

6. If request by MROSD or O.R. a clear, invisible, non-staining sealer shall be applied to all surfaces of the redwood—If request by MROSD.

D. Trailhead Bench: Columbia Cascade Timberform, PARKWAY, 6-foot bench. Model # 2016-6-E. Steel frame with unpainted galvanize finish—no powder coating.
Douglas fir slats. Embed mount in 12” dia. x 30” deep CIP concrete footings. Provide rebar for embed per manufacturer.

E. Call Box: Rath Security, Tower solar powered emergency phone, (866) 850-8854. Freestanding tower style, 9-foot height. Color, and phone line options per MORSD.

F. Bike Rack: Loop type rack, Welle Series, WSH 3602-IG-G in ground mount in 12” dia. x30” deep CIP concrete footings. Galvanized finish.

G. Anchors, Fasteners, Fittings, and Hardware (if specified): Manufacturer’s standard, corrosion-resistant-coated or non-corrodible materials; commercial quality; tamperproof, vandal and theft resistant; concealed, recessed, and capped or plugged. Provide as required for site furnishing assembly, mounting, and secure attachment.

1. Anti-theft Hold-Down Brackets: For securing site and street furnishings to substrate; two per unit.

H. Metal for Cardinal Point Markings and Edging at Ceremonial Space: Weathering steel, ASTM A606 Type 4.


2. Edging at Ceremonial Space: 1 X 6-inch by steel plate shall span two openings: East and North entry points.

I. Metal Edging at Resin Pavement and Guardrail in Grade: Weathering steel, ASTM A606 Type 4. Steel plate 3/8 inch by 1 inch X 6 inch in minimum 20 foot sections. Provide 1-1/2 inch by 3/8th inch by 18-inch to 24-inch long flat bar steel stakes (length per O.R. direction in field and field condition) to secure edging. Provide welded overlapping seam plate (at all adjoining 20 foot metal edging sections).

1. At Guardrail in Grade, add black, rigid plastic spacer (1-3/4 inch x 1/2 inch x 6 inch deep. Spacer is used to isolate weathering steel from painted steel guardrail. See Plans for detail.

J. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

2.2 FINISHES, GENERAL

A. Comply with NAAMM’s "Metal Finishes Manual for O.R. and Metal Products" for recommendations for applying and designating finishes.
B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.3 RESTORATION FENCE

A. Posts: hot-dipped galvanized steel pipe, without pipe markings of any kind. Sizes as noted on Plans.

B. Cable: galvanized, 3/16 inch diameter.

C. Fittings: galvanized crimp fittings and miscellaneous fittings as required to complete assembly.

2.4 SPLIT RAIL FENCING (MROSD STANDARD, SEE DETAIL ON PLANS)

A. Posts: Pressure Treated (P.T.) Douglas fir. Structural grade, No. 1 or better, F.O.H.C. Pressure treated for ground contact, to meet AWPA standards. Pressure treated with CA-C copper azole. Provide CA-C “green tinted” P.T. stain as provided by Truitt & White, Berkeley, CA or approved equal—Note that no alternative P.T. treatment (stain) will be accepted. Treat all cut sections and ends with CA-C copper azole to match factory pressure treatment stain. Ensure that wood does not exhibit cupping, warping, or crowning, twisting or checking.

B. Rails: Split Rail, redwood or cedar per Plans.

C. Footings for Rail Fencing Posts: Intermediate posts Aggregate Base Course footings (See Section 02300). Concrete footings at ends, turns of greater than 45 degrees, and at 30'-0” o.c. within runs.

2.5 FASTENERS

A. Split Rail Fencing: as noted on Plans.
PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

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

3.2 INSTALLATION

A. Comply with manufacturer’s written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.

B. Site Furnishings: Install level, plumb, true, and securely anchored at locations indicated on the Plans.

C. Post Setting: Layout shall be staked and roped as mock-up for all fencing locations. O.R. to review and approve on-site.

   1. At concrete footings, finish top of footing with smooth, shaped top at 3% slope to shed water. Protect portion of posts above footing from concrete splatter.

   2. Verify that posts are set plumb and aligned at correct height and spacing.

   3. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

D. Timber Benches: Install as noted on Plans. Coordinate elevations and layout with paving.

   1. In Tower and Site area, install bench footings prior to paving.

   2. At Tower, slope bench towards Tower at 1% (1/4 inch) across width of bench.

   3. Within Site, slope bench away from adjacent walkways as directed by O.R. at 1% (1/4 inch) across width of bench.

E. Summit Stair Bench: slope bench away from retaining wall at 1% (1/4 inch) across width of bench. Ensure timber is set to retaining wall per Plans.

F. Split Rail Fence: Install per Plans and Specifications and MROSD Detail.
1. Posts: Install plumb and aligned to site features and per O.R. direction. O.R. to approve prior to final set and trimming. Ease edges – only if directed by O.R.

2. Post Footings: Power auger excavation required for all post footings. Install Aggregate Base in 6 inch lifts and compact to 95 percent. Install concrete footings where called for.

3. Split Rails installed per Plans. Rails to be set level in level areas.
   a. On sloped areas, create a review mock-up for the railing layout. Mark joints for trimming at each post for O.R. review and approval prior to trimming and fastening.
   b. Provide compound miter cuts at all posts where fence changes direction and elevation.

4. Split Rail Fasteners: Align all fasteners and space equally as directed by O.R. and per approved Mock-up. Install level, straight, and evenly spaced from edges and end of rail and from each other. Countersink fasteners as noted on Plans.

G. Restoration Fence: Install as noted and as directed by O.R. in field.

H. Bike Rack: Install per manufacturer's recommendations and specifications in below grade concrete footings. Footings shall be 12-inch diameter, 24-inch depth. Set top of footing 4-inches below finish grade of paving.

I. Call Box: Install per manufacturer's recommendations in concrete footing, on pedestrian paving as noted on Plans. Ensure pavement is free draining. Ensure ADA accessibility. Provide necessary conduits and wiring to connect to existing AT&T land line.

J. Metal for Cardinal Point Markings and Edging at Ceremonial Space:
   1. Cardinal Point Markings: Set into stonewall concrete footing prior to initiating stone wall masonry.
   2. Edging at Ceremonial Space: Set into stonewall concrete footing prior to initiating stone wall masonry or final Ceremonial Space or adjacent Resin Pavement. Set flush to finish surface elevations on Plans. Weld (provide continuous welds) to East and North Cardinal Point Markings prior to pouring stonewall footing. Coordinate with Division 5 Metal specifications.

K. Metal Edging at Resin Pavement. See notes on Plans. Install edging and stakes per Plans. Coordinate with Division 5 Metal specifications.
1. At each connection between 20 foot metal edge sections, provide continuous butt weld along seam both sides of metal edge.

2. After welding metal edge sections, install 3/8" by 5 inch by 18 inch seam plate at each seam between metal edge sections—only on inside Resin Pavement side of metal edge. Set seam plate down 1 inch below top of metal edge. Weld overlapping seam plate on top edge and both ends.

3. Stakes shall be driven to refusal on the outside edge of the metal edge. Trim top of stake to sit 1 inch below top of edge per Plans. Weld stakes continuous on both edges to metal edging, see Plans for additional notes. Spacing 30 inch o.c. minimum unless otherwise noted.

L. Metal Edging Guardrail in Grade: Set edging along posts, spaced off Guard per Plans with plastic spacer. Set top of edging flush to pavement elevations noted on Plans. Use (2) steel stakes between each post (5'-0" o.c. typical) to secure edging between posts at prescribed spacing.

M. Construction Funding Sign: Mount Contractor fabricated sign on 4-1/2 foot by 8-foot plywood (3/4 inch) backing sheet. Regulators may allow for the use of (1) 4x8 sheet of plywood.

1. Graphic file shall be provided to Contractor by Owner. Contractor responsible for all printing, fabrication, coordination, and installation.

2. Provide (2) sign posts per 4x8 sign. Posts shall be 4x4 pressure treated Doug Fir posts, in 12-inch diameter by 3-foot deep augered concrete footings. Slope top of footing to drain

3.3 CLEANING

A. After completing the work in this section, inspect all components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 02870
SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY
   A. Furnish, install, and remove forms for structural cast-in-place concrete including shoring and form supports.
   B. Work included in this section includes formwork required for concrete for the Summit Shelter, Trailhead Shelter and Restroom Screen including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete as shown on Drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS
   A. Cast-in Place Concrete: Section 03 30 00
   B. Cast-in Place Concrete Finishing: Section 03 33 00 (including finish for concrete building formed surfaces including patching and curing of concrete.

1.4 DEFINITIONS
   A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 CODES AND STANDARDS
   A. The latest editions of the following references, codes, and standards are hereby made a part of this Section and formwork shall conform to the applicable requirements therein except as otherwise specified herein or shown on the drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.
1. “Recommended Practice for Concrete Formwork,” ACI 347.


1.6 ALLOWABLE TOLERANCES

A. Design, construct, set, and maintain formwork so as to ensure completed work within the suggested tolerance limits specified in ACI 347, Section 3.1.1.

1.7 MATERIALS

A. Earth Forms: Unless otherwise indicated or required by the Drawings or these specifications, concrete for footings may be placed directly against vertical excavated surfaces provided the material will stand without caving and provided that minimum reinforcing steel clearances indicated on the Drawings are maintained and suitable provisions are taken to prevent raveling of top edges or sloughing of loose material from walls of excavation. Sides of excavation shall be made with a neat cut and the width made as detailed on the Drawings.

B. Fabricated Forms:

1. Exposed Architectural Concrete Not Otherwise Noted or Specified: Plywood, metal, metal framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on drawings.

If plywood is used, plywood shall comply with U.S. Product Standard PS 1-09 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark. Thickness shall be of sufficient design and strength to hold concrete properly in place and alignment.

2. Chamfer Strips, Reveals, and Score Marks: Extruded polyvinylchloride specifically produced for concrete work; Greenstreak, Vinylex Corp., Preco Industries, Vulcan Metal Products, or approved equivalent.

3. Unexposed Concrete Not Otherwise Specified: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit. Of sufficient design and strength to hold concrete properly in place and alignment.
4. Framing: At Contractor option subject to meeting necessary strengths and surface tolerances.

C. Form Release Agents:

1. Exposed Concrete Including Surfaces to Receive Paint and Other Coatings: Chemically active type producing water insoluble soaps. Form release agents shall be delivered in manufacturer's sealed and trademarked containers and shall be guaranteed to provide clean, stain-free concrete release and not to interfere with future applied coatings and finishes. Release agents shall contain no petroleum solvents such as creosote, paraffin, waxes, or diesel oil.

2. Concealed Concrete: Contractor option except that release agents shall not interfere with bond of any applied finish.

D. Form Sealer (Wood Forms):

1. MeadowBurke “Form Sealer,” or approved equivalent, and of a type which will not interfere with bond of applied finishes.

E. Form Ties:

1. Metal, spreader type, removable to 1” from concrete face. Ties for exposed concrete shall leave smooth 1” diameter conical holes with no spalling upon form removal. Ties for exposed concrete shall be of same type throughout Project. Wire ties and wood spreaders will not be allowed.

F. Cold Joints (Exterior Paving Slab on Grade):

1. Standard 24 GA. galvanized steel, keyed profile, sized to suit slab thickness, punched on permit passage of continuous or doweled reinforcing bars of size and spacing shown on the drawings.

PART 2 - EXECUTION

2.1 PREPARATION

A. Vertical and Horizontal Controls: Establish and maintain necessary benchmarks, lines, or controls throughout construction.

B. Secure information and provide for underfloor electric raceways, openings, sleeves, chases, reglets, pipes, recesses, nailers, anchors, ties, inserts, and similar embedded
items. Coordinate with concrete work for requirements governing embedment and sleeving of pipes, raceways, and conduits.

2.2 CONSTRUCTION

A. Formwork - General: Construct wood forms of sound material, straight and rigid, thoroughly braced, mortar tight, and of such strength that the pressure of concrete and the movement of men and equipment will not displace them. Visible waves in exposed concrete surfaces after stripping of forms may result in rejection of that portion of the concrete. The design and engineering of formwork shall be the complete responsibility of the Contractor.

B. Plywood Forms for Exposed Concrete: Plywood panels shall be clean, smooth, uniform in size, and free from damaged edges or faces (including holes other than those required for form ties). Use full panels wherever possible. Make plywood panel pattern regular and symmetrical, joints plumb or level, horizontal joints continuous. Block plywood edges, which do not occur at bearing points in order to eliminate, joint offsets.

C. Framing and Bracing: Framing, bracing, and supporting members shall be of ample size and strength to carry safely, without excessive deflection (exceeding allowable tolerances), all dead and live loads to which formwork may be subjected, and shall be spaced sufficiently close to prevent any apparent bulging or sagging of forms.

D. Form Ties: Form ties shall be of sufficient strength and used in sufficient quantities to prevent spreading of the forms. Ties for exposed concrete surfaces shall be arranged symmetrically and shall be aligned both vertically and horizontally (do not stagger), with layout pattern acceptable to Engineer based on Drawing layouts and, where not shown, in accordance with reviewed formwork layout shop drawing submittals.

E. Forms for concrete shall be constructed full height and width between indicated construction joints or emphasized joints in concrete surface and shall not be broken for pour or construction joints within these areas.

F. Construct forms no higher than 12” above top of pour or construction joint.

G. Construction Joints: Construction joints shall be in accord with requirements of Section 033000: "Cast-in-Place Concrete." Confine construction or pour joints to rustication strip locations where they occur; where rusticated joints do not occur in a surface, provide a surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints. Prior to subsequent pour, remove strip and tighten forms. Construction joints shall show no "overlapping" or
offsetting of concrete surfaces and shall, as closely as possible, present the same appearance as butted plywood joints. Joints in a continuous line shall be straight and true.

H. Score Lines: Where "score," emphasized or rustication lines are indicated on vertical surfaces, obtain such lines by accurate placement of moldings in forms. Pieces shall be in longest lengths practical with joints mitered.

I. Arrange forms to allow proper erection sequence and to permit form removal without damage to concrete.

J. Form Sealer: Uncoated plywood forms for smooth Architectural Concrete shall be sealed on contact faces and edges using two (2) coats of specified form sealer in strict accord with manufacturer’s directions.

K. Form Release Agent: Thoroughly clean forms and coat with release agent prior to initial use and before each reuse. Apply release agent in strict accord with manufacturer's directions and coverage recommendations avoiding starved areas or excessive applications. Apply release agents reinforcing steel is placed.

L. Reuse of Forms: Control reuse of forms for exposed surfaces to provide surface of uniform color and texture without sharp demarcation between adjacent surfaces.

M. Prior to placement of concrete, remove dirt, debris, and foreign material from forms. Leave no wood in concrete except nailers.

2.3 FALSEWORK

A. Contractor shall be fully responsible for proper strength, safety, and adequacy of formwork supports, and bearing surfaces thereof, used on and in connection with the work. Falsework shall be designed to support imposed loads without deformation, deflection, or settlement.

B. Vertical and lateral loads shall be carried to ground by falsework system, or by the completed structure after it has attained the requisite strength.

C. Erect shoring and vertical supports so that they cannot tilt or settle. Securely brace inclined shores against slipping or sliding. Cut bearing ends of shores square and with a tight fit at splices. Splices, where used, shall be secure against bending and buckling.
2.4   REMOVAL OF FORMS AND FALSEWORK

A. The removal of forms and falsework shall be carried out in such manner as to ensure the complete safety of the structure. Supports shall not be removed until members have sufficient strength to support safely their own weight and any superimposed loading with proper factor of safety.

B. Forms for exposed concrete surfaces shall be removed in such a manner as to preclude damage to finishes. Pinch bars and similar tools shall not be used for prying against exposed surfaces. Stripping shall commence at top edge or vertical corner where the use of wooden wedge is possible. Wedging shall be done gradually and shall be accompanied by light tapping on panels to loosen them. When free at one end, gradually loosen remaining area without jerking.

C. After concrete is placed, the following minimum times shall elapse before the removal of forms or shoring:

1. Vertical Forms (Walls, Columns, and Beam Sides): 3 days
2. Side Forms (Footings, Slabs on Grade): 48 hours
3. Side Forms (Cantilevered Structural Slabs): 7 days
4. Horizontal Forms (Cantilevered Structural Slabs): 21 days

D. Upon removal of forms, remove bolts, wires, clamps, rod, etc., not necessary to the work to a minimum of 1" from the surface. Conduct operations so as to eliminate the danger of rust stains from form tie materials or other unprotected ferrous materials embedded in or adjacent to exposed concrete surfaces.

*** END OF SECTION ***
SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY

A. The work under this section includes all materials, labor, accessories, equipment and related services to furnish and place all reinforcement in cast-in-place concrete construction, as shown on Drawings, as specified herein, and all required accompanying accessories.

B. Work included in this section includes reinforcement required for concrete for the Summit Shelter, Trailhead Shelter and Restroom Screen including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete as shown on Drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Concrete Formwork: Section 03 10 00

B. Cast-in-Place Concrete: Section 03 30 00

C. Cast-in-Place Concrete Finishing: Section 03 33 00 (including finish for concrete building formed surfaces including patching and curing of concrete.

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 CODES AND STANDARDS

A. Code:
Reinforcement shall conform to the requirements of the 2013 California Building Code.

B. Standards:

Perform all work in accordance with the latest editions and revisions of the following standards which hereby become part of this section.

1. American Concrete Institute (ACI):
   a. ACI 318 "Building Code Requirements for Reinforced Concrete".
   b. ACI 301 "Specifications for Structural Concrete for Buildings".
   c. ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete".

2. Concrete Reinforcing Steel Institute (CRSI):
   a. "Recommended Practice for Placing Reinforcing Bars."
   b. “Suggested Specifications, Reinforcement, including Provisions for Coated Reinforcing Bars.”

3. American Welding Society (AWS):
   a. 1. AWS D1.1 "Structural Welding Code - Steel".
   b. 2. AWS D1.4 "Structural Welding Code - Reinforcing Steel".

   a. “Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement” (ASTM A615)
   b. “Specification for Steel Wire, Plain, for Concrete Reinforcement” (ASTM A82)
   c. “Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement” (ASTM A706)

1.6 SUBMITTALS

A. Shop Drawings:

1. The Contractor shall prepare shop drawings showing detailed layout of reinforcement, including dimensions, openings, bar spacing, bending details, bar schedules, and similar items required for the proper construction of the work. Drawings shall show grades of reinforcing steel
and shall be prepared in compliance with the Structural and Architectural Drawings.

2. The shop drawings for the top bars and the bottom bars for the slabs shall be prepared on different sheets. Reinforcement of concrete walls and beams shall be shown on elevations with sections as required. Elevations of walls and beams shall be at least 1/4" = 1'-0" scale.

3. Shop drawings shall be prepared in accordance with ACI 315 "Details and Detailing of Concrete Reinforcement".

4. Shop drawings relating to the parts comprising a proposed unit shall be submitted simultaneously so that parts may be checked individually and as an assembly for said unit. Shop drawings shall list the Contract Drawings used as reference in the development of said shop drawings. Shop drawings shall be submitted per the format called for in the General Requirements.

5. Numbering: All shop drawings shall be numbered in a logical and sequential manner.

B. Recycled Content Submittals:

1. Contractor shall provide documentation for reinforcing steel recycled content. Include statement indicating costs.

C. Submissions:


D. Mill Certificates: Submit steel producer’s certificates of mill analysis, tensile and bend tests for reinforcing steel. Certificates shall reference heat numbers, and corresponding heat numbers shall be indicated on the tags of unbroken bundles of bars. If mill certificates are not available for the heats supplied, or if heat identification is missing from bundles supplied, verification testing of the supplied bars shall be required, paid for by the Contractor. Submit Certificates to Special Inspector in accordance with Source Quality Control requirements of this section.

E. Product Data:

1. Bar Supports.
2. Coated bar tie wire.
3. Mechanical couplers.
4. Headed reinforcing.

F. Samples:
1. One sample of each type of bar support.
2. One 12 inch length of each type of tie wire.
3. One sample of each size of headed reinforcement.

1.7 PRODUCT HANDLING

A. Delivery: Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths and other information corresponding to markings shown on shop drawings. Note heat identification requirements for correspondence to mill certificates.

B. Storage: Store reinforcement at the job-site in a manner to prevent damage and accumulation of dirt and excessive rust.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All reinforcing shall conform to the requirements of ASTM A615, Grade 60 or ASTM A706 Grade 60, unless otherwise noted on the structural drawings.

B. Mechanical couplers:

1. Mechanical couplers shall only be used where specifically indicated on the structural drawings.
2. Mechanical couplers shall satisfy the requirements of 2013 CBC and ACI 318 Section 12.14.3 for both Type 1 and Type 2 splices as noted on the structural drawings.
3. Mechanical couplers shall have a current ICBO Evaluation Report which evidences compliance with requirements of these specifications.

C. Headed reinforcing:

1. Headed reinforcing may only be used where specifically indicated on the structural drawings. The connection of the head to the bar shall develop the lesser of 95% of the ultimate tensile strength of 160% of the specified minimum yield strength of the bar.
2. Headed reinforcing shall have a current ICBO Evaluation Report which evidences compliance with requirements of these specifications.
3. Headed reinforcing “HRC 100 series T-headed bars” as manufactured by “Headed Reinforcement Corp”, or approved equivalent.

D. Smooth dowels: ASTM A615 Grade 40, smooth; shop painted with iron oxide zinc chromate primer.

E. Tie Wire:
   1. Black annealed wire, 16 gauge or heavier.

F. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for supporting, spacing and fastening reinforcement in place:
   1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
   2. For slabs on grade use supports of precast concrete blocks of size sufficient to resist settlement into soil, but not less than 3 inches square, with embedded plastic coated wires.
   3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs. For this project, soffits and faces of slabs and beams shall be considered as exposed-to-view unless specifically noted otherwise.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabrication of reinforcing bars shall conform to required shape and dimensions, with fabrication tolerances complying with the CRSI Manual and ACI 315. Fabrication shall not commence until shop drawings have been reviewed and returned by the Engineer as appropriate. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work:
   1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
   2. Bends or kinks not indicated on Drawings or final Shop Drawings.
   3. Bars with reduced cross-section due to excessive rusting or other causes.
C. Welded splices shall be used only where specifically indicated on the structural drawings. When used, the splice shall have bars butted and welded to develop in tension at least 100 percent of the specified tensile strength of the bar.

D. Welding of stirrups, ties, inserts or other similar elements to longitudinal reinforcing bars shall not be permitted.

3.2 INSPECTION AND SOURCE QUALITY CONTROL

A. Contractor to examine the substrate, formwork, and the conditions at which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the work. Do not proceed with the work until satisfactory conditions have been obtained.

B. Contractor shall submit the following to the Special Inspector for all supplied reinforcing steel:

1. Certificates of compliance with specified standards for reinforcing bars.
2. Welding electrodes.
3. Reinforcing bar coating.
4. Certified mill test reports including physical and chemical analysis.

C. Special Inspector will:

1. Collect test reports and certificates of compliance.
2. Review test reports and certificates of compliance for conformance with Contract Documents.
3. Select random samples of reinforcing steel for testing by Testing Laboratory, at the discretion of the Special Inspector.

D. Testing Laboratory will test random samples of reinforcing steel selected by the Special Inspector for compliance with strength, ductility and chemical requirements of ASTM A615 or A706.

3.3 INSTALLATION

A. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
C. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain the required minimum coverages for concrete protection. Arrange, space, and securely tie bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

E. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Splices shall only be made at locations and by the method indicated on the structural drawings. Any proposed alternate location or method must be submitted in writing to the Engineer for approval.

G. Welding:
   1. Welding is not permitted unless specifically detailed on the structural drawings.
   2. Employ shielded metal arc, gas metal arc or flux cored arc method and conform to requirements of AWS D1.4 using qualified procedures.
   3. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
   4. Welding of crossing bars is not permitted.

H. Special Inspector will:
   1. Inspect placement of reinforcement for conformance with the Contract Documents as required by CBC Section 1704 and Table 1704.4.
   2. Inspect mechanical coupling of reinforcing steel in accordance with applicable ICBO Evaluation Report.

I. Testing Laboratory will inspect the following and report results to the Special Inspector:
   1. Inspect welding as required by CBC Section 1704.3.1 and Table 1704.3 in accordance with AWS D1.4, including checking materials, equipment, procedure and welder qualifications as well as the welds.
2. Inspector will use nondestructive testing or any other aid to visual inspections that the inspector deems necessary to be assured of the adequacy of the weld.

3. For welding of ASTM A 706 reinforcing steel not larger than No. 5 bars used for embedments, continuous presence during welding is not necessary provided the materials, qualifications of welding procedures and welders are verified prior to the start of work, periodic inspections are made of the work in progress, and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.

*** END OF SECTION ***
SECTION – 03 25 00 DRILLED DOWELS AND EPOXY ANCHORS

PART 1 GENERAL

1.1 SUMMARY

A. Provide all material, labor, equipment and services necessary for the installation of all dowels and/or epoxy anchors. The work shall include but not necessarily be limited to the following:

1. Design hole depths to achieve required test loads for the approved epoxy.
2. Drill holes in existing concrete elements for new dowels and/or epoxy anchors.
3. Insert dowels and/or epoxy anchors in holes.

B. Work included in this section includes dowels and anchors required for concrete for the Summit Shelter, Trailhead Shelter and Restroom Screen including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete as shown on Drawings.

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 RELATED SECTIONS

A. Concrete Reinforcing: Section 03 20 00.

B. Cast-in-Place Concrete: Section 03 30 00.

1.4 QUALITY ASSURANCE

A. Standards: Comply with the following applicable standards unless otherwise specified herein:
1. CBC - California Building Code, latest edition
3. ACI 315—American Concrete Institute, “Details and Detailing of Concrete Reinforcement.”
4. ASTM A615—American Society for Testing and Materials, “Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.”
5. ASTM C109—“Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50-mm Cube Specimens).”
6. ASTM C309 – “Liquid Membrane-Forming Compounds for Curing Concrete.”
7. A.C. 308 – ICC-ES Acceptance Criteria for the testing of Cracked Concrete epoxy anchors in compliance with adapted ACI 318 Appendix D requirements.

B. Tests and Inspections: Tests and inspections shall be done by Testing Agency.

1. Sampling and Testing
   a. Reinforcing bar dowels and/or anchors shall be sampled and tested in accordance with ASTM A615 as specified in Section 03200, “Concrete Reinforcing.”

2. Inspection
   a. Special Inspection as required by CBC Chapter 17.
   b. Mixing and placing of epoxy and placing of dowels and/or epoxy anchors in the drilled holes shall be continuously inspected by a qualified inspector from the Testing Agency.

3. Dowel and/or Anchor Testing
   a. Load-test 10 percent of each size of dowel set each day to
DRILLED DOWELS AND EPOXY ANCHORS

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for Engineer’s review. Indicate placing and assembly diagrams for dowels and epoxy anchors, dimensions and details of dowel and anchor, accessories, and cover. Do not scale dimensions from structural drawings to determine lengths of dowels and anchors.

1. Review of drawings will cover only the general scheme and character of the details, but not the checking of dimensions, nor will such review relieve the Contractor from responsibility for executing the work in accordance with the Drawings.

B. Manufacturer’s Catalog Data for epoxy anchors

C. ICC-ES Report: Submit Current ICC-ES report showing Cracked Concrete Compliance for each epoxy or adhesive system.

D. Test and Inspection Reports from qualified inspector
   1. Anchor placement inspection report including all items referenced by ICC-ES report
   2. Anchor pull testing values

1.6 STORAGE
A. Provide dry and weather tight job site storage of epoxy within temperature ranges required by manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Epoxy Adhesive


B. Reinforcing Bar Dowels and/or anchors

1. ASTM A615—Grade 60

C. Threaded Rods

1. ASTM A36—Threaded full length with standard UNC threads.

PART 3 EXECUTION

3.1 PREPARATION

A. Inspect areas to be drilled to verify conditions of access, interferences and existing materials.

1. Verify location of all existing mild steel reinforcement in existing concrete prior to drilling. Pacometer tests, radiograph tests, or other appropriate tests shall be required to locate steel.

2. Where drilling causes existing concrete to spall or crack, remove unsound materials and replace as directed by the Engineer.

3. Proceed with drilling following removal or replacement of unsound or damaged concrete.

B. Holes for dowels and epoxy anchors shall be drilled in existing concrete using a rotary hammer drill with a carbide-tipped drill bit.
1. Hole depth shall be in accordance with manufacturer’s recommendations as determined by the Contractor to suit the proposed epoxy and to achieve the required test loads. Minimum hold depth shall be indicated in Schedules and Details on the Drawings.

2. Clean hole by blowing out with oil-free compressed air, brushing hole out with a nylon brush and blowing out again with oil-free compressed air.

3. Mix contents of two cartridges using nozzle as required by manufacturer and inject adhesive into bottom of hole and fill hole approximately half full.

4. Insert dowel into hole containing adhesive to specified embedment depth. Adhesive should be visible at the top of the hole.

5. Install dowel strictly in accordance with approved manufacturer’s recommendations.

6. Dowels and/or anchors shall be clean and free of dust, paint, grease, loose mill scale, rust corrosion or any other contaminant that would affect bonding of steel to epoxy.

3.2 PROTECTION

A. Protect dowels or epoxy anchors from displacement or disturbance during curing time specified by the manufacturer, or for at least 24 hours, whichever is greater.

B. Protect existing exposed surfaces and surrounding area during drilling and placing operations. Clean and/or repair marred or damaged surfaces as directed by the Architect.

3.3 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.
**** END OF SECTION ****
SECTION 03 25 50 - EXPANSION ANCHORS and SCREW ANCHORS

PART 1   GENERAL

1.1   SUMMARY

A. Provide all material, labor, equipment and services necessary for the installation of all expansion and screw anchors. The work shall include but not necessarily be limited to the following:

1. Drill holes in existing and or new concrete elements for new expansion and screw anchors.

2. Install expansion and screw anchors in drilled holes.

3. Tighten the expansion anchors to the required torque.

B. Work included in this section includes anchors required for concrete for the Summit Shelter, Trailhead Shelter and Restroom Screen including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete as shown on Drawings.

1.2   RELATED SECTIONS

A. Cast-In-Place Concrete: Section 03 30 00

1.3   DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4   QUALITY ASSURANCE

A. Standards: Comply with the following applicable standards unless otherwise specified herein:


4. ASTM E488-88 - Strength of Anchors in Concrete and Masonry Elements.

5. A.C. 193 – ICC-ES Acceptance Criteria for the testing of Cracked Concrete Expansion and Screw anchors in compliance with ACI 318 Appendix D.

B. Tests and Inspections: Test and inspections shall be done by the Testing Agency.

1. Sampling and Testing
   a. Anchors shall be sampled and identified in accordance with manufacturer’s suggested identification method.

2. Inspection
   a. Special inspection as required by Chapter 17, CBC.

   1) Drilling and placing of anchors in the drilled holes shall be inspected periodically by a qualified inspector from the Testing Agency.

3. Testing
   a. Test each size and type of anchors to tension loads specified in schedules on the Drawings:

   1) Test Load 10 percent of the total number of anchors installed each day:

   2) Testing shall be in accordance with ASTM E488, “Strength of Anchors in Concrete and Masonry Elements.”

   3) Tension Test Loads: Refer to schedules on Drawings or this section for test loads.

   4) Test loads shall be held a minimum of 2 minutes each with a maximum slip of 1/8 inch

   5) If any one anchor installed in any one day fails the tension and slip test, all anchors installed that day shall be tested.

   6) Do not apply test loads until at least two days after anchors are set and torqued.

1.5 SUBMITTALS
A. Shop Drawings: Submit shop drawings for Engineer’s review. Indicate placing diagrams for the anchors.

1. Review of drawings will cover only the general scheme and character of the anchor layout, but not the checking of dimensions, nor will such review relieve the Contractor from responsibility for executing the work in accordance with the Drawings.

B. Manufacturer’s Catalog Data

1. Expansion Anchors, Screw Anchors and Components

C. ICC-ES Evaluation Reports:

1. Submit Current ICC-ES report showing Cracked Concrete Compliance for Expansion Anchors and Screw Anchors.

D. Test and Inspection Reports from qualified inspector

1. Anchor placement inspection report including all items referenced by ICC-ES report.

2. Anchor pull testing values.

1.6 STORAGE

A. Provide job site storage in weatherproof and dry enclosure. Protect from contaminants such as grease, oil and dirt.

PART 2 PRODUCTS

2.1 MATERIALS

A. Expansion Anchors

1. Expansion anchors shall be steel "Wedge Anchors," stud type with wedge clips, tested in accordance with ICC-ES AC 193 and shall have ‘Cracked Concrete’
2. The following "Wedge Anchors" have the minimum ICC-ES/CBC requirements for shear and tension values for use in lightweight aggregate concrete and/or stone aggregate concrete at the tabulated values for anchor diameter, minimum embedment, and concrete strength:

   a. Simpson Strong-Bolt as manufactured by Simpson Strong-Tie (ICC-ESR #1771)

   b. Hilti Kwik Bolt-TZ as manufactured by Hilti Corporation (ICC-ESR #1917)

3. Carbon steel anchors shall consist of the following, or equivalent, materials:

   a. Studs - ASTM A1 08, AISI Grade Designation 1010.

   a. Wedge Clips - ASTM A1 08, AISI Grade Designation 1010.

   c. Nuts - ASTM A563, Grade A

   d. Washers - ASTM A1 08, AISI Grade Designation 1010.

   e. Zinc Coating on all items - ASTM A153 or ASTM B695.

PART 3 EXECUTION

3.1 PREPARATION

A. Inspect areas to be drilled to verify conditions of access, interferences and existing materials.

1. Drilling operations may be limited to particular times of the normal work day.

2. Verify location of all existing mild steel reinforcement in new and/or existing concrete prior to drilling. Use care and caution to avoid cutting or damaging existing reinforcing bars. Pacometer tests, radiograph tests, or other appropriate tests shall be required to locate steel. Maintain a minimum clearance of 1 inch.
between existing reinforcement and anchors.

3. Where drilling causes concrete to spall or crack, remove unsound materials and replace as directed by the Engineer.

4. Proceed with drilling following removal or replacement of unsound or damaged concrete.

3.2 ANCHOR HOLES

A. Holes for anchors shall be drilled in new and/or existing concrete using a rotary hammer drill with a carbide-tipped bit. Holes shall be same diameter as bolt diameters and holes shall be drilled to the depths indicated on the plans.

B. Anchor size and embedment shall be as indicated in Schedules and Details on the Drawings or this Section. In no case shall embedment of anchor be less than that shown in the valid ICC-ES Evaluation Report for that particular anchor.

C. Dust and other contaminants shall be completely removed from holes by blowing with oil-free compressed air.

3.3 ANCHOR EMBEDMENT AND TEST LOAD SCHEDULE

A. Anchors shall be installed with the minimum embedments as indicated in Schedules and Details on the Drawings and be tested to the values noted on the Drawings.

3.4 ANCHOR PLACEMENT

A. Anchors shall be placed and driven in holes to a depth that will provide the minimum embedment.

3.5 ANCHOR TIGHTENING

A. Anchors shall be tightened to the minimum torque values specified in schedules on the Drawings or this Section using torque wrenches or other approved methods for tightening the anchors.
B. Installation of anchors shall be in strict accordance with manufacturers written recommendations and as directed by the manufacturer's service representative.

C. Anchors shall set for a minimum of 2 days before any load test can be performed on the anchors.

3.6 PROTECTION

A. Protect anchors from displacement or disturbance after installation.

B. Protect existing exposed surfaces and surrounding area during drilling operations. Clean and/or repair marred or damaged surfaces as directed by the Architect.

3.7 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

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

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY

A. Furnish and install cast-in-place concrete required for the Project as shown on the Drawings and specified herein for the site buildings, including the following principal items: Summit Shelter, Trailhead Shelter, and Toilet Screen Wall. This Section also includes:

1. Building concrete including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete.
2. Curing of formed concrete surfaces.
3. Installation of anchor bolts, hangers, anchors, reglets, plates, inserts, and miscellaneous metal or other materials embedded in concrete.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

1. Concrete Formwork: Section 03 10 00 (including erection, stripping, and removal).
2. Concrete Reinforcing: Section 03 20 00.
3. Concrete Finishing: Section 03 33 00 (including finish for concrete building formed surfaces including patching and curing of concrete).

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

B. Architectural Concrete: The term "Architectural Concrete" where used herein shall mean concrete normally exposed to view.

1.5 REFERENCES, CODES, AND STANDARDS The following references, codes, and standards are hereby made a part of this Section and concrete work shall
conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.


1.6 SUBMITTALS:


B. Product data for proprietary materials and items, including admixtures, pigments, joint fillers, manufactured grouts, curing materials and vapor retarder.

C. Delivery tickets for each batch of concrete delivered, bearing the following information.

1. Mix identification.
2. Weight of cement, aggregate, water and admixtures, and aggregate size.

D. Samples: See Section 03 35 00 Cast-In-Place ConcreteFinishing. Provide panel using proposed mix design for Architectural Concrete or integrally colored concrete. Panels shall be cast, reviewed by MROSD’s Representative and Architect.

E. Quality Control:

1. Mix design for each concrete mix.
2. Laboratory test reports for concrete mixes.
3. Material certificates for concrete materials, including cements, aggregates and admixtures.
4. Statement of installer/finisher qualifications for Architectural Concrete.

1.7 ENVIRONMENTAL CONDITIONS

A. Cold Weather Requirements: Comply with ACI 306(R)-10, "Cold Weather Concreting."

B. Hot Weather Requirements: Comply with ACI 305(R)-10, "Hot Weather Concreting."

1.8 FINISH

A. Refer to Section 03 33 00 for finishing cast concrete after formwork is stripped.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C 150-07, Type II. Cement shall be of same brand, type, and source throughout Project. Where aggregates are potentially reactive, use low alkali cement.

B. Fly Ash: ASTM C 618 CLASS C OR F, with the following requirements:
   1. Fly ash shall be added to all concrete at a 20% minimum up to a 35% maximum rate of replacement by weight of the scheduled amount of cement.
   2. Modified ASTM requirements:
      a. Loss on Ignition (L.O.I.): Maximum 1%
      b. Sulfur Trioxide (SO₃) shall not exceed 3% by weight.
      c. Water requirement – maximum: 100% of control
      d. \[ R = \frac{\text{CaO}}{\text{Fe}_2\text{O}_3} - 5\% \]

      \[ R = \text{Sulfate Resistance} = 0.75 \text{ maximum} \]

      \[ \frac{\text{CaO}}{\text{Fe}_2\text{O}_3} \] Percentage fly ash oxide analysis

C. Normal Weight Concrete Aggregate: Aggregate shall be 1" x #4 coarse, clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:
   1. Crushed stone, processed from natural rock or stone.
   2. Natural or crushed gravel. Do not use pit, bank run, or pea gravel.

Conform to ASTM C-33 uniformly graded, 3/4-inch (19-mm) maximum aggregate size. Source shall be constant unless 10 days’ prior notice is given for approval after recheck of mix design.

C. Water: Clean and potable, free from impurities detrimental to concrete.

D. Admixtures: The use of admixtures shall be subject to prior approval of the Engineer per ACI 318-08 Section 3.6 Admixtures. Calcium Chloride, Thiocyanates, and admixtures containing more than 0.05% chloride ions by mass of cementitious material are not permitted. Batch admixtures in strict accordance with manufacturer’s recommendations.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type G.
4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
5. Color Admixtures: see Section 03 35 00 Cast-In-Place Concrete Finishing
6. Certification: Prior to preparation of mix designs, submit written conformance to above requirements and the chloride ion content of the admixture(s).

E. Expansion Joint Fillers:

1. Exposed Fillers (On-Grade Slabs and similar flatwork where joints are not otherwise noted or specified): ASTM D 1751-2008, preformed, non-extruding strips, 3/8” thick unless otherwise noted, precut to proper size.

F. Granular Fill: Open graded gravel with maximum ¾-inch (19 mm) aggregate size conforming to Class 2 Aggregate Base as defined in Caltrans Standard Specifications Section 26.

G. Sand: ASTM C33, uniformly graded, clean sand, free from excessive fines, organic materials, and other deleterious substances.


J. Curing Compounds: Conform to requirements of Concrete Finishes Section

K. Waterstop: Products listed are by Southern Metal & Plastic Products and are specified to establish the required level of performance, quality, and appearance.

1. Provide dumbbell/center bulb waterstops Concrete Tie Catalog Number 28DBCB, or approved equivalent.

2.2 MIXES

A. Mix Designs:

1. Mix designs for concrete shall be Contractor-designed at his expense. Designs shall be prepared by a qualified agency approved by the Engineer. Submit mix designs for review by the Engineer at least 2 weeks prior to placing any concrete. Submissions shall completely indicate brands, types, and quantities.
of admixtures included. If concrete is to be placed by pumping, recommendations of ACI Committee 304 shall be followed.

a. Slabs on Grade, Foundations and Retaining Walls (Normal Weight)
   i. Minimum compressive strength, f’c at 28 days .............. 3,000 psi *
   ii. Maximum slump: ............................................................. 4”
   iii. Maximum water to cement ratio: .............................. 0.45
   *note: no special inspection required as f’c (design) = 2,500 psi

b. Walls and Elevated Slabs and Beams (Normal Weight)
   i. Minimum compressive strength, f’c at 28 days .............. 5,000 psi
   ii. Maximum slump: ............................................................. 4”
   iii. Maximum water to cement ratio: .............................. 0.45

2 Mix designs shall be proportioned in accord with Section 4.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-11. Submit mix designs for each class of concrete for review. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve a compressive strength 1,200 psi higher than the specified strength.

2.3 SLABS ON GRADE

A. Place slabs over 15 mil. vapor barrier over 4” clean, free-draining crushed rock over 12 inches (6 inches for exterior concrete flatwork) imported, non-expansive structural fill (95% relative compaction) placed on the prepared subgrade soil. Slope subgrade to drain. The Water Vapor Barrier must have the following qualities: The Water Vapor Transmission Rate, ASTM E 96, shall be 0.008 gr./ft²/hr WVTR or lower. The Water Vapor Barrier shall meet ASTM E 1745, Class A (Plastics) standards and it should be installed with seams lapped 6 inches according to ASTM E 1643. The vapor barrier material shall be subjected to conditioning testing as outlined in ASTM E 154 sections 8, 11, 12, and 13.

PART 3 - EXECUTION

3.1 MIXING: Concrete shall be ready mixed per ASTM C 94-11(b). Equipment shall be adequate for the purpose and kept in good mechanical condition at all times.

A. The rate of delivery, haul time, mixing time, and hopper capacity shall be such that mixed concrete delivered shall be placed in the forms within 90 minutes or 300 revolutions of the drum from the time of introduction of cement and water to the mixer. Any interruption in placing in excess of 90 minutes or 300 revolutions will cause shutdown of the work for the day and the wasting of any mixed
concrete remaining in hoppers or mixers. In case such interruption occurs, the Contractor shall provide construction joints where and as directed and cut concrete back to such line, cleaning forms and reinforcing as herein specified. Delivery tickets shall show departure time from plants. Revolution counters shall be set at "0" and shall commence to operate when drum revolution begins after introduction of all ingredients into the mixer.

B. No water shall be added to the mix after the initial introduction of mixing water for the batch except when, on arrival at the job site, the slump of the concrete is less than that specified. In this case, additional water may be added from the truck system to bring the slump within required limits. The drum or blades shall then be turned an additional 30 revolutions until the mix is uniform.

C. Mixers shall be equipped with an automatic device for recording number of revolutions of drum or blades prior to completion of mixing operation.

D. Concrete shall be kept continuously agitated until discharged into the hopper at the job site.

E. Contractor shall note that the appearance of concrete surfaces depends upon uniform color and texture within any one area and between adjacent areas and shall exercise strict batching and mixing controls to achieve this end.

3.2 PLACING

A. Notify Engineer 72 hours (3 working days) minimum prior to placing of any concrete.

B. Thoroughly wet absorbent forms before concrete is placed. Aggregate base/sand beds for slabs on grade shall be moist but not saturated when concrete is placed.

C. Placing of concrete shall be done immediately after mixing. No concrete shall be placed or used after it has begun to set and no retempering will be allowed. The method used in placing shall be such that concrete is conveyed to place and deposited without separation of the ingredients. Place no concrete with a free unconfined fall in excess of five (5) feet. Concrete shall not be allowed to cascade through reinforcing steel in such a manner as to promote segregation. Do not support runways on reinforcing steel.

D. Where concrete slab surfaces have obtained 75% of their 28 day compressive strength (56 day for fly ash replacement concrete) and such surfaces are to be used for construction traffic, including concrete buggies and other conveyances, such surfaces shall be protected over traffic lanes by not less than 1 layer of waterproof kraft paper and 1 layer of 5/8" (min.) plywood.

E. Remove splash or accumulations of hardened or partially hardened concrete. Protect contact faces of forms for exposed concrete from splash during placement.
of adjacent concrete. Place concrete containing piping and electric raceways in a manner that will prevent damage to them.

F. Distribution of concrete shall be even and continuous and no placement joints shall show. Before a placement is started, make certain that adequate equipment, workers, and concrete will be available to place in cycles, which will permit proper and thorough integration of each layer of concrete. Upon stopping of a placement, the top surface shall be level.

G. Place no concrete for any element until reinforcing for same is fastened in place nor until forms are complete. Place no concrete before work that is to be embedded has been set. Notify other crafts so that they may deliver anchors, inserts, etc., or other work to be embedded in ample time and also notify them when their assistance in setting is required. Do not disturb reinforcing or other materials that have been set in place.

H. Comply with CBC 1906.3 for requirements governing embedded conduits and pipe. Sleeves and inserts will be provided and set under other Sections of the work

I. Remove debris, mud and water from places to receive concrete. Verify depths of any depressed slab conditions for suitability with type and method of surfacing to be applied over concrete.

J. Remove concrete splash and/or grout from exposed surfaces and from surfaces that will receive painter's finish.

K. Place no concrete in water unless written permission has been obtained from Engineer as to proposed procedures.

3.3 VIBRATION AND CONSOLIDATION

A. Thoroughly consolidate all concrete by means of internal mechanical vibrators. Such consolidation shall be produced as will be obtained by placing the vibrator-directly in concrete at 18” - 30” intervals for a period of 5 to 15 seconds and withdrawing slowly or as directed, depending on the consistency of the concrete. One vibrator will be required for each location where simultaneous placing takes place, to ensure thorough vibrating of all sections. Provide sufficient spare vibrators on the job so as to have them readily available in case any vibrator in use should suddenly cease to function properly. When spare vibrators are employed, provide additional spares. Under no condition shall vibrator be placed against reinforcing steel or attached to forms. Do not use vibrators to transport material.

B. Vibrators shall be of the flexible immersion type having a frequency of not less than 8,000 RPM. Use and type of vibrator shall conform to ACI 309, “Recommended Practice for Consolidation of Concrete.”
C. Spading will not be permitted on exposed concrete surfaces.

D. Voids and rock pockets shall be eliminated. Voids and rock pockets occurring in exposed concrete may subject that portion to rejection.

3.4 CONSTRUCTION JOINTS

A. Placement of construction joints and the manner in which they are provided for shall be only as approved by the Engineer or as shown on the Drawings. Construction joints shall be as few as possible and will not be permitted simply to save forms.

B. Under no condition will construction joints be permitted in Architectural Concrete surfaces other than where specifically shown and specified. See Concrete Formwork Section.

C. Clean and roughen construction joints by removing entire surface and exposing clean solidly embedded aggregate by means of sandblasting or other approved methods. Clean forms and reinforcing of drippings, debris, etc. Thoroughly consolidate initial pour with grout so that no variation in texture will occur in Architectural Concrete surfaces.

3.5 CURING CONCRETE

A. Curing Concrete shall conform to Section 90-7 “Curing Concrete” of the Caltrans State Standard Specifications. The Curing Compound Method, Curing Compound Method or Forms in Place Method are acceptable methods.

Concrete surfaces exposed to the atmosphere within 7 days of placement shall be protected and cured per Caltrans State Standard Specifications, Section 90-7 “Curing Concrete” and as necessary until specified design strength has been achieved. At greater rates of cement replacement with fly ash the early strength and setting for flat work can be delayed, and in some cases, the 28 day design strength may have to be exceeded to 56 days or more. In this case, the construction needs and schedules may impact the cement replacement percentage. Care should be taken to ensure that proper curing is maintained for concretes in which fly ash has been substituted for a portion of the portland cement.

B. If forms are permitted to be removed prior to expiration of curing period, exposed concrete surfaces shall be kept continuously wet by means of fog sprays or non-staining cotton or burlap mats kept moist or by approved curing compound. Application of curing compounds shall conform to requirements of Concrete Finishes Section.

3.6 EXPANSION JOINT FILLERS
A. Preformed Filler Joints: Place filler material so that top of surface is level and aligned uniformly 1/4" below adjacent concrete surface. Provide where walks abut vertical surfaces, at not over 24 ft. centers horizontally in paving and at other locations so noted on the Drawings. Follow Drawings for pattern where indicated; where not indicated, coordinate locations with Engineer before proceeding.

3.7 GROUTING

A. Where grouting is required and such grout is exposed in the finished work, use non-metallic, non-shrink grout only.

3.8 QUALITY CONTROL

A. Tests and inspections shall comply with CBC Section 1903.1 and shall be performed by qualified individuals, engineering companies, or testing laboratories who shall perform those special inspections required by Table 1705A.3 of the latest California Building Code, those tests and inspections specified below, and other such tests and inspections as the Engineer and MROSD may require to establish the acceptability of the work.

B. Testing and inspection services shall be retained by the MROSD at its expense, except that when tests or inspections reveal failure of materials to meet contract requirements, costs for subsequent tests and inspections will be deducted from the moneys due the Contractor. Excessive inspection time required by Contractor’s failure to provide sufficient workers or to pursue properly the progress of the work shall likewise be deducted from the Contract Price.

C. Furnish material and handling for test cylinders and any other samples which testing agency requires for analysis of concrete work.

D. Batch Plant Inspection: Concrete is subject to batch plant inspection as per CBC 1705A.3.

E. Compression Strength Tests to determine Strength and Durability of Concrete shall be provided per CBC Sec. 1905.1. Concrete test samples: samples for concrete tests shall be taken in accordance with ASTM C 172. Test cylinders shall be cured under conditions not more favorable than the most unfavorable conditions for portions of concrete which specimens represent. Casting and curing on test cylinders shall be the responsibility of the Contractor. Testing of samples shall be carried out by an independent testing agency meeting the requirements of ASTM C 1077. Concrete shown to be defective shall be removed and replaced. Cost of core tests, repairs and removal, and replacement of defective concrete shall be paid by Contractor.

Compressive Strength Tests on concrete shall comply with the following:

1. Frequency of concrete sampling: for concrete {Note choose one of two following options in italics depending on condition} [A) at or below grade, B)
which is part of the lateral force resisting system (shear walls, moment frames, transfer beams, diaphragms, etc.) Samples for concrete compressive strength tests of each class of concrete placed each day shall be taken not less than once per day or per batch, nor less than once for every \[A)150, \ B)10\] yd\(^3\) of concrete, nor less than once for every \[A)5000, \ B)1000\] ft\(^2\) surface area for slabs or walls. A sample shall consist of \[A) four, \ B) five\] standard cylinders, one to be tested at 7 days, one to be tested at 14 days, and the remainder to be tested at 28 days, as required.

2. Acceptance of concrete shall be based on strength test results of standard cured cylinders in accordance with ASTM C 31 and tested at 28 days in accordance with ASTM C 39. Strength test results are defined as the average of a minimum of two specimens. Additional specimens for testing may be made at contractor’s option and expense.

3. When cylinders are made, tests of slump, air content, temperature, and density shall be made and recorded with the strength test results.

4. Strength of each concrete class shall be deemed satisfactory when the following criterion is met:
   a. No individual compressive-strength test result (i.e. the average of two cylinders minimum) falls below specified compressive strength by more than 500 psi.

5. When compressive strength tests indicate low strength, follow procedure in ACI 318 chapter 5.6.4 investigation of low-strength test results.

6. Submit certified test report of cylinders to engineer.

F. Slump Tests: Slump tests will be performed as per ASTM C143/C143M-10(a) (slump cone) at time of taking test cylinders.

G. MROSD's testing agency will supervise preparation and selection of samples taken at job site.

*** END OF SECTION ***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY
A. The work under this section includes all materials, labor, accessories, equipment and related services to finish cast-in-place concrete construction, as shown on Drawings, as specified herein, and all required accompanying accessories.

B. Work included in this section includes finishing required for concrete for the Summit Shelter, Trailhead Shelter and Restroom Screen including walls, elevated slabs, structural slabs, slabs on grade and foundation concrete as shown on Drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS
A. Cast-in Place Concrete: Section 03 30 00

B. Cast-in Place Concrete Finishing: Section 03 33 00 (including finish for concrete building formed surfaces including patching and curing of concrete.

1.4 DEFINITIONS
A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

B. Architectural Concrete: The term "Architectural Concrete" where used herein shall mean concrete normally exposed to view.

1.5 SUBMITTALS
A. Product Data: Submit for any specified color treatments.

B. Samples:

1. Architect’s Selection: Where colors, etc. are specified to be selected by Architect from manufacturer’s standard range, submit full range for Architect’s use.

2. Specified Materials and Colors: Submit samples of specified color treatments.

1.6 QUALITY ASSURANCE

A. Reference Standards apply to this Section and shall be the most current edition of the following:

1. Comply with Reference Standards of Section 03 30 00, Cast-In Place Concrete.

B. Requirements of Regulatory Agencies: Comply with air pollution regulations of governing authorities for sandblasting activities and operations.

C. Concrete Finishing: Supervised and performed by workmen experienced in concrete finishing operations and capable of demonstrating completion of finishing projects of similar scope and complexity, including the finishing of blast furnace slag replacement concrete.

D. Field Sample: On proper substrate and in location directed by Architect, prepare a sample area approximately 1.2 m x 1.2 m (4’ x 4’), with representative tool joint and score line pattern, surface finish, and integral color for Architect’s review; make changes until sample is satisfactory to Architect. Unexposed portions of walls, those portions to be covered with stone veneer may be used as a sample panel. Sample shall comply with the approved Midpeninsula Regional Open Space District (MROSD) finish requirements and be available for MROSD review. Approved sample shall serve as a standard for finishing operations. If separate panel, then Contractor shall remove when no longer needed.

PART 2  -  PRODUCTS

2.1 MATERIALS

A. Unless otherwise noted, integral color additives shall be as follows: Davis Color Sierra 61078 as required to produce color specified by Architect. [DEDUCT ALTERNATE: 2 LBS Lamp Black / CY] Verify integral color concrete mix design w/ MSROD and Architect.
B. Stainless Steel or Bronze Wind Rose, Mountain Top Directions and Names/Letter Inserts Embedded into Concrete. Provide stainless steel bolts and stabilizer plate. Recess metal 1/16” to 1/8” and pour clear hard resin over insert to form a wear barrier. Comply with all ADA requirements.

PART 3 - EXECUTION

3.1 PRECONDITIONS

A. Examine surfaces to receive finishing operations and conditions under which they are to be applied or conducted. Correct unsatisfactory surfaces or conditions prior to commencement of finishing operations.

1. Lines and Levels: Ensure that surfaces have been brought to proper lines and levels to produce finish surfaces within specified tolerance and at required elevations.

3.2 WORKMANSHIP

A. Formed Surfaces: Remove all fins and other projections, fill and patch depressions and plug form tie holes in permanently exposed areas, leave "As-cast" unless otherwise shown or specified.

1. Grouting of Form Tie Holes: After installation of plugs, fill depression with grout, strike flush with adjacent surfaces.
   a. Grout Color: Match adjacent concrete color.

2. Protruding Formwork Nails, Staples, etc. cut off flush with concrete surface, grind smooth.

B. Slabs: Finish monolithically unless otherwise shown or specified, ensure that an even joint is maintained between successive concrete pours.

1. Levels: As shown on drawings or as directed by Architect.

2. Drainage: Slope slabs uniformly to provide positive drainage into floor drains, gutters, etc. where indicated on drawings.

3. Finishes: As shown on drawings and as specified below.

C. Chamfer: Provide a 3/4” cast-in-place chamfer at all exposed edges of walls, beams, ledges, corbels, etc. as shown on plans. Chamfer shall provide a uniform
flat edge, at 45 degrees relative to cast concrete surfaces. Verify and coordinate exposed chamfer with Architectural documents. Foundation concrete, permanently below grade need not be chamfered.

D. Radius Corners: Provide ½’’ troweled radius corners on all exposed edges of concrete benches as shown on plans. Verify and coordinate exposed radius corner with Architectural documents.

E. Tolerances: Finish concrete to smooth, even surfaces with no abrupt variations, within the following tolerances:


3.3 FINISH DESCRIPTIONS

A. Surface Finish of As-Cast Exposed to View Concrete: Concrete shall have uniform as-cast surface with minimal additional finishing being anticipated or required.

1. Patch voids larger than 3/4 in. wide or 1/2 in. deep, surface blemishes will not be filled.
2. Remove projections larger than 1/8 in. by grinding without marring surface.
3. Fill tie holes and strike flush with adjacent surfaces, except as otherwise noted.
4. Surface tolerance Class A as specified in ACI 117.
5. Mockup of concrete surface appearance and texture required.

B. Sandblast Finish: All Architectural Concrete and as-Cast Exposed to View Concrete including benches, walls, vertical portions of stairs (if not broom finished) or as indicated on finish schedule, after concrete walls have completely cured and all formwork has been removed, a Light Sandblast Finish shall be applied, sufficient to expose fine aggregate with occasional exposure of coarse aggregate, to produce uniform color and a degree of reveal of approximately 1/16 inch, to match MSROD and Architect approved sample.

C. Broom Finish: After floating operations have been completed and concrete has sufficiently hardened, lightly steel trowel slabs to remove irregularities and, prior to concrete becoming non-plastic, Smooth Broom Finish slabs using broom not less than twenty four (24) inches wide to produce a finished surface free of small pockets, disturbed aggregate or other defects. Obtain OMSROD and Architect approval of sample for texture of final finish before application.

1. Brooming: Produce even texture from edge-to-edge, lap adjacent strokes slightly to produce uniform pattern, perpendicular to the direction of traffic flow unless otherwise shown.
3.5 TOOLING

A. Layout: Locate score lines or control joints where shown on drawings or as directed by Architect.

B. Workmanship: Unless otherwise shown, use tool to produce a groove 6 mm (1/4 inch) wide at the top and 13 mm (1/2 inch) deep with rounded corners. Lines shall be straight, parallel and/or square, with square intersections unless otherwise shown.

C. Edges: Round edges of slabs with tool to match score line corners.

3.6 PATCHING

A. General: Minor defects in Cast-In-Place Concrete that do not affect its structural properties or weathertight integrity may be patched if approved by the Architect.

1. Approval: Only defects that, in the opinion of the Architect, can be restored to the specified quality of finish and have a reasonable appearance match may be patched.

B. Workmanship: Within three days after form removal, when approved by Architect, fill and patch all rock pockets, "honeycomb" voids and other surface defects to achieve specified finish quality.

1. Filling and Patching: Remove any loose material, thoroughly wet area to be patched, fill with fine sand-cement grout and patching mortar, compact and screed to achieve proper levels.

   a. Form Tie Holes: Unless otherwise shown, fill and patch all form tie holes which would be exposed to view.

2. Finishing: Match adjacent surfaces and levels.

C. Final Approval: Areas that have been patched will be re-inspected by the Architect. If the patching has not, in the opinion of the Architect, restored the specified quality and appearance of the surface, the concrete shall be removed to nearest control joints, re-placed and refinished.

*** END OF SECTION ***
SECTION 04 10 00 – MORTAR

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY

A. The work under this section includes all materials, labor, accessories, equipment and related services for furnishing mortar for masonry work specified in other sections, as shown on Drawings, as specified herein, and all required accompanying accessories.

B. Work included in this section includes furnishing mortar for the following masonry work:
   1. Mortar for all new stone masonry construction including the Summit Shelter, Trailhead Shelter and associated walls and retaining walls.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Section 04 45 00 Stone Veneer

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 SUBMITTALS

A. As specified in General Provisions.

B. Samples: Submit samples (including colors) of cured mortars for review and approval.

C. Certificate: Manufacturer’s certification that materials and products meet specified requirements.

D. Tests: Reports of tests conducted by an independent testing laboratory certifying that
mortar meets specified requirements. Testing will be at no additional expense to MROSD.

1.6 PRODUCT HANDLING

A. Delivery: Deliver materials in manufacturers’ original, unopened, protective packaging.

B. Storage: Store cementitious materials in a dry area, under cover, and off the ground.

1.7 PROJECT CONDITIONS

A. Do not place mortar when temperature is below 40 degrees F unless approved means are provided to heat sand or water and ensure that mortar will harden without freezing.

PART 2 PRODUCTS

2.1 MORTAR MATERIALS

B. Portland Cement: ASTM C150-92, Type II.

C. Masonry Cement: ASTM C91-93.

D. Lime: ASTM C207-91, Type N.

E. Lime Putty: Stiff mixture of lime and water.

F. Quicklime: ASTM C5-79, slaked in accordance with manufacturer’s recommendations.

G. Aggregates: ASTM C144-93 for joints narrower than ½-inch and ASTM C144-93 and C404-93 for joints wider than ½-inch.

H. Water: Clean and potable.

I. Admixtures: Shall not be added in the field.

J. Color: Color should match stone. Submit samples for approval prior to mock-up construction and site construction. For exposed work, provide limeproof and alkali proof mineral oxide pigments produced by an approved manufacturer.

2.2 MORTAR PROPORTIONS (MEASURED BY VOLUME)
A. Reinforced Masonry, Pargeting, and Masonry in Contact with Earth: ASTM C270-92a, Type M. Use one of the following mixes.

1. 1 part cement, 1/4 part lime or lime putty, 3 parts sand.
2. 1 part Portland cement, 1 part masonry cement, 6 parts sand.

B. Masonry Above Grade: ASTM C270-92a, Type S. Use one of the following mixes.

1. 1 part cement, 1/2 part lime or lime putty, 4-1/2 parts sand.
2. 1 part masonry cement, 3 parts sand.

PART 3 EXECUTION

3.1 MIXING SETTING MORTAR

A. While mixer is in operation, add three-fourths of the required water, one half of the sand, and all of the lime and cement; then the remainder of the sand. Allow batch to mix briefly; add water in small quantities until mortar is of a workable consistency. To ensure complete hydration, mix all cementitious materials and sand in mechanical batch mixer for a minimum of 10 minutes after adding all materials. If mortar begins to stiffen, retemper immediately by adding water and remix. When air temperature is 80 degrees F or higher, use mortar within 1-1/2 hours; under 80 degrees F, use within 2 hours. Discard remaining mortar. Retempering within these time limits will be permitted only as necessary to maintain workability. Use no calcium admixtures or antifreeze chemicals.

*** END OF SECTION ***
SECTION 04 22 00 – CONCRETE MASONRY UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing Concrete Masonry Unit blocks including but not limited to the following items:

1. Bathroom (Toilet Vault) Screen privacy wall at lower parking lot.

1.3 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 SUBMITTALS

A. Comply with pertinent provisions of General Conditions and Special Provisions.

B. Certification: Prior to delivery of concrete masonry materials to the job site, deliver to the Architect a letter from the manufacturer of the proposed masonry units certifying that all such units to be delivered to the job site are in strict conformance with the provisions of this Section.

C. Submittals: Submit mix proportions for Mortar design and Grout Design to Architect for Review.

D. Shop Drawings: Indicate in shop drawings for reinforcing steel bending diagrams, assembly diagrams, splicing, and laps of rods, shapes, dimensions and details of bar reinforcing and accessories.
1.5 QUALITY ASSURANCE

Provide quality assurance (testing and inspection) specifications per CBC Sections 1705.4 and 2105.

A. Preconstruction Testing.
   1. MROSD District will select a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by MROSD.
   2. Determine the compressive strength of masonry by the strength of the unit and type of mortar specified (Unit Strength Method) per CBC Table 2105.2.2.1.2.
      a. Concrete Masonry Units: Test per ASTM C140.
      b. Grout: Test per ASTM C1019.
   3. Determine the compressive strength of masonry by the prism test method in accordance with ASTM C1314. Schedule masonry procurement sufficiently in advance to allow for prism construction and curing.
      a. Prism Test: For each type of construction required, construct and test three prisms per ASTM C1314.

1.6 PRODUCT HANDLING

A. Protection: Protect concrete unit masonry before, during and after installation, and protect installed work of other trades.
   1. Avoid scattering concrete materials on the site.
   2. Cover and protect against wetting prior to use.

B. Storage: Store masonry units above ground on level platforms allowing air circulation under stacked units.

C. Replacements: In event of damage, make repairs and replacements to satisfaction of the Architect without additional cost to Owner.

1.7 PROJECT CONDITIONS

A. Avoid placing masonry units when air temperature is below 40°F.
B. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 99°F in the shade, with relative humidity less than 50%.

PART 2 - PRODUCTS

2.1 CONCRETE BLOCKS

A. Blocks shall conform to the requirements of ASTM C 90, precision block, Color shall be standard grey (Basalite #225 [ALT. #101]) as approved by Architect, and strengths as specified in ASTM C 90. Blocks shall be standard medium weight split face (single sided) 8x8x16.

B. Caps shall be Basalite standard solid beveled cap 8x4x16, Color shall be standard grey (Basalite #225 [ALT. #101]) as approved by Architect.

C. Limit moisture absorption during delivery and until time of installation to the maximum percentage specified for Type I units.

2.2 MORTAR

A. All mortar for concrete block shall be Type "S" and shall conform to ASTM C 270 and shall have minimum compressive strength of 2,500 psi. Color shall be standard grey (Basalite #225 [ALT. #101]) as approved by Architect.

B. Mortar shall be freshly prepared and uniformly mixed and be of spreadable, workable consistency.

C. Mortar should be retempered with water as required to maintain high plasticity. Retempering on mortar boards shall be done only by adding water within a basin formed with the mortar and the mortar worked into the water. Any mortar which is unused after one and one-half hours from the initial mixing time shall not be used.

D. After all ingredients are in the batch mixer they shall be mechanically mixed for not less than three minutes.

E. The use of fire clay, rock dust, dirt and other deleterious materials is prohibited in mortar.

F. Sand and aggregates for mortar shall conform to ASTM C 144.
2.3 REINFORCEMENT

A. Reinforcement: New, deformed billet steel bars conforming to ASTM A 615. Grade as shown on the drawings.
B. Deliver bars new and free from rust and mill scale in original bundles with mill tags intact.
C. Ties and Anchors: Comply with requirements for type, metal and size of referenced unit masonry standards.

2.4 GROUT

A. Grout shall conform to ASTM C 476 and shall have minimum compressive strength of \( f'_c = 2000 \) psi (13.8 MPa) or higher as indicated on Drawings.
B. Coarse grout shall be proportioned by volume, shall consist of one part portland cement, three (3) parts sand and one to 2 parts coarse aggregate.
C. Laboratory design mixes are acceptable in lieu of the above proportions and are required if the minimum strength is more than 2000 psi. Grout shall be of fluid consistency with proper proportions of sand to gravel for pouring or pumping.
D. Aggregate for masonry grout shall conform to ASTM C 404.
E. Maximum slump shall be 8” with a low absorption masonry and 10” with a high absorption unit.

2.5 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as selected by the Contractor subject to approval by the Architect.
B. Commencement of installation of any products of this Section shall be considered as acceptance of the substrate and conditions as being satisfactory for proper installation of products of this Section.

3.2 INSTALLATION

A. Coordinate as required with other work to assure proper and adequate provision in other work for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

C. Provide bond indicated in drawings.

D. Avoid using chipped or broken units. If such units are discovered in the finished wall, Architect may require their immediate removal and replacement with new units without additional cost to the Owner.

E. Care shall be taken to prevent grout and mortar stains. Keep wall continually clean; if grout does run over, clean immediately.

F. All masonry shall be laid true, level and plumb in accordance with the Drawings.

G. The masonry units shall be cut accurately to fit all plumbing, ducts, openings, electrical work, etc., and all holes are to be neatly patched.

H. No construction support shall be attached to the wall except where specifically permitted by the Architect.

I. The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed before starting masonry construction.

J. Wall shall be laid up in straight, uniform courses with regular stack bond.

K. All work, bond patterns or special details as shown on the Drawings shall be accurately and uniformly executed.

L. Joints:
1. The starting joint on foundations shall be laid with full mortar coverage on the bed joints except that the area where the grout occurs shall be free from mortar so that the grout will be in contact with the foundation.

2. Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled as shown on the plans. Unless otherwise specified or details on the plans, in hollow unit masonry the horizontal and vertical mortar joints shall be 3/8" thick.

3. Visible joints shall be tooled with a concave surface. Cut joints flush for masonry walls to be concealed or to be covered by fluid-applied membrane waterproofing or other materials, unless otherwise indicated. Tooling shall be done when the mortar is partially set and still sufficiently plastic to bond. All tooling shall be done with a tool that compacts the mortar.

4. Vertical head joints shall be butted for a thickness equal to the face shell of the unit and these joints shall be shoved tightly so that the mortar bonds well with both units.

5. If it is necessary to remove a unit after it has been set in place, the unit shall be removed from the wall, cleaned and set in fresh mortar.

6. All work, bonds or special details shall be accurately and uniformly executed. Face joints shall be tooled as shown on the Plans and in the Specifications.

7. Where control joints are required or specified, they shall be as detailed on the Drawings.

M. Reinforcing:

1. When a foundation dowel does not line up with a vertical core, it shall be sloped at not more than one horizontal to six vertical. Dowels shall be grouted into a core in vertical alignment even though it is in an adjacent cell to the vertical wall reinforcing.

2. Reinforcing bars shall be straight except for bends around corners and where bends or hooks are detailed on the structural drawings.

3. Reinforcing steel where spliced shall be lapped a minimum of 40 bar diameters, unless otherwise indicated in drawings.

4. When full length vertical bars are used, they shall be held in position at top and bottom at intervals not exceeding 200 bar diameters of the reinforcement.

5. Horizontal reinforcing shall be laid on the webs of bond beam units and shall be solidly grouted in place. Reinforcing in channel units shall be spaced off the bottom of the unit.

6. Vertical reinforcing shall have a minimum clearance of 1/2" from the masonry shell.

N. Grouting:

1. Reinforcement shall be in place before grouting starts.

2. Mortar droppings shall be kept out of a grout space.
3. All grout shall be mechanically vibrated in place.
4. Vertical cells to be filled shall have vertical alignment to maintain a continuous unobstructed cell area not less than two inches by three inches.
5. All cells shall be solidly filled with grout and pours shall be stopped 1-1/2 inch below the top of a course to form a key or joints.
6. Grouting at beams over openings shall be done in one continuous operation.
7. Spaces around metal door frames and other built-in items shall be filled solidly with grout or mortar.
8. Columns, beams, joists, and similar structural members shall be anchored to the wall with anchor bolts or their equivalent. Anchors shall be fully, solidly embedded in place. Embedment shall not be less than shown on the drawings.
9. Low Lift Grouting: Structure shall be grouted in lifts per code. Grout shall be mechanically vibrated to insure full penetration into mortar joints and around steel.

*** END OF SECTION ***
SECTION 04 45 00 – STONE VENEER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing exterior stone wall veneer:

1. Summit Shelter stone walls, shelter bench bases, pillars and adjacent site retaining walls at ramp as shown on Architectural drawings.
2. Trailhead Shelter stone walls, shelter bench bases and pillars as shown on Architectural drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

1. Cast-in-Place Concrete Section 03 30 00
2. Mortar Section 04 10 00.

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 SUBMITTALS

A. Samples: Two samples of each type, color, grade and finish of stone required. Show range of size, color, pattern, and finish.

B. Shop Drawings: Show stone sizes, dimensions, sections and profiles, arrangement and provisions for jointing, anchoring, and fastening stone in place. Show location of inserts for stone anchors and supports to be built into other work.

C. Mock-Up: After approval of samples, provide 4-foot x 4-foot sample panel of
stone proposed to be used showing range of color, texture and workmanship to be expected in the completed work. Show full range of color variation of the stone and pattern, joint treatment, and color of joint mortar or sealant. Modify as directed until mock-up is approved by MROSD and the Architect.

1. Locate mock-ups on the site in locations where directed by MROSD and the Architect.

2. Retain during construction as a standard for judging completed work. Demolish and remove from the site when directed by MROSD.

3. Stone low retaining walls: Construct an 8-foot-long sample section, showing color range, texture, bond pattern, and joints. Approved section shall become the standard of comparison and remain in place until completion of wall work. Sample may be incorporated into completed wall.

D. Calculations: Furnish for information only, calculations signed by a registered structural engineer, showing that stone, anchorage, and setting materials comply with code requirements. Include test data and/or reports to verify characteristics of materials as required by codes.

E. Maintenance Instructions: Include recommended frequency and materials for cleaning and sealing stonework.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Successfully fabricated stone similar to the specified quality for a period of not less than 5-years and equipped to furnish the quantity required.

B. Anchorage details indicated are suggested only. Attachment of stone shall be designed in accordance with the design criteria stated in the California Building Code, and of all authorities having jurisdiction.

1.7 DESIGN CRITERIA

A. General: The requirements for design of stone veneer attachment and support system includes the requirement for cooperative and coordinated work with the Architect and the Architect's consultants to develop the connections, support, and back-up structure required for fastening and support of stone veneer. The drawings are diagrammatic and intended to indicate the external dimensions, organization of units, profiles, conditions, and scope. The Contractor is responsible for compliance with the design
criteria.

B. Structural Loads: The design of stone anchorage and back-up system shall conform to the loads specified in the California Building Code.

C. Anchorage and Support: Work under this Section includes back-up structure required for the support of stone veneer, including but not limited to, framing, angles and supports and anchors required for securing the stone veneer in place.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against moisture, soiling, staining and physical damage.

B. Handle stone to prevent chipping, breakage, soiling and other damage.

1. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials.

2. Lift with wide-belt type slings; do not use wire rope or ropes containing tar or other substances which might cause staining.

3. If required, use wood rollers and provide cushion at end of wood slides.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane.

1. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking.

2. Protect from weather with waterproof, non-staining covers or enclosures, allow air to circulate around stones.

D. Protect mortar materials and accessories from weather, moisture and contamination with earth and other foreign materials.

1.9 JOB CONDITIONS

A. Review installation procedures and coordination with other work affected by stonework.

B. Cold Weather Protection: Install stone when temperature in area surrounding work is 40-deg. F. or above. Provide suitable means to heat materials, protect work from cold. Maintain temperature of work above 40-deg. F. for at least 24-hours after installation.
PART 2 - PRODUCTS

2.1 STONE

A. Shall be Ryolite Napa Wall Stone with a color and texture matching approved samples and mock-up. Provide a combination of Head Size 5x9 and Double Head Size 6x18 and Light Masonry for lower portions of walls. Veneer shall be 80% 4 ½” +/- ½” and 20% 3 ½” +/- ½”. Available through Stone Water Quarries (707) 738-3687, www.stonewaterquarries.com.

2.2 MORTAR

A. Mortar: Laticrete 3701 Fortified Mortar Bed or approved equal. Color as selected by the Architect (#39 Mushroom).

2.3 ACCESSORIES

A. Stone Veneer Anchors: Hohmann & Barnard, Inc. Stone Seismic Anchors and ties. Type and size required to anchor and fasten stone in place. Fabricate anchors and dowels from AISI Type 302/304 stainless steel as indicated.

B. Anchor Bolts, Nuts and Washers: Fabricate from AISI Type 302/304 stainless steel if in contact with stone. Provide ASTM A307 regular low carbon steel bolts and nuts, hot-dip galvanized, complying with ASTM A153, if not in contact with stone.

D. Cleaner: Marble Techniques "Stone Care 6" or approved equal. Where initial cleaning requires the use of an acid type cleaner, use "Tone Clean 2" or approved equal.

E. Sealer: Marble Techniques "Marble Seal 3" or approved equal.

2.4 MORTAR MIXING

A. Mortar: Mix in accordance with manufacturer’s instructions.

2.5 FABRICATION

A. General: Fabricate as indicated and detailed on final shop drawings.

1. Provide holes and sinkages cut or drilled for anchors, fasteners, supports and lifting devices required to secure stonework in place.

2. Cut and back-check as required for proper fit and clearance.
B. Cut field stone to thickness no greater than 5-inches with natural face. Veneer shall be 80% 4 ½” +/- ½” and 20% 3 ½” +/- ½”.

1. Provide 1/2-inch wide dry joint with mortar.
2. Stagger corner stone pieces.

C. Slab Stone Thickness: Provide stone of thickness indicated or required for unit sizes. Saw-cut back surfaces which will be concealed in finished work.

D. Fabricate molded work, to produce stone shapes having a uniform profile throughout their entire length and with precisely formed arrises slightly eased to prevent snipping, and matched joints between units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination: Furnish installers of other work with drawings and templates showing location of inserts for stone anchors and supports.

B. Clean stone before setting by scrubbing with fiber brushes followed by drenching with clear water.

1. Use mild cleaning compounds containing no caustic or harsh fillers or abrasives.
2. If not wet at time of setting, drench or sponge stone.

3.2 INSTALLATION

A. Apply waterproofing over concrete substrate in accordance with manufacturer’s instructions.

B. Install stone with skilled mechanics, and employ skilled stone fitters at the site to do field cutting as stone is set.

C. Ferrous Metal:

1. Apply a heavy coat of bituminous paint on concealed ferrous metal surfaces prior to setting stone.
2. Do not coat ferrous metal exposed in finished work.
3. Do not apply coating to stainless or non-ferrous metals.

D. Set stone in accordance with drawings and final shop drawings.
   1. Provide anchors, supports, fasteners and other attachments required to secure stone in place.
   2. Shim and adjust accessories.
   3. Fill holes, slots and other sinkages for anchors, dowels, fasteners and supports with epoxy during setting.

E. Erect plumb and true with joints uniform in width and accurately aligned.
   1. Joint patterns shall be as indicated.
   2. Use joint spacers to maintain specified joint width.
   3. Field verify existing substrate and notify the Architect if expansion joints are required. Submit drawings showing proposed expansion joint locations for Architect's review if expansion joints are required.

3.3 ADJUST AND CLEAN

A. Remove and replace stone units which are broken, chipped, stained or otherwise damaged.
   1. Remove and replace units which do not match adjoining stonework, where directed.
   2. Provide new matching units, install as specified and eliminate evidence of replacement.
   3. Repoint or seal defective and unsatisfactory joints as required to provide a neat, uniform appearance.

B. Clean stonework not less than 6-days after completion of work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh fillers.

C. Protect stonework from damage, discolorations, and deterioration during construction and until time of Substantial Completion.
*** END OF SECTION ***
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 SUMMARY

A. Provide all materials, labor, equipment and services necessary for the fabrication, erection and completion of all structural steel, including all bracing and shoring required for erection and related work. The work shall include and not necessarily be limited to the following:

1. Summit and Trailhead Shelters.

2. Structural steel shade structure, steel columns, girders, beams, bracing, anchor bolts, base plates, connection bolts, welded studs connected to structural steel.

3. Verification of anchor bolt setting and of levels to assure adequate fit of the steel work.

1.3 RELATED SECTIONS

A. Cast-in-Place Concrete: Section 03 30 00.

B. Rough Carpentry: Section 06 10 00.

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.
1.5 QUALITY ASSURANCE

A. Standards: Comply with the following applicable standards unless otherwise specified herein:

1. CBC—“California Building Code,” 2013 Edition and all applicable local Building Codes.


7. SSPC—Steel Structures Painting Council.


B. Tests and Inspections:

1. Contractor shall certify, test and inspect all materials, welding, fabrication and erection in accordance with the requirements of AISC and AWS D1.1 and as noted herein. The Owner will employ a Testing Agency to provide for additional testing and inspections only as noted in the sections below.

2. Mill analysis and test reports for the steel, certified and properly executed by the manufacturer, will constitute sufficient evidence of conformity with the specifications. Contractor shall identify steel in accordance with CBC Section 2203A as to heat number and furnish the Testing Agency. If the material cannot be identified or its source is questionable, one set of tension and bend tests shall be made by the Testing Agency in accordance with the CBC Section 2203A.

   a. The cost of all tests including sampling and machining of test coupons shall be paid by the Contractor.
b. The Contractor shall cooperate with Testing Agency and provide all material required to take coupons for testing, as required by the Engineer.

3. Certificates of compliance for welding electrodes and shear studs properly executed by the manufacturer(s) shall constitute sufficient evidence of compliance with the specification.

4. High strength bolts, nuts, washers and thread rods shall be sampled and tested in accordance with the requirements of the specification for High Strength Bolts for Structural Steel Joints, ASTM A325 or ASTM A490 Bolts.

5. Additional testing required as a result of corrective measures to correct defects shall be paid for by the Contractor.

C. Welding Inspection by the Contractor: All shop and field welding shall be inspected by the contractor’s “Welding Inspector” as defined by AWS D1.1, Section 6.1. Governing Building Code regulations shall not be construed as to alleviate either the Contractor’s welding inspector of the Testing Agency from the welding inspection requirements of AWS D1.1. The Contractor’s Quality Control Inspector shall be present during all shop and field welding operations, shall inspect the work as required by AWS D1.1, Section 6, shall possess and be familiar with all approved WPSs and shall cooperate with the Testing Agency.

D. Welding Inspection by the Testing Agency: All shop and field welding shall be inspected by a qualified and certified “Verification Inspector” as defined by AWS D1.1 Section 6.1, employed by the Testing Agency in accordance with AWS D1.1 Section 6 and in accordance with the Special Inspection Requirements of the governing Building Code. This inspector shall confirm the qualification of welders, the use of AWS qualified procedures, the manufacturer’s recommended use of automatic equipment and the proper use of preheat. Inspection personnel shall be qualified for non-destructive testing at Level II as specified in Section 6, Paragraph 6.7 of AWS D1.1. The Testing Agency shall submit welding inspector qualifications to the engineer for approval. The Testing Agency shall submit a welding inspection checklist to the engineer for approval.

1. Welder Qualifications: All welders shall be qualified for the work in accordance with AWS D1.1, Section 5, Part C. Except as noted herein, the welders’ qualification shall be considered as remaining in effect indefinitely unless there is a specific reason for questioning the welder’s ability, in which case welder re-certification may be required. If in the opinion of the Architect, the welder is not suitable for the project, said welder may be disqualified from the project. Field Welders shall be
qualified in all processes to be used on-site, in all positions, and on all thickness.

2. Equipment Electrical Meter Calibration Verification: The Contractor shall verify, to the satisfaction of the Testing Agency, that electrical meters are being used, and those in use accurately reflect voltage and amperage at the welding site for the length of cable in use.

3. Visual Inspection: Visually inspect all shop and field welding, including the superstructure, stairs, guardrails, and supports and/or bracing of finishes and non-structural components. Visual inspection shall be in accordance with AWS D1.1., Sections 5 and 6, and shall include verification of fit up, preheat, calibration of equipment, equipment settings, materials, adherence to approved WPS, interpass temperatures, deposition rates, technique, proper fusion of each pass, ensure the weld is crack free at each pass, confirm porosity and undercut do not exceed AWS requirements and confirm the final weld profile, and confirm that all special requirements specified herein are adhered to. Visual inspectors shall examine each step of the welding process.

4. NDT Ultrasonic Inspection: 100% of all complete joint penetration (CJP) groove welds and partial penetration groove welds shall be subject to ultrasonic testing. Ultrasonic testing shall be performed by a specially trained, qualified technician, who shall operate the equipment, examine the welds and maintain a record of all welds examined, defects found and disposition of each defect. All defective welds shall be repaired by the Contractor and re-tested with ultrasonic equipment, at the expense of the Contractor.

   a. The ultrasonic instrumentation shall be calibrated by the technician to evaluate the quality of the welds in accordance with AWS D1.1., section 6.18.

5. Welded Studs: Testing and inspection of steel studs welded to structural steel shall be in accordance with Section 7, Stud Welding, AWS D1.1.

E. Fabrication Inspection: All fabrication of structural steel shall be inspected by the Testing Agency. This inspection, in addition to the welding inspection requirements specified herein, shall consist of, but shall not necessarily be limited to, the following:

   1. Visually inspect steel shapes and plates for existence of defects such as laminations and non-metallic inclusions. Use ultrasonic equipment and other NDT methods to determine extent of defects.
2. Verify steel materials with mill certificates, particularly where yield strength limits, grain size and/or toughness properties are specified in Section 2.01. Verify weld filler metal materials with certificates and manufacturers recommended limitations.

3. Review sections used for conformity to dimensional standards specified.

F. Erection Inspection: All erection of structural steel shall be inspected by the Contractor and the Testing Agency. Provisions under “Fabrication Inspection” and “Welding Inspection” shall apply.

1. All welding shall be inspected by the Testing Agency. Complete and partial penetration welds shall be ultrasonically tested per the provisions under “Welding Inspection.”

2. High strength bolting shall be inspected by the Testing Agency in conformance with the “Specification for Structural Joints using ASTM A325 Bolts” as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineered Foundation.

1.6 SUBMITTALS

A. Mill Test Reports: Contractor shall furnish certified copies of all mill analysis and test reports covering the chemical and physical properties of the steel for review by the Testing Agency and the engineer.

B. Certificates of compliance: Contractor shall submit certificates of compliance for bolts, welding electrodes, and shear studs.

C. Shop Drawings:

1. Contractor shall submit shop drawings showing anchor bolt layout, details of members, their connections, details of weld groove profiles, indication of size and spacing of bolts, and erection plans for the execution of the work showing the marking, and position of each member. Detail drawings shall indicate the position of each member on the framing plans. Shop drawings of details incorporating SR welds shall include explicit references to corresponding approved weld procedure specifications.

2. At least one month prior to commencing with shop drawing submission, the Contractor shall submit for approval a shop drawing weekly submission schedule. This schedule shall include a list and format of all drawings scheduled to be submitted each week, including but not limited
to the number of shop drawings. Once shop drawing submissions have commenced, any modification or addition to this schedule must be submitted for approval at least one month before the modification or addition is proposed to take place. The Contractor shall allow for at least ten (10) working days between the time the shop drawings are received by the Engineer and the time they are released by the Engineer. Materials shall not be fabricated before shop drawings have been reviewed as noted. If at any time the total number of shop drawings received in any one week period exceeds the approved scheduled amount by more than 10% for that week, the Engineer has the right to add an additional 2 days to the average turnaround times for each 20% increment that it exceeds for that week’s submissions. For example, if the weekly total exceeds the schedule by 10% to 20%, 2 days may be added, if it is exceeded by 21% to 40%, 4 days may be added and so on.

3. Checking by Contractor: Prior to submission of the shop drawings to the Architect/Engineer, they shall be pre-checked by the Contractor for conformity of detail with the Contract Documents and as coordinated with other subcontractors. The signature of a representative of the Contractor indicating that the drawings have been pre-checked will be required. The Contractor shall be wholly responsible for the conformity of dimensions and details of the shop drawings with the Contract Documents.

4. Review by Architect/Engineer: Provide PDF Digital copies of any shop drawing submittal. After receipt of the shop drawings by the Architect/Engineer, they will be reviewed and necessary corrections will be marked on one copy, which will be returned. One copy shall be retained by the both the Architect and the Engineer. Corrections shall then be made and the drawings resubmitted. This procedure will be continued until the drawings are approved or approved as noted and released for construction. Once approved, if variations between the shop drawings and the original construction drawings (plans & details) exist, the shop drawings shall take precedence.


6. Additional copies of the approved shop drawings shall be at the Contractor’s expense.

7. File: At least one copy of each approved shop drawing shall be kept available in the Contractor’s field office. Drawings not bearing evidence of approval and release for construction by the Architect shall not be kept on the job site.
D. Bolts: Submit manufacturer’s data for high strength bolts and direct tension indicator washers.

E. Review of submittals and shop drawings will cover only the general scheme and character of the details, but not the checking of dimensions, nor will such review relieve the Contractor from responsibility for executing the work in accordance with the contract drawings.

F. Provide five (5) paint color samples for approval by MSROD and Architect prior to beginning paint coating process.

PART 2 – PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

A. Structural Steel shapes and Plates: ASTM A572 Grade 50, typical unless noted.

B. Rolled steel W and WT sections: ASTM A992, Grade 50.

C. Channel and angle sections may be ASTM A36.

D. Rectangular HSS Sections: ASTM A500, Grade B—Cold Formed Structural Tubing.

E. Steel Pipe: ASTM A53, Grade B.

F. Round HSS Sections: ASTM A500, Grade B, $F_y = 42$ ksi, $F_u = 58$ ksi.

2.2 FASTENER PRODUCTS AND MATERIALS


C. High-Strength Bolts: ASTM A325, Connection Type X, N or SC, as indicated on the Drawings.

D. Direct Tension Indicators: ASTM F959-94A for use with SC bolts.

E. Welded Steel Studs: ASTM A108, shear studs headed per Section 7, Stud Welding, AWS D1.1.

F. Connections to Wood Heavy Timber Framing: ASTM A47 Galvanized Malleable Iron washers.
2.3 WELDING PRODUCTS AND MATERIALS

A. Arc-welding Electrodes: Filler metals shall conform to Table 4.1 of AWS D1.1. Electrodes and equipment settings shall be as recommended by the filler metal manufacturer for the position, thickness or other conditions of actual use. All electrodes and filler metals shall be low hydrogen types.


B. Arc-welding equipment: Equipment for electric welding shall have calibrated meters for voltage and amperage that accurately indicate voltage and amperage quantities at the welding site for the length of the cable to be used. Contractor shall demonstrate to the satisfaction of the Testing Agency the accuracy of the meters, using external meters attached to extension cables of a length that reflects actual project conditions. If equipment meters do not accurately reflect electrical properties at the welding site, external meters shall be used at the welding site and shall be provided but the Contractor at the Contractor’s expense.

2.4 COATING PRODUCTS AND MATERIALS

A. All steel items noted on the drawings as painted shall be according to the following specifications.

1. Steel Primer Paint: Tnemec Series 90-97 Tnemec-Zinc at 2.5 to 3.5 mils DFT, or equal meeting VOC requirements for BAAQMD of State Air Resources Board.

2. Steel Intermediate Coating: Tnemec Series V69 Epoxoline at 4.0-6.0 mils DFT.

3. Steel Final Coating: Tnemec Series 1075 Urethane finish at 3.0-5.0 mils DFT.

i. Shelters Steel Columns and Beams Color: “Anthracite Grey color RAL 7016”. [ALT 1 “Slate Grey color RAL 7015”], [ALT 2 “Grey Brown color RAL 8019”], [ALT 3 “Quartz Grey color RAL 7039”], [ALT 4 “Basalt Grey color RAL 7012”]. Mathews Paint (800) 323-6593. Contractor shall provide a range of five (5) grey color site samples painted on actual metal work for approval by MSROD and Architect prior to beginning coating process.
B. Shop Galvanizing: All items noted on the drawings or specifications as galvanized shall be hot dipped galvanized in accordance with ASTM A123. Thickness of galvanized coating shall be in conformance with ASTM A123.

C. Galvanizing repair compound shall be All State Galvanizing Powder, Drygalvo, by American Solder and Flux, or approved equivalent.

PART 3 – EXECUTION

3.1 GENERAL

A. Workmanship and details of structural steel work, unless otherwise specified, shall conform to Uniform Building Code and the AISCC Specification for Design, Fabrications and Erection of Structural Steel for Buildings. The quality of materials and the fabrication of all welded connections shall conform to the American Welding Society’s Structural Welding Code, AWS D1.1.

B. The Contractor shall secure all field measurements necessary for the completion of this work. The contractor shall be responsible for all errors of detailing and fabrication and for the correct fitting of the structural members to each other and to their supports. Provide column anchor bolts and templates for setting under Section 77; this Section to verify location.

C. All materials both before and after fabrication shall be protected from rust corrosion and shall be kept free from dirt, grease and other foreign matter.

D. Each framing member shall be free from twists and bends. Holes and all cut and sheared edges shall be neatly made without kinks, butts, and warped edges. All steel left exposed shall be straight, smooth and free of nicks, scars and dents. Exposed welds shall be uniform and neat.

E. Installation of steel studs, headed for shear connectors and threaded for parts connectors, welded to structural steel, shall be in accordance with Section 7, Stud Welding, of AWS D1.1.

F. Holes for Bolts: Holes for bolts shall be 1/16 inch larger than the nominal diameter of the bolt. If the thickness of the material is not greater than the nominal diameter for the bolt plus 1/8 inch, the holes may be punched. Holes in thicker material shall be drilled from the solid or sub-punched and reamed. Holes for high-strength bolts shall have all burrs removed by grinding.
G. Column Bearing Surfaces: Column bases, as required by the AISC specification, and all column bearing surfaces shall be milled to a true plane perpendicular to the axis of the member to assure a complete bearing at the contact face.

H. Camber: All beams and girders shall be cambered if and as indicated on the Drawings.

I. Dimensional Tolerances: Fabrication and erection tolerances shall conform to AISC requirements except where closer tolerances are shown on the Drawings.

3.2 WELDING

A. Welded Connections: Where structural joints are made by welding, the details of all joints, the techniques of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to requirements of “Structural Steel for Buildings” of American Institute of Steel Construction and “Structural Welding Code” of the American Welding Society.

B. Qualification of Welders: Welding operators shall qualified by tests, as prescribed in the “Standard Qualification Procedure of the American Welding Society (AWS D1.1) to perform the type of work required, including process, position and thickness. All welders shall be capable of reading and following the approved written WPS.

C. General Requirements: All welding shall conform to the following:

1. Equipment: Use equipment which will supply proper current, voltage, etc., as recommended by the manufacturer of electrodes to be used, adjusted to suit arrangement and thickness of base metal. Suitable meters and means of adjustment shall be provided for current and voltage

2. Preparation for Welding: All surfaces shall be clean, free of rust, paint and foreign matter of any kind. Scale shall be removed by wire brush, chipping or hammering as required. Thermal cut edges to be welded shall be chipped clean, and ground at least 1/32 inch to bright metal before welding. Clamp members as required, space and alternate welds all as may be necessary to prevent warping or misalignment.

3. Fitup: Weld joint profiles shall meet dimensional requirements and maximum tolerances specified by AWS D1.1 or as specified in approved Qualification Procedures. Joint fitup that does not comply shall be corrected using approved procedures and approved by the inspector before welding proceeds.
4. Preheat/Interpass/Postheat: Provide minimum preheat and interpass temperatures and Post-heat/Cool Down procedures as required by AWS D1.1, unless otherwise specified herein. Deposition rates shall be controlled to be within minimum and maximum interpass temperatures.

5. Weld Quality: Welds shall present a uniform surface, free of imperfections as defined by AWS, and without undercutting or overlapping and free of excessive oxides, gas pockets and non-metallic inclusions. Welds shall be made with the proper number of beads or passes to secure sound, thoroughly fused joints. Each deposit shall not exceed 5/16 inch of weld for each pass, nor shall each deposit exceed maximum layer height and bead width specified in AWS D1.1. Each pass shall be cleaned by chipping and wire brushing to remove scale and slag, before placing any additional weld metal.

6. Sequence of Welding: For highly restrained connection and/or weldments, the sequence of welding shall be designed to minimize distortion of the members and to minimize the buildup of internal stresses.

7. Filler Metal: Filler metal shall conform to Table 4.1 of AWS D1.1. Weld metal shall be thoroughly fused with the base metal along all surfaces and edges of the union. Penetration shall be 1/16 inch minimum and shall be into the root of the joint.

D. Faculty and Defective Welding: Any welding performed without inspection or contrary to the approved WPS, or showing cracks, slag inclusion, lack of fusion, undercut or other defects as defined by AWS, ascertained by visual or other means for inspection, shall be chipped out and properly replaced by the contractor, and re-inspected by the Testing Agency, all at the Contractor’s expense.

3.3 ERECTION

A. Field Connections: Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication. Holes shall be cut, drilled or punched to a diameter 1/16” larger than the bolt holes, UON. Holes shall not be burned or enlarged by flame cutting.

B. All bolted connections shall conform to the AISC and shall use high strength threaded fasteners, UON. High Strength bolted connections shall be made in conformance with the “Specification for Structural Joints using ASTM A325 , heavy hexagonal structural diameter, approved by Research Council of Riveted and Bolted Joints of the Engineering Foundation.”
C. Tighten nuts using wither “Calibrated Wrench” method, “Twist off Element” method, “Turn-of-Nut” method, or by the use of a “Direct Tension Indicator”. Minimum bolt tension as per applicable standard ISC “Specification for Structural Joints using ASTM A325 or A490 Bolts” for each bolt type and size used. Washers may be omitted for ASTM A325 bolts when “Turn-of-Nut” method is used.

D. Column anchor bolts shall be furnished under this Section and set under Section 77, Structural Cast-in-Place Concrete. Anchor bolts shall be Heavy Hex Head ASTM F1554-55 ksi yield strength. Provide washers under nuts and heads.

E. Metal templates shall be furnished with bolts for setting of all column anchor bolts. The Contractor shall furnish instructions for the setting of anchor bolts and shall ascertain that the items are properly set during the progress of the work.

F. Column base plates shall be set level to correct elevation, and temporarily supported until the supported members has been plumbed and the column base plate grouted. The entire bearing area under plates shall be grouted solid under Section 77 with non-shrink grout placed in strict accordance with the manufacturer’s recommended procedures for 28-day minimum ultimate compressive strength of 5,000 psi.

3.4 FRAMING AND BRACING

A. All structural steel shall be erected true and plumb. Temporary shoring and bracing shall be used wherever necessary and shall be adequate for all loads to which the structure may be subjected, including wind and erection equipment and operation of same. Leave temporary bracing and shoring in place as long as may be required for safety, and until final framing construction is completed.

B. No final connections shall be made until the structure has been properly aligned. All temporary flooring, planking and scaffolding necessary in connection with the erection of the structural steel, or support of erection machinery shall be provided as part of the erection work. The temporary floors and scaffolding shall conform to the requirements of all laws governing safety regulations.

C. Drifting done during assembly shall not distort the metal or enlarge the holes. Mismatching of holes greater than 3/32 inch shall require reaming for the next larger bolt. Mismatching of holes greater than 1/8 inch shall be cause for rejection.
3.5 SHOP PAINTING

A. General: Shop prime all structural steel work except members or portions of members to be fireproofed or embedded in concrete. Prime embedded steel that is partially exposed on the exposed portions and the initial 2” of embedded areas only. Do not prime contact surfaces that are to be welded or high-strength bolted with friction-type connections or top flanges of beams to which metal decking will be welded.

1. Apply two coats of primer to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

B. Surface Preparation: After inspection, clean all steel work to be primed and prime before shipping from the shop. Remove loose rust, mill scale and spatter, slag or flux deposits. Clean all steel, including steel to be fireproofed or embedded in concrete as follows:

1. Clean steel in accordance with Steel Structures Painting Council’s “Painting Manual” for Solvent Cleaning (SSPC-SP 1) and either Hand Tool Cleaning (SSPC-SP2) or Power Tool Cleaning SSPC-SP3).

C. Also refer to Part 2.4 – Coating Products and Materials

3.6 FIELD TOUCH-UP PAINTING

A. After installation, all field welds and areas in which shop painting has been disturbed shall receive surface preparation as specified for shop painting.

PART 4 – DEFECTIVE WORK

4.1 GENERAL

A. Work found to be defective, missing or damaged shall immediately be replaced with proper work. Such replaced work and the inspection for it shall be at the expense of the Contractor.

B. Straightening of any material, if necessary, shall be done by a process and in a manner that will not injure the materials, and which is approved by the Architect. Sharp kinks or bends shall be cause for rejection. Heating will not be allowed.
C. De-lamination and other rolling defects in structural shapes and plates shall be cause for rejection when, in the judgment of the Architect, repairs are not feasible or acceptable.

D. If defects or damaged work cannot be corrected in the field, the material shall be returned to the shop, new parts furnished, as the Architect directs; the Contractor shall replace all work at his own expense.

E. Beams supporting metal deck that are not in alignment or at the right elevation shall be changed to suit proper support conditions of the metal deck.

F. Welds completed, or in process, that do not conform to the approved Welding Procedure Specification may be considered defective and shall be repaired at the Contractor’s expense.

*** END OF SECTION ***
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing metal fabrications made from steel shapes, plates, sheets, bars, strips, tubes, pipes and castings not a part of structural steel or specified in other Sections, including but not limited to the following items:

1. Weathering Steel Metal Panels.
2. Bench support brackets.
   i. Site Stair Locations.
   ii. Summit Shelter and Ramp Locations.
   iii. Tower North Perimeter Locations.

1. Pulling irons, inserts, and other miscellaneous steel shapes.
2. Miscellaneous angles, plates, bars, rods and other items not specified in other Sections but shown or required to complete the work.

B. Related Sections:

1. Cast-In-Place Concrete is specified in Section 03 30 00.
2. Cast-In-Place Concrete Finishing is specified in Section 03 35 00.
3. Exterior Architectural Woodwork is specified in Section 06 40 10.
4. Metalwork is specified in Section 05 51 00.
1.3 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Handrails and Railings: If handrails and railings are not detailed, design, engineer, fabricate and install railings and handrails to withstand the following structural loads:

1. Top Rail of Guardrail System: Capable of withstanding a lateral load of 50-psf applied horizontally at right angles to the top rail.
2. Handrails: Capable of withstanding a load of 200-psf applied at any direction and point along the handrail.
3. Guardrails, Handrails and Railings shall comply with ADA requirements.

1.5 SUBMITTALS

A. Product Data: Include information on weathering steel panels grade and thickness, steel grade, galvanizing and paint products including color samples, and grout.

B. Shop Drawings: Include plans, elevations and details of guardrails, metal fabrications, weathering steel panels including panel layout, perforation design and panel connection details. Show anchorage and accessory items. Furnish templates for anchors and bolts installed under other Sections.

C. Samples: Provide samples of Weathering Steel Panels and Perforation Design. Provide five (5) paint color samples of Guardrail and Handrail finish and color for approval by MSROD and Architect prior to beginning paint coating process.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Welding Qualifications: Qualify welding processes and welding operators in
accordance with AWS D1.1, D1.2, and D1.3 as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

1.7 ENVIRONMENTAL QUALITY ASSURANCE

A. Recycled Content of Ferrous Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25-percent.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule to avoid delay of work.

1.9 SEQUENCING AND SCHEDULING

A. Mount handrails only on steel or concrete assemblies reinforced to receive anchors, and where the location of concealed anchor plates has been marked for the installer.

B. Painting: Items specified in this Section as having a shop applied prime coat will be painted as specified in Section 05 50 00, Paragraph 2.5 B, below.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. General: For fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Steel Tubing: Cold formed, ASTM A500; or hot-rolled, ASTM A501.

D. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1.

E. Weathering Steel Sheet: ASTM A606 Type 4.
F. Galvanized Structural Steel Sheet: ASTM A653, galvanized in accordance with ASTM A525, G90 coating designation.

G. Steel Pipe: ASTM A53; type and grade selected by fabricator; Duplex (Galvanized and painted) finish; standard weight, schedule 40, unless otherwise indicated.


I. Malleable Iron Castings: ASTM A47, grade selected by fabricator.

2.2 PREWEATHERED WEATHERING STEEL PANELS

A. Zahner Architectural Metal Zira Imagewall Solanum Steel (Unsealed), 11 Gauge Perforated Metal Panels (perforation pattern to be defined by Architect and design as shown on plans, elevations and details), Design Detailed and Shop Fabricated by Zahner, 1400 E. 9th Street, Kansas City MO 64106, (816) 474-8882, wwwazahner.com

ALTERNATE: COR-TEN ASTM A606 Type 4 Flat Steel Sheet 11 Gauge Perforated Metal Panels (perforation pattern to be defined by Architect and design as shown on plans, elevations and details), (48” x 144” stock), by United States Steel Corporation, USS. Supplier: Western States Metal Roofing (855) 426-7836 or equal local supplier.

2.3 FASTENERS: All Fasteners shall be Hot Dip Gavanized per ASTM A-153 or ASTM F-2329 or A316 Stainless Steel per ASTM F593 as called out on plans.

A. Bolts and Nuts: Regular hexagon-head bolts ASTM A325 (F3125), Type 1, with Heavy Hex Nuts ASTM A563 Grade DH, and flat washers.

B. Machine Screws: ANSI B18.6.3.

D. Lag Bolts: ANSI B18.2.1.

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.


H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when
installed in unit masonry and equal to 4 times the load imposed when installed in concrete, determined in accordance with ASTM E448.

2.4 GROUT


2.5 PAINT

A. Metal Primer: SSPC 20, Type 2. VOC content shall not exceed 400 g/L.

1. Exterior Exposure: Tnemec 90-97 Tnemec Zinc or approved equal.
2. Interior Exposure: Tnemec Series FD88 Azeron Primer or approved equal VOC compliant rust-inhibitive alkyd primer.
3. Steel Tubing Handrails, Railings, and Guardrails: Tnemec 69-1211 or approved equal polyamide epoxy.
4. Exposed to view items to be field painted shall be primed with a primer compatible with final finish coats specified in Section 05 50 00.

B. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel; Rust-Oleum Corp. "Zinc-Rich Cold Galvanizing Compound", Tnemec 90-93, ZRC Worldwide "Galvalite" or approved equal. VOC content shall not exceed 420 g/L.

C. Guardrails, Railing and Handrail Paint Color: Duplex System: Hot Dipped Galvanized and Powder Coated (See Appendix for Spec Sheet).

2. Summit Shelter and Ramp Locations: Color RAL 7039 Quartz Grey.
4. Contractor shall provide a range of six (6) grey color site samples painted on actual metal work for approval by MSROD and Architect prior to beginning coating process. Mathews Paint (800) 323-6593. Colors shall include:
   a. ALT 1 Signal Grey color RAL 7004
   b. ALT 2 Quartz Grey color RAL 7039
   c. ALT 3 Anthracite Grey color RAL 7016
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d. ALT 4 Slate Grey color RAL 7015

e. ALT 5 Basalt Grey color RAL 7012

f. ALT 6 Grey Brown color RAL 8019

2.6 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.

2. Work to dimensions indicated,

3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

4. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated.

5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished work.

6. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat-headcountersunk screws or bolts for exposed fasteners, unless tamperproof security screws are indicated.

7. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Duplex System (Powder Coating PER AAMA 2605 over Zinc (Hot-Dip Galvanized) Coated in accordance with ASTM D7803 for all exterior steel railings, guardrails, and handrails, including tubing, fittings, brackets, fasteners, and other ferrous components. See Appendix for Spec Sheet.

C. Galvanizing: Provide zinc coating for items indicated or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes,
plates, bars, and strip 0.0299-inch thick and heavier.

D. Fabricate joints exposed to the weather to exclude water or provide weep holes.

E. Shop Powder Coating:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SP-3, or SP-7.

3. Remove oil, grease and similar contaminants in accordance with SP-1.

4. Brush or spray on primer in accordance with manufacturer’s instructions, at a rate of 2.0-mils thickness for each coat.

5. Apply one shop coat to fabricated metal items, except apply 2-coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.

6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 05 50 00.

7. Apply a heavy coat of bituminous paint, compounded for application in 30-mil coat, to metal surfaces in contact with concrete, masonry and dissimilar metals. Do not apply on exposed surfaces.

2.7 MISCELLANEOUS METAL FABRICATIONS

A. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete work.

2. Fabricate to sizes, shapes and profiles shown or required.

3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.

4. Cut, drill and tap units to receive hardware and similar items.
5. Furnish integrally welded anchors for casting into concrete or building into masonry.

6. Finish: Galvanize exterior frames and supports, shop prime interior frames and supports.

B. Steel Pipe Railings and Handrails: Fabricate to design, dimensions and details indicated. Maximum member size shall be 2-inch O.D. Railings and handrails shall comply with ADA requirements.

2. Interconnect railing and handrail members by butt welding or welding with internal connectors.

3. Provide coped joints at tee and cross sections.

4. Form simple and compound curves by bending tubing in jigs to produce uniform curvature for each repetitive configuration. Maintain cylindrical cross-section of tube throughout entire bend without buckling, twisting or deforming exposed surfaces.

5. Provide wall returns at ends of wall-mounted handrails.

6. Close exposed ends of tubing by welding 3/16-inch steel plate in place or by using prefabricated fittings.

7. Flanges, Fittings and Anchors: Provide end closures, flanges, miscellaneous fittings and anchors for interconnections of tubing and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry.

8. Pipe Sleeves:
   a. Provide galvanized pipe sleeves not less than 6-inches long with an inside diameter not less than 1/2-inch greater than the outside diameter of pipe or tube.
   b. Provide steel plate closure welded to bottom of sleeve, width and length not less than 1-inch greater than outside diameter of sleeve.
   c. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2-inch below finished surface of concrete.


PART 3 - EXECUTION
3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.2 INSTALLATION

A. General:

1. Fastening to In-Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

2. Cutting, Fitting and Placement:
   a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
   b. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry or similar construction.

3. Fit exposed connections together forming tight hairline joints.
   a. Weld connections not shop welded.
   b. Grind exposed joints smooth and imperceptible, and touch-up shop paint coat.
   c. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS for procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

5. Install prefabricated items in accordance with manufacturer’s instructions.

B. Setting Loose Plates:

2. Set loose leveling and bearing plates on wedges, or other adjustable devices.
3. Tighten anchor bolts after the bearing members have been positioned and plumbed.
4. Cut-off protruding ends of wedges flush with the edge of the bearing plate before packing with grout.
5. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations.
6. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

C. Steel Tube Railings and Handrails:

1. Adjust railings prior to anchoring to ensure matching alignment at abutting joints.
2. Space posts as indicated.
3. Plumb posts in each direction.
4. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts are inserted in sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer’s directions.
5. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
6. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
7. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to structural steel members.
8. Provide removable railing sections where indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Locate sleeves to match post spacing.
9. Secure handrails to wall with wall brackets and end fittings.
   a. Locate brackets as indicated.
b. Secure wall brackets in accordance with manufacturer's instructions.

10. Expansion Joints: Provide at intervals not exceeding 40-feet. Provide slip joint with internal sleeve extending 2-inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6-inches of posts.

3.3 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0-mils.

B. Duplex Galvanized and Epoxy Coated Surfaces: Clean field welds, bolted connections and abraded areas and spot prime with specified primer applied to a minimum dry film thickness of 2.5-mils.

*** END OF SECTION ***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION
   A. General: Provide miscellaneous metal fabrications in accordance with the Contract Documents including but not limited to handrails and guardrails.
   B. Related Sections:
      1. Cast-In-Place Concrete is specified in Section 03 30 00.
      2. Cast-In-Place Concrete Finishing is specified in Section 03 35 00.
      3. Exterior Architectural Woodwork is specified in Section 06 40 10.
      4. Metal Fabrications including paint colors are specified in Section 05 50 00.

1.3 DEFINITIONS
   A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 QUALITY ASSURANCE
   A. Fabricator/Installer: A firm specializing in miscellaneous metal work with minimum 5 years of experience on projects with requirements similar to that indicated for this project, and with sufficient production capacity to produce required units without causing delay to the Work. Employ experienced trades for fabrication and installation capable of producing industry standard quality work.
   B. Welders: Qualified per AWS.
1.5 PERFORMANCE CRITERIA

A. Railings and Handrails: Design and construct to support a concentrated load of 250 lbs. applied at any point and in any direction and for a uniform load of 50 lbs. per ft. applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.

1.6 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

1. AWS D1.1 "Structural Welding Code".
2. AWS D1.2 "Structural Welding Code -Sheet Steel"
4. NAAMM "Metal Bar Grating Manual".
5. NAAMM "Pipe Railing Manual".
6. NAAMM "Metal Stairs Manual".
7. SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".
8. Industrial Fasteners Institute "Fastener Standards Book".
9. ANSI A14.3, ANSI A12.1, ANSI A58.1 and Part 1910 of the Occupational Safety and Health Standards (OSHA) as applicable to stairs, ladders, railings and protection of floor openings.

1.7 SUBMITTALS

A. Manufacturer's Data: Submit for Architect's record only manufacturer's specifications, load tables, diagrams, details and installation instructions for products to be used in miscellaneous metal work.

B. Setting Drawings: Provide setting drawings and templates for the location of miscellaneous metal items that are to be embedded in or anchored to concrete or masonry.

C. Samples: Submit samples of materials and finishes as specified and as requested. Samples will be reviewed by MSROD and Architect for color, finish and appearance only.

D. Shop Drawings and Manufacturer's Data: Submit shop drawings as indicated on drawings, and for fabrication and erection of work which is not completely shown by manufacturer's data sheets. Submit manufacturer's data sheets. Include plans and elevations at not less than 1" = 1'-0" scale, and include details of sections and connections at not less than 3" = 1'-0" scale. Show anchorage
and accessory items. Shop drawings for items specified by design load shall include engineering calculations and shall bear seal and signature of Professional Engineer registered in State of California.

E. Calculations:

1. Calculations For Railings and Handrails: Submit engineering calculations together with shop drawings to substantiate that Work complies with performance criteria and other structural and safety requirements. Calculations shall bear the seal of a Profession Engineer registered in the State of California.

PART 2 -PRODUCTS

MATERIALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal fabrications which will be exposed to view in the finished work, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Pipe: ASTM A53, Type S, Grade A, suitable for close coiling, Duplex Finish (Galvanized then Powder Coated); Extra Strong (XS) weight (Schedule 80S), unless otherwise indicated or required to satisfy performance criteria.

C. Steel Bars and Bar Size Shapes: ASTM A675, Grade 65, or ASTM A36.

D. Cold Finished Steel Bars: ASTM A108, grade as selected by fabricator.

E. Structural Steel Shapes, Plates and Bars: ASTM A36.

F. Rolled Steel Floor Plates: ASTM A786. 1/4" thick unless otherwise shown. Thickness shown for raised pattern safety plates is exclusive of projected pattern.

G. Steel Tubing: ASTM A501; hot-formed, welded or seamless process. For exterior use and other locations noted, provide hot-dip galvanized tubing in accordance with ASTM A53.

H. Steel Bars and Bar Size Shapes: ASTM A675, Grade 65, or ASTM A36.

I. Cold Finished Steel Bars: ASTM A108, grade as selected by fabricator.

J. Cold Rolled Carbon Steel Sheets: ASTM A366; commercial quality, stretcher leveled, free from scale, pitting or other defects.

K. Galvanized Carbon Steel Sheets: ASTM A526, galvanized in accordance with
ASTM

L. Stainless Steel

1. Plate, Sheet and Strip: ASTM A167, Type 302 or Type 304. Provide mill finish unless otherwise shown.

2. Bars and Shapes: ASTM A276, Type 302 or Type 304. Provide mill finish unless otherwise shown.

M. Paint: All steel handrails, guardrails and railings to be Duplex System (Powder Coated over Hot-Dip Galvanized steel). Provide primer and finish paint as supplied by a single manufacturer for the entire project.

1. Exterior Ferrous Metal Primer For Architecturally Exposed Steel: Compatible with finish coats of paint; shop apply to the respective dry film mil thickness specified; one of the following:
   a. "90-97 Tneme Zinc" (Tnemec Co. Inc.); 2.0 - 3.0 mils d.f.t.
   b. "Imron 622F" (DuPont Co., Inc.); 2.0 - 3.0 mils d.f.t.
   c. "Zinc Clad IV" (Sherwin-Williams); 2.0 mils. d.f.t.

2. Powder coat for handrails as indicated on drawings: Hammerhead Endura-Shield IV, Tnemec Semigloss High Build Acrylic Polyurethane Enamel No. 75-J7751, or approved equal. Submit color samples for approval.

N. Non-Metallic Shrinkage Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining, shrinkage resistant product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621 and ASTM C1107, free of gas-producing or gas-releasing agents, oxidizing catalysts, inorganic accelerators and chlorides. Provide one of the following:

1. "Five Star Grout" (U.S. Grout Corp.).
2. "Masterflow 713" (Master Builders Co.).
3. "Crystex" (L&M Construction Chemicals, Inc.).

O. Fasteners and Anchorage Devices: Provide fasteners complying with the requirements of Industrial Fasteners Institute standards. Type, grade, class and style best suited for the respective purpose. Use countersunk flat-head Phillips type machine screws for exposed fasteners, except where Allen head screws are required. Use galvanized steel or stainless steel fasteners for exterior construction and for fastening components fabricated of galvanized steel. Fasteners exposed in finish surfaces to match finish of adjacent surfaces.
N. Galvanizing:
   1. Comply with ASTM A153, Classes A and B, for galvanizing iron and steel hardware. Comply with ASTM A123, for galvanizing rolled, pressed and forged steel shapes, plates, bars, strip 1/8 in. thick and heavier and for assembled steel products.
   2. Hot-dip galvanize miscellaneous ferrous metal items after fabrication. Galvanize items exposed to weather and where shown or specified. Do not galvanize portions of items completely embedded in concrete.

P. Handrails, Guardrails and Supports
   1. Steel Pipe Railings and Guardrails:
      a. Provide steel pipe railings, guardrails and supports as shown, with smooth bends unless otherwise indicated of design and dimensions indicated, and welded joints; complete with all sleeves, brackets, bolts and fastening devices as required for a complete installation.
      b. Design and construct for a concentrated load of 250 lbs. applied at any point and in any direction and for a uniform load of 50 lbs. per ft. applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.
      c. Provide removable sections where shown. Provide wall returns at ends of wall mounted handrails unless otherwise shown. Close exposed ends of pipe railing by welding prefabricated fittings. Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. For railing posts set in concrete, provide sleeves fabricated from steel pipe not less than 6 in. long and with an inside diameter not less than 1/2 in. greater than the outside diameter of the post. Provide a steel plate closure welded to bottom of sleeve.
      d. Provide expansion joints at intervals not to exceed 40 ft. unless otherwise shown. Provide slip joints with internal sleeves extending 2 in. minimum beyond joint each side. Fasten internal sleeve securely to one side without exposed fasteners. Locate joints within 6 in. of posts as shown.
      e. If required to accommodate expansion and contraction, provide pressure relief holes at bottom ends of pipe in concealed locations.
      f. Form simple and compound curves by bending pipe in jigs to produce uniform curvature; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.
      g. At tee and cross-section provide coped joints and at elbow bends provide mitered joints, unless otherwise indicated.
      h. Handrail Brackets: Manufacturer's standard complying with ASTM653-FS Type B; Duplex Finish, Hot Dipped Galvanized Steel Powder Coated.
2. Finish:
   a. All Steel Handrails, Railings and Guardrails finish to be: Duplex System (Powder Coating PER AAMA 2605 over Zinc (Hot-Dip Galvanized) Coated in accordance with ASTM D7803 for all exterior steel railings, guardrails, and handrails, including tubing, fittings, brackets, fasteners, and other ferrous components.

SHOP PAINTING

A. General:
   1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded and stainless steel, unless otherwise specified.
   2. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning", prior to any additional surface preparation specified.
   3. Clean and prepare metal surfaces before applying shop coat. Remove rust and mill scale in accordance with SSPC SP-3 "Power Tool Cleaning".
   4. Immediately after surface preparation, apply primer in accordance with manufacturer's instructions. Use painting methods which will result in full coverage and dry film thickness specified.
   5. Apply one shop coat of primer to fabricated metal items, except apply 2 coats of primer to surfaces inaccessible after assembly or erection. In addition, apply one shop coat of finish paint to entire surfaces of exterior loose lintels, shelf and relieving angles, dunnage and other items as noted or specified. Change color of second or finish coat to distinguish it from the first coat.
   6. Separate dissimilar metals with one coat of dielectric separator. Do not extend coating onto exposed or finished surfaces.
   7. Application: Do not paint when ambient temperature is below 40°F. Paint in dry weather or under cover; paint over dry rust-free surfaces. Stir paint and keep at uniform consistency during application. Apply paint by brush or spray per manufacturer's directions to a dry film thickness of not less than 1.5 mils (approximately 370-375 SF of surface per gallon); do not thin paint in excess of manufacturer's recommendations. Allow paint to dry before handling or shipment.

B. Fully Concealed Items:
   1. Clean steel work by "Solvent Cleaning" method specified in SSPC-SP 1, followed by "Hand Tool Cleaning" to remove loose mill scale and rust by methods specified in SSPC-SP 2.
   2. Apply ferrous metal primer immediately after cleaning to uniform dry film thickness of 2.0 mils.
   3. Apply second coat of same primer and same thickness on concealed work which will be built into below grade work, or will be concealed in areas.
C. Exposed Exterior Items:
1. Apply the following cleaning, treatment and painting to exterior work which will be fully exposed or only partially exposed, and to exposed interior work in areas designated as high humidity areas.
2. Clean by "Solvent Cleaning" method specified in SSPC-SP 1, followed by "Power Tool Cleaning" to remove loose mill scale and rust by methods specified in SSPC-SP 3, followed by "Pickling" to remove remaining mill scale and rust by methods specified in SSPC-SP 8. Power tool cleaning and pickling may be omitted from work fabricated from cold-rolled or cold-finished stock, and from castings, provided surfaces are not heavily rusted.
3. Apply pretreatment as recommended by ferrous metal primer manufacturer.
4. Apply prime coat of ferrous metal primer immediately after pretreatment to uniform dry film thickness of 2.0 mils.

PART 3 - EXECUTION

INSTALLATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and other miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site. Deliver items which are to be built into the work of other Sections in time so as not to delay the progress of the Work.

B. Field Welding: Comply with AWS Welding Code for procedures related to field welding as related to appearance and quality of welds made and for methods used in correcting welding work. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

C. Except where otherwise specified for a particular item for built-in work, fasten metal work to concrete or solid masonry with embedded anchors or expansion bolts, and to hollow block with toggle bolts. Fastening to wood plugs will not be permitted. Drill holes for bolts to the exact diameter of the bolt. Provide screws threaded full length to the screw head.

D. Install work as shown, plumb, level and in line with adjacent materials where designated high humidity areas.
required. Provide fastenings as indicated on the Drawings, specified herein or as shown on final shop drawings. Fit exposed connections accurately together to form tight hairline joints.

E. Protect finished surfaces against damage during construction and remove protection at time of substantial completion.

F. Steel Ladders: Provide steel ladders where indicated and at all locations requiring access to equipment, catwalks or gratings. Secure steel ladders to masonry or concrete with a minimum of two 1/2 in. diameter expansion bolts at each bracket, unless additional attachments are required to sustain imposed loads.

G. Railings and Guardrails:
   1. Anchor posts of railings into concrete by means of pipe sleeves preset and anchored into concrete. Set sleeves in concrete with tops flush with finish surface elevations and protect sleeves from water and concrete entry. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with non-shrink non-metallic grout. Cover anchorage joint with a round steel flange welded to post after placement of anchoring material.
   2. Anchor posts to steel members with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
   3. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements. Mount handrails only on gypsum board assemblies reinforced to receive anchors. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Locate posts at spacing indicated, or if not indicated, at equal intervals as required by design loadings.
   4. Secure handrails to wall with wall brackets and end fittings. Provide brackets of design shown, with flanges tapped for concealed anchorage and with not less than 1-1/2 in. clearance from inside face of handrail and finished wall surface. Located brackets as indicated, or if not indicated, at equal spacings as required by design loads.

H. Loose Plates: Prior to setting loose bearing and setting plates, clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates. Set on wedges or other adjustable devices. After members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the plate before packing with grout. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

I. Immediately after erection, clean field welds, bolted connections, marred and
abraded surfaces. Paint and touch-up paint with the specified paint system. Touch up galvanized surfaces in accordance with ASTM A780.

*** END OF SECTION ***
SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. Work Included: Rough carpentry, light hardware, and miscellaneous items of work not included in another Section. This Section also includes:

1. Heavy Timber Structural truss and roof framing.

2. Structural wood supports, grounds, backing, and blocking required for millwork items and which are an integral part of wall, floor and/or ceiling construction.

3. Wood cants, stops, and nailers for roof as may be required.

4. Wood blocking, backing, and nailers for flashings and sheet metal work.

B. Related Work Specified Elsewhere:

1. Exterior Architectural Woodwork Section 06 40 00.

2. Concrete Formwork Section 03 10 00.

3. Sheet Metal Roofing Section 07 61 00

1.3 DEFINITIONS

C. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.
1.4 REFERENCES, CODES AND STANDARDS

The following references, codes and standards are hereby made a part of this Section and carpentry work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.


E. American Wood Protection Assn. (AWPA) UCS Standard “Processing and Treatment Standard T1-07”.

F. American Wood Preservers Bureau (AWPB) Quality Control Standards.


1.5 QUALITY ASSURANCE:

Lumber and plywood shall be grade or quality marked by WWPA, WCLIB, APA, AWPA, or by other grading and inspection agencies acceptable to the Engineer. Grade marks shall include the designation “S-DRY” (or “MC-15” as applies) where applicable. Grade and quality marks shall not be apparent on surfaces exposed in the finish work.

1.6 PRODUCT STORAGE

Store kiln dried materials, in enclosed areas, protected from moisture and separated from contact with concrete or soil.
1.7 SUBMITTALS

A. Provide documentation certifying that wood products were obtained from forests verified by an FSC accredited certification body. Include statement indicating costs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary Construction: Clean lumber at Contractor’s option, rough or smooth as usage requires, strength as required for purpose.

B. Truss and Purlin Framing Lumber: Redwood Grade No. 1.

C. Truss and Roof Rafter Framing

2. Grade: WWPA No. 1 or better, Heavy Timber, S4S, free of any knots or sap wood.
3. Lumber Size: As indicated.
4. Lumber Species: Douglas Fir, No. 1 Grade and Better, smooth finish, fire-retardant treated.
5. Finish: Field-applied semi-transparent stain finish as specified in Section 06 40 00.

D. All Exterior Exposed lumber: Western Red Cedar No. 2 or Better Clear, S4S, no knots or Sap. Fire-retardant treated. Stain finish as specified in Section 06 40 00.

E. Framing Lumber Not Otherwise Specified or Noted: Douglas Fir or Larch graded and grademarked according to Reference Standard 1.02 A or B. Maximum bow, crook, and cup shall be as established by WWPA Para. 752.00 for “Light” or better.

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<th>Reference (WCLIB)</th>
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<td>123 (c) and 130 (b)</td>
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<td>Joists and Rafters</td>
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<tr>
<td>Other members</td>
<td>No. 2</td>
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2. Sill Plates (on Concrete or Concrete Masonry): Construction Grade Light Framing, pressure treated as hereinafter specified.

F. Plywood: Each panel shall be identified with the appropriate grade-trademark of the American Plywood Association (APA) and shall meet the requirements of Reference Standard 1.02C.

1. Miscellaneous Not Otherwise Specified (Concealed): CD or better and free of defects, which would adversely affect finish materials.

2. Miscellaneous (Exposed): “A” face or better.

3. Exterior plywood, interior plywood exposed to continuing moisture, and pressure treated plywood shall be fabricated with exterior glue. Plywood with interior glue shall be fully protected from soaking or continuing moisture at all times and shall not be used for any structural purposes.

4. Roof and Wall Sheathing not noted as “Structural I”: APA Rated Sheathing CD, Exposure 1 with proper span rating. Wall sheathing under cement plaster shall have a 24/0 or Wall-24 span rating for framing at 16” O.C. and a minimum 24/0, 7/16” or thicker for framing 24” O.C.

5. Roof and Wall Sheathing noted as “Structural I”: Structural I-CD, all veneers Group 1 species.

G. Rough Hardware: All hardware to be hot-dipped galvanized or stainless steel.

1. Bolts and Nuts: ASTM A 307 (a) and A 563 (a), Grade A.


4. Powder Actuated Fasteners: Hilti, Simpson Strong Tie, or approved equivalent, unless otherwise noted, galvanized.

5. Joist Hangers and Framing Connectors: Simpson, USP Connectors, or approved equivalent, unless otherwise noted, galvanized.

6. Heavy Timber Connection Washers: Malleable Cast Iron Hot-Dip Galvanized Washers, Portland Bolt or approved equal.
Mount Umunhum Summit Project
Bid Set / 10 May 2016


8. Expansion Bolts: Simpson Strong Tie, Hilti, or approved equivalent. See also Section 03255 – Expansion Anchors


10. Self Drilling Screws: Simpson Strong Tie SDS galvanized wood screws, or approved equivalent.

H. Pressure Treatment (Decay and Termite Prevention):

1. Pressure treat for decay and termite prevention, wood materials, which are embedded in or set against concrete, masonry, plaster, or roofing, or where otherwise exposed to continuing dampness or moisture required by California Building Code. Where materials are also required to be treated for fire retardance, fire retardant shall be in lieu of decay and termite treatment.

2. Treat in accord with Reference Standard 1.02 D and E quality marked as per Reference Standard 1.02 F.

3. Treat with either of the following processes at Contractor option except do not use waterborne salts where wood is in contact with built-up roofing and other bituminous products. Creosote type preservatives are not permitted.
   a. Alkaline Copper Quaternary (ACQ) 0.6 retention or ACZA.
   b. Members treated with waterborne salts shall be dried to a moisture content not exceeding 19% after treatment.


5. Holes and cut-offs and handling and storage shall be in accord with AWPA M-4.

6. Ensure that ferrous metal fastenings and items in contact with wood treated with waterborne salts are hot dip galvanized (1.25 oz. coating).

2.2 MOISTURE CONTENT:

At time of closing in: 15% maximum for 2x thickness or less; 19% maximum for thickness greater than 2x, and 22% maximum thickness greater than 4x.
2.3 SIZES:

Surfaced to “Dry” sizes. Sizes noted are nominal unless shown as net.

2.4 SURFACING:

S4S unless noted or specified elsewhere.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION:

A. Bridging and Blocking: Conform to CBC Sections 2306.7, 2326.8.6, 2326.11 and 2326.12. Provide 2x blocking at intersections of finished surfaces for adequate bearing and at points where required for internal support of fixtures, cabinets, hardware, and other equipment suspended from ceiling or mounted on walls. Provide fire stops as per CBC Sec. 708. Provide vent holes in blocking at concealed areas per the Drawings as required.

B. Connections and Fastenings: Conform to Sec. 2311, California Building Code, unless otherwise specified or shown on the Drawings, conform to minimum nailing requirements of Table 23-I-Q. For bolted connections, provide washers under heads and nuts bearing on wood, and draw nuts tight. Retighten before closing in framing.

C. Coordinate with Roofing Section and provide treated cants, stops, blocking and nailers for rigid insulation, roof drains and flashings in accord with roofing manufacturer’s requirements. Fit cant strips flush at ends and to wall surfaces corner mitered.

D. Wood cants, blocking, backing, and nailers for perimeter sheet metal flashings shall be anchored in accord with recommendations contained in Reference Standard 1.02 G.

E. Framing: Conform to CBC Sec. 2326 where same covers points not indicated in the Drawings. Properly lay out framing with pieces closely fitted, accurately plumbed, leveled and aligned, and rigidly secured in place. Select corner studs and trimmers free of crook or wind; plates free from perceptible variations from straight line. Locate studding for proper installation of finish, trim, cabinets, fixtures, piping, and
other work. Set joists and beams with crown up. Vent roof framing as required to provide circulation of outside air in encased spaces above ceiling or soffit. Set headers on edge, doubled and supported at each end by cripples unless otherwise shown. Frame walls with piping and conduits to provide clearances for same. Fur walls or reinforcing plates and sills with metal as required for rigidity and bearing of finishes.

F. Except as specifically shown on Structural Drawings, cutting of all wood joists, beams, wall framing, etc., is limited to those cuts permitted by CBC Secs. 2306.2.2, 2326.11.9, and 2326.12.4.

G. Plywood (General): Unless more stringent requirements are indicated on the Drawings or required by Code, application and nailing of plywood shall be in accord with recommendations of the American Plywood Association. Use full 4’ x 8” sheets wherever possible to minimize joints, with minimum sheet size at any vent in either direction to be 24”.

i. Roof Sheathing: Unless otherwise indicated, install with long dimension of panel across supports with panel continuous over two or more spans. Stagger end joints and locate over framing. Allow 1/8” spacing at panel ends and ¼” at panel edges unless otherwise recommended by panel manufacturer.

ii. Wall Sheathing: Allow 1/8” spacing at panel ends and ¼” at panel edges unless otherwise recommended by panel manufacturer. Where used under cement plaster, install with long dimension or strength axis across studs with panel continuous over two or more stud spaces. Install blocking or plywood cleats at all horizontal joints.

H. Flashing (Paper): Install flashing strips of duplex building paper (9” minimum width) at periphery of cased openings in exterior walls. Weather lap, fold and turn in under sills.

I. Plywood Soffits and Paneling: Allow 1/8” spacing at panel ends and edges unless otherwise recommended by panel manufacturer. Nail with hot dip galvanized siding nails. Use 6d for ½” and less material and 8d for greater thickness. Where plywood is applied over backing, make nail length sufficient for penetration of ½” length in bearing. Space nails 6” o/c. at panel edges and 12” o/c. at intermediate bearings. Align in both directions. Locate joints only when indicated on Drawings. Transverse joints will not be permitted unless specifically shown. Install soffit vents to fit neatly, plywood edges fully concealed, and joints of vent units butted.

J. Any wood located nearer than 6 inches to the earth shall be treated wood or wood of
natural resistance to decay. CBC Section 2317.4.

K. Positive connection shall be provided between post and beam or girder construction per CBC Section 2324 and 2326.7.

L. All materials shall be approved grade and identified by a grade mark. CBC Section 2305.

M. Minimum nailing of structural members shall be in accordance with CBC Table 23-1-Q CBC Section 2305.

N. The size, height, and spacing of studs shall be in accordance with Table 25-1-R-E. CBC Section 2326.11.2.

O. Rafters shall be framed directly opposite each other at the ridge. CBC Section 2326.12.3.

*** END OF SECTION ***
SECTION 064010 - EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.1 DESCRIPTION

A. This Section describes the requirements for furnishing and installing exterior architectural woodwork items including the following:

1. Exterior column facing.
2. Exterior roof / ceiling decking.
3. Eave soffit trim.

B. Related Sections:

1. Metal fabrications are specified in Section 05 50 00.
2. Furring, blocking, shims, nailers, and other carpentry not exposed to view is specified in Section 06 10 00.

1.2 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.3 SUBMITTALS

A. Product data for each type of product and process specified in this Section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

B. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, fasteners, plates, attachment devices, and other components
including:

1. Apply "WI Certified Compliance Label" to first page of shop drawings.

C. Samples for verification purposes of the following:

   1. Lumber for transparent finish in form of exterior wood stain, 50-square inches, for each species, with one half of exposed surface finished with coating specified in Section 06 40 10, Paragraph 2.9.
   2. Lumber and panel products for factory-applied opaque finish, 8-1/2 inches by 11-inches for panels and 50-square inches for lumber, for each finish system and color, with one half of exposed surface finished with coating specified in Section 06 40 10, Paragraph 2.9.

D. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

F. Submittals:

   1. Provide chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Single-Source Responsibility for Fabrication and Installation: Engage a qualified manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication and installation.

C. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

D. WI Quality Standard: Comply with applicable requirements of "Manual of Millwork" published by Woodwork Institute (WI) unless otherwise indicated. Issue WI
Certificates of Compliance certifying that items comply with Wire requirements for WI grade specified.

E. Exterior wood shall comply with the requirements of California Building Code (CBC) Section 701A.3.2 and the requirements of the Wildland-Urban Interface Fire Area designated by the enforcing agency.

1.5 ENVIRONMENTAL QUALITY ASSURANCE

A. Wood Products: Shall originate in forests that are certified well-managed by an agency accredited by the Forest Stewardship Council (FSC), 202.342.0413.

1. FSC-accredited certifying agencies include the following:
   a. Smart Wood Program administered by the Rainforest Alliance, 802.434.5491.
   c. For a complete list of internationally accredited agencies, visit www.fscoax.org.

2. Well-managed shall mean forests that are being managed through professionally administered forestry management and logging plans that ensure regeneration of desired species so that timber growth equals or exceeds harvesting rates in both quantity and quality over the long term. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, operating in concert with the lawful interests of local populations, and maximizing both the yield and value of the forest products.

B. Documentation confirming the FSC-certified status of all wood products shall be submitted for approval prior to fabrication. Products not complying with this requirement will be rejected. Acceptable documentation includes the following:

1. A copy of the wood supplier’s Chain of Custody certificate issued by an FSC-accredited certifying agency and a copy of the supplier’s invoice detailing the quantities of certified wood products supplied for this Project, with the FSC-certified status of each product listed in the individual line-items, or

2. A copy of a letter from a FCS-accredited certifying agency corroborating that the products detailed on the wood supplier’s invoice originate from certified well-managed forests.

C. Submission of a Chain of Custody certificate without an invoice or submission of an invoice without a Chain of Custody certificate shall not constitute acceptable
D. Proper procedures shall be followed to ensure that certified wood products are kept separate from non-certified materials and that auditing procedures as mandated by the certifier are complied with.

E. Furnish MSDS Sheets for adhesives showing that the VOC content does not exceed specified limits.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Obtain and comply with woodwork manufacturer’s and installer’s coordinated advice for optimum temperature and humidity conditions for woodwork during its storage.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions will permit work to be performed and at least one coat of finish applied without exposure to rain or dampness.

C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related items to ensure that exterior woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

EXTERIOR ARCHITECTURAL WOODWORK
A. General: Provide materials that comply with requirements of the WI woodworking standard for each type of woodwork and WI quality grade indicated.

2.2 INSTALLATION MATERIALS

A. Blocking, Shims and Nailers: Softwood or hardwood lumber, kiln dried to less than 15-percent moisture content.

B. Screws: Material, type, size, and finish required, nonferrous metal or hot-dip galvanized.

C. Nails: Material, type, size, and finish required for each use, hot-dip galvanized or stainless steel.

D. Anchors: material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts.

E. Adhesives: Low VOC emitting adhesive. FS MMM-A-125C, Type II, water and mold resistant. For laminated and finger-jointed members, use ASTM D3110, dry use type. Adhesives shall be certified in accordance with ASTM C557 and shall comply with local VOC regulations.

2.3 FABRICATION GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of solid wood (lumber) members less than 1-inch in nominal thickness: 1/16-inch.

2. Edges of rails and similar members 1-inch or more in nominal thickness: 1/8-inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of
2.4 CEILING DECKING FOR STAIN FINISH

A. Quality Standard: Comply with WI “Architectural Woodwork Standards” Sections 3 and Section 6.

B. Grade: Select Tight Knot and Better Clear, free of any knots or sapwood, S4S, 15% Max. moisture content.

C. Type: T&G, V-Groove,

D. Thickness: 2x material.

E. Width: as shown on plans.

F. Back prime all members.

G. Lumber Species: Western Red Cedar, fire-retardant treated.

H. Finish: Field-applied semi-transparent stain as specified in Section 06 40 10, Paragraph 2.9.

2.5 EAVE SOFFIT FASCIA AND TRIM FOR STAIN FINISH

A. Quality Standard: Comply with WI “Architectural Woodwork Standards” Sections 3 and Section 6.

B. Grade: Select Tight Knot and Better Clear, free of any knots or sapwood, S4S, 15% Max. moisture content.

C. Back out or groove backs of flat trim members, kerf backs of other wide flat members, except for members with ends exposed in finished work.

D. Back prime all trim members.

E. Lumber Species: Western Red Cedar, fire-retardant treated.

F. Length: 20-feet, join with scarf joint.

F. Finish: Field-applied semi-transparent stain as specified in Section 06 40 10, Paragraph 2.9.
2.6 COLUMN FACING FOR STAIN FINISH

A. Quality Standard: Comply with WI “Architectural Woodwork Standards” Sections 3 and Section 6.

B. Grade: No. 2 and Better Clear, free of any knots or sapwood, S4S, 19% Max. moisture content.

C. Back prime all members.

E. Lumber Species: Western Red Cedar, fire-retardant treated.

F. Fasteners: Galvanized malleable iron washers, do not countersink.

G. Finish: Field-applied semi-transparent stain as specified in Section 06 40 10, Paragraph 2.9.

2.7 DENS DECK FIRE RESISTANCE SHEATHING

A. Approved Manufacturer: Georgia-Pacific Gypsum or approved equal.

B. Fire Resistance Panels: Non-asbestos UL Type DD gypsum panels shall be non-combustible when tested in accordance with ASTM E136.

   1. Type: UL 240 PSF 5/8” DensDeck Prime (20 fasteners per 4’ x 8’ board)

2.8 SHOP PRIMING

A. Woodwork for Transparent Finish: Shop seal woodwork for transparent finish with stain, if required, and first coat of finish as specified in Section 06 40 10, Paragraph 2.9.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations.

C. Back priming: Apply one coat of exterior sealer or exterior primer compatible with finish coats to concealed surfaces of woodwork, including back. Apply two coats to items installed over concrete or masonry.

2.9 STAIN FINISH

A. Exterior Wood Semi-Transparent Penetrating Oil Stain Finish

   1. TWP 1500 (Color 116 Rustic) or Penofin Verde (Color Cedar), Apply per
manufacturer’s recommendations.

2. Wood surface must be cleaned, and dry for a minimum of 48 hours before stain can be applied. Temperature must at least 50 degrees and dry weather must be forecasted for the next several days. Apply the stain using a brush, roller, or sprayer. If the wood seems very thirsty, apply two “wet on wet” coats. For a penetrating stain never apply more stain than the wood can absorb. Once the stain has had 10 minutes or so to penetrate into the wood, wipe away or back brush any puddles, drips, or runs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with WI “Manual of Millwork” for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0” for plumb and level and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work.

D. Install exterior woodwork with cupping to the interior side.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

F. Soffit Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members, cope at returns and miter at corners.
G. Dens Deck Sheathing Panels: Install in accordance with manufacturer’s instructions. Touch-up all field cut edges before installing. Pre-drill nail holes if required to prevent breakage. Allow space between both ends of sheathing panels that butt against trim for thermal movement; seal joint between panel and trim with exterior grade sealant.

H. Refer to Paragraph 2.9 for final finishing of installed architectural woodwork.

3.03 ADJUSTMENT AND CLEANING

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

B. Clean woodwork on exposed and semi-exposed surfaces.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that woodwork is without damage or deterioration at time of Substantial Completion.

3.05 WASTE MANAGEMENT

A. Separate the following categories for salvage or re-use on the site:

1. Sheet materials larger than 2-sq. ft.
2. Solid wood trim longer than 16-inches and multiple offcuts of any size larger than 12-inches.

B. Separate the following for recycling. Material shall be placed in source-separated or comingled recycling bins.

1. Composite wood.
2. Clean dimensional lumber.

C. Separate the following categories for disposal and place in designated areas for hazardous materials:

1. Treated, stained, painted, or contaminated wood.

*** END OF SECTION ***
SECTION 07 13 90 - ROOFING UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing roofing underlayment under metal roofing.

B. Related Sections:

1. Rough carpentry is specified in Section 06 10 00.

2. Metal roof panels are specified in Section 07 41 20.

1.3 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 SUBMITTALS

A. Product Data: Include manufacturer’s product data and installation instructions and details.

1.5 JOB CONDITIONS

A. Apply underlayment in fair weather at temperatures of 40-deg. F. and above.

B. Provide adequate ventilation of enclosed spaces where primer is used.

C. Apply roof covering material promptly at temperatures of 40-deg. F. and above.
1.6  Warranty

A. Warrant that roofing underlayment to be free from defects in materials and workmanship, including water penetration, for a period of 15-years from date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1  APPROVED MANUFACTURERS

A. Grace Construction Products "Grace Ultra" or approved equal.
2.2 MATERIALS

A. Membrane: Composite of self-adhesive butyl rubber integrally bonded to polyethylene sheeting, conforming to the following physical properties:

1. Thickness: 30-mils minimum.
2. Tensile Strength: 250-psi minimum when tested in accordance with ASTM D412.
3. Elongation: 250-percent minimum when tested in accordance with ASTM D412 (Die C) modified.
5. Adhesion to Plywood: 3-lbs./in. width when tested in accordance with ASTM D903.
6. Membrane shall be compatible with rigid roof insulation.

B. Slip Sheet: Rosin paper or as recommended by metal roof panel manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove dust, dirt, loose fasteners and other protrusions.

3.2 INSTALLATION

A. Cut the membrane into 10- to 15-foot lengths and re-roll loosely.

B. Peel back 1- to 2-feet of release paper, align on the lower edge of the roof and place the first 1- to 2-feet. Pull the release paper under the membrane and continue to peel it from the membrane.

C. Press and roll the membrane in place to assure full adherence to the deck.

D. Lap ends at least 6-inches and sides at least 3-1/2-inches. Install so that all laps shed water working from the low point to the high point of the roof.

E. Apply membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application up the roof. Membrane may be applied either vertically or horizontally.

F. For valley and ridge applications, peel the release liner, center the sheet over
the valley or ridge, drape, and press in place. Work from the center of the valley or ridge outward in each direction and start at the low point and work up the roof.

G. Cover installed membrane with slip sheet material.

*** END OF SECTION ***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing preformed standing seam roofing and other associated components, trim, and flashing and sheet metal indicated and required to make the building watertight.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry.

2. Section 07 13 90: Roofing Underlayment.

1.3 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 REFERENCES

A. American Iron & Steel Institute (AISI) Specification for the Design of Cold formed Steel Structural Members.

B. ASTM A-653-09 Steel Sheet, Zinc-Coated (Galvanized)

C. ASTM 792-86 AZ-50 Aluminum Zinc Alloy Coated Steel (Galvalume Sheet Metal)

D. ASTM E-1680

E. ASTM E-1646
1.5 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide architectural standing seam metal roof system with minimum 2 inch high vertical seam side joint.

2. Attach roof panels to support substrate with concealed anchor clips designed to allow for thermal movement of the panels. There shall be no exposed fasteners except at panel fixing line and flashing details unless otherwise indicated on approved shop drawings.

3. Provide metal roof panel system manufactured and installed to withstand design loads and maintains performance requirements without defects, damage or failure.

4. Metal roof panel system shall be suitable for the roof slope and underlayment.

B. Assembly Description

1. The roofing assembly includes preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.

C. Roof panel system shall be tested in accordance with UL Standard 580 and have a Class 90 rating.
A. Design Load: In accordance with Structural Plans General Structural Notes Sheet S0-0.0 Design Loads and California Building Code.

B. Wind Uplift: Install metal roofing for UL580 Class 90 wind uplift – with a static uplift pressure of 140 psf.

C. Air and Water-Infiltration Requirements: Install the metal roofing work so that no air or water infiltrates through the panels, in accordance with ASTM E 1680 and E 1646.

D. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.


E. Thermal Movements: Install the metal roofing work capable of withstanding thermal expansion and contraction movements for ambient temperature from 20-120 degrees F without failure of any kind.

F. Energy Star Rating: High-emissivity roof coating meeting the following:

1. Initial Reflectance: Minimum 0.25 when tested in accordance with ASTM E903.

2. Three-year Aged Reflectance: Minimum 0.18 when tested in accordance with ASTM E903.

3. Emissivity: Minimum 0.9 when tested in accordance with ASTM E408.


1.6 SUBMITTALS

A. Product Data: Manufacturer's product specifications, standard details, installation instructions, general recommendations, and certified product test results indicating compliance with minimum requirements of the following performance tests:

1. Air Infiltration - ASTM E 1680
2. Water Infiltration - ASTM E 1646

3. Wind Uplift - UL 90

B. Samples: Furnish sample panel 36-inches long by actual panel width, in profile, style, factory finish, and texture indicated and selected. Include clips, battens, fasteners, closures, and other panel accessories.

C. Shop Drawings: Show layouts of panels, details of edge conditions, joints, corners, panel profiles, supports, anchors, trim, flashings, closures, penetrations, and special details. Distinguish between factory and field assembly work.

D. Submit calculations with registered engineer seal, verifying roof panel and attachment method resist wind pressures imposed on it pursuant to Design Loads and applicable building codes.

1.8 QUALITY ASSURANCE

A. Thermal Movements: Fabricate and install metal roofing capable of withstanding thermal expansion and contraction movements for an ambient temperature change of 120-deg. F. resulting in a surface temperature variation of 180-deg. F. without failure, including air and water leakage when tested in accordance with ASTM E283 and E331, and without noise from metal-to-metal contact in movement.

B. Installer’s Qualifications: Authorized or certified by the panel manufacturer with a minimum of 10-years experience installing accepted roof panels on Projects of similar scope.

C. No product substitutions shall be permitted without meeting specifications.

D. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against transportation damage.

B. Exercise care in unloading, storing, and erecting panels to prevent bending,
warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage. Do not store trim material with strippable film exposed to direct sunlight.

1.10 WARRANTY

A. Roofing Installer shall furnish guarantee covering watertightness of the roofing system for the period of two (2) years from the date of substantial completion.

B. Galvalume material shall have a twenty-year warranty against failure due to corrosion, rupture or perforation.

C. Furnish warranty covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading, (not to exceed 5 N.B.S. units), for 20-years following date of Substantial Completion.

D. This warranty shall be in addition to and not a limitation of other rights MSROD may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Berridge Zee-Lock Double-Lock or AEP Span Span-Lok hp (High Wind).

B. Substitutions shall fully comply with specified requirements

2.2 STANDING SEAM METAL PANELS

A. Material: Prefinished metal panel shall be 24-Gauge Steel Sheet, conforming to ASTM 792-08, Grade 40, yield strength 40 ksi min.

B. Wind Uplift: Fabricate panel with sufficient thickness to meet or exceed UL580 Class 90 wind uplift requirements.

C. Factory-fabricate panels with integral continuous double overlapping seams suitable for continuous locking or crimping by mechanical means during installation.

D. Seam Size: 2-inch.
E. Provide factory-installed, high grade, hot-melt elastomeric sealant on bottom edge of female leg, designed to seal against male panel leg.

F. Panels shall be flat in the pan with no stiffening ribs.

G. Finish shall be full strength Kynar 500® or Hylar 5000™ fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil. Bottom side shall be coated with a primer (non-metallics only) and beige urethane coating with a total dry film thickness of 0.35 ± 0.05 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500® or Hylar 5000™ finish supplier.

H. Strippable film shall be applied to the top side of all prefinished metal to protect the finish during fabrication, shipping and field handling. This strippable film MUST be removed immediately before installation.

I. Unpainted metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Acrylic Coated Galvalume®) Steel Sheet, 24-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min., with clear acrylic coating on both sides of material.

J. Field protection must be provided by the contractor at the job site so stacked or coiled material is not exposed to weather and moisture.

K. Flashing maybe factory fabricated or field fabricated. Unless otherwise specified all exposed adjacent flashing shall be of the same material and finish as panel system.

L. Clip/Fastener Assemblies:


2. Fasteners: Pancake head Phillips drive screws; non-corrosive base material, size and type as recommended by metal roof panel manufacturer for securing clips to roof substrate.

3. Fasteners: Galvanized Steel with washers at exposed fasteners where approved by Architect.

4. Sealant: Sealant shall be an ultra low modulus, high performance, one-part, moisture-curing silicone joint sealant. [Tremco Spectrum One] or [Dow 790] or [Pecora 890NST] or [Duralink] or [Titebond]
Metal Roof Sealant] (Do not use a clear sealant or sealants which release a solvent or acid during curing).

5 Sealant must be resistant to environmental conditions such as wind loading, wind driven rain, snow, sleet, acid rain, ozone, ultraviolet light and extreme temperature variations.

6 Features must include joint movement capabilities of +100% & -50% ASTM C-719, capable of taking expansion, compression, transverse and longitudinal movement, service temperature range -65°F to 300°F (-54°C to 149°C), Flow, sag or slump: ASTM C-639; Nil, Hardness (Shore A): ASTM C-661; 15, Tensile strength at maximum elongation: ASTM D-412; 200 psi, Tensile strength at 100% elongation: ASTM D-412; 35 psi, Tear strength, (die “C”); ASTM D-624; 40 pli, Peel strength (Aluminum, Glass, Concrete): ASTM C-794; 30 pli

7 Vinyl Weatherseal Insert.

M Accessories: Provide manufacturer’s standard accessories and other items required to complete the installation. Include nylon seam end plugs, factory-fabricated rib covers at slope transitions, transition rib covers where roofing changes directions, and miscellaneous pre-finished sheet metal.

N. Field Sealant: Color-coordinated primerless silicone or high-grade, non-drying butyl as recommended by panel manufacturer. Do not use sealant containing asphalt.

O. Engineer panels to use concealed anchors that permit expansion and contraction. Exposed fasteners in roofing panels will not be permitted.

2.3 FABRICATION

A. Fabricate panels in longest practical lengths, true to shape, accurate in size, square, and free from defects.

B. Fabricate cleats of same material as panels, interlockable with roofing panel sheets.

C. Fabricate flashings and trim from same materials and finish as the roof panels.

D. Hem all exposed edges of flashing on underside, ½ inch.
2.4 FINISH

A. Finish: Full strength 70-percent “Kynar 500” coating baked on for 15-minutes at 450-deg. F. to dry film thickness of 1.0-mil over 0.3-mil baked on epoxy primer. Custom color to match Berridge “Zinc-Cote or Zinc Grey”. Provide number of coats required for specified warranty.

1. Finish shall have been field tested under normal range of weathering conditions for minimum of 20-years without significant peel, blister, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D659; and without fading in excess of 5 NBS units.

PART 3 - EXECUTION

3.1 INSPECTION

A. Substrate

1. Examine plywood or metal deck to ensure proper attachment to framing.

2. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to ¼” in 20’ and properly sloped to eaves.

3. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

4. Verify deck is dry and free of snow or ice. Joints in wood deck to be solidly supported and nailed.

B. Underlayment:

1. Provide one layer of waterproof underlayment as specified in Section 07139. Verify #30 unperforated asphalt saturated roofing felt underlayment has been installed over solid plywood sheathing and fastened in place.

2. One (1) layer of #30 asphalt roofing felt paper for roof slopes of 3:12 and up, two (2) layers for roof slopes of 1:12 - 3:12 in moderate climates.
3. Underlayement materials approved by Berridge for a watertightness warranty include - Grace Ultra (30 mil), Tamko TW Underlayement (40 mil), Tamko TW Metal & Tile (75 mil), Carlisle WIP 300 HT (40 mil), Soprema Lastobond Shield HT (40 mil), Polyglass Polystick MTS (60 mil)

4. Ensure felt installed horizontally, starting at eave to ridge with a 6” minimum overlap and 18” endlaps.

5. Ensure that all nail heads and felt caps are totally flush with the substrate. Fasteners shall be galvanized roofing nails or zinc-coated fasteners with Berridge Coated Felt Caps.

3.2 INSTALLATION

A. Roofing Underlayement: Provide one layer of waterproof underlayement as specified in previous section.

B. General: Comply with manufacturer’s instructions and recommendations. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

1. Field cutting of panels by torch is not permitted.

2. Install panels with concealed fasteners.

C. Accessories: Install components required for a complete roof system, including trim, fascias, gravel stops, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers recommended by panel manufacturer.

1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.

F. Install panels to be weather-tight, without waves, warps, buckles, fastening stress or distortion.
G. Do not walk on panels until panels are fastened to substrate and battens are snapped onto panels.

H. Workmanship shall conform to standards specified in SMACNA "Architectural Sheet Metal Manual".

I. Install panels weathertight without waves, warps, buckles or distortions and allow for expansion and contraction. Attachment and joints shall allow for expansion and contraction from temperature changes without distortion or elongation of fastener holes.

J. Install panels plumb, level and straight with seams and ribs parallel, conforming to design as indicated.

K. Do not allow panels or trim to come into contact with dissimilar materials.

L. Hem edges on flashings and trim.

3.2 CLEANING AND PROTECTION

A. Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces of any grease, finger marks or stains as recommended by panel manufacturer, and maintain in a clean condition during construction.

C. Remove all scrap and construction debris from the site.

*** END OF SECTION ***
SECTION 09 96 50 - GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General Conditions and Special Provisions, and other Technical Specification Sections apply to this Section.

1.2 DESCRIPTION
A. Section Includes: Graffiti-resistant coatings on exterior wall surfaces up to a height of approximately 8-feet above grade. Scope includes Summit Shelter, Trailhead Shelter, and Toilet Screen CMU Wall.
B. Related Sections:
   1. Cast-in-Place Concrete is specified in Section 03 30 00.
   2. Stone Veneer is specified in Section 04 45 00.

1.3 DEFINITIONS
A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.4 SUBMITTALS
A. Product Data: Manufacturer's product literature for each coating system indicated. Include block fillers and primers.
B. Samples: Minimum two 8-inch square samples of each color of coating for verification purposes after initial color selection has been made.
C. Certification: Duplicate copies of manufacturer's affidavit with each shipment of materials delivered to the Project site certifying that materials furnished comply with specified requirements.
D. Sample Panel: Apply specified graffiti-resistant coatings on approximately 10 square feet of wall area where directed by the Architect. Obtain Architect's approval before proceeding with coating application. Approved sample shall be used as a standard for the Project.
E. Maintenance Materials and Instructions:

1. Furnish one identified unopened 5-gallon container of each coating used, and one 5-gallon container of cleaning agent to be used for graffiti removal.

2. Coating and cleaning agent shall not be used for re-coating or touching-up damaged surfaces before final acceptance of the work.
3. Furnish Owner with manufacturer’s instructions for graffiti removal and maintenance.

1.5 QUALITY ASSURANCE

A. Applicator shall be certified by the coating manufacturer for application of graffiti-resistant coatings of the type required for this Project, with a record of successful in-service performance.

B. Source Limitations: Obtain base coatings, top coatings and removal agent from the same manufacturer.

1.6 PERFORMANCE REQUIREMENTS

A. Provide graffiti-resistant coating system complying with the following:

1. Permanent coating system. Coating shall not require re-application regardless of number of graffiti taggings during the life of the 10-year performance warranty period.

2. Show no signs of deterioration or change of appearance after graffiti removal during the warranty period. No ghosting, staining or shadowing.

3. Capability of removing 100-percent of all types of paint and graffiti materials from treated surfaces without damaging the coating or the substrate.

4. Upon graffiti removal, no evidence of graffiti shall remain.

5. Capable of withstanding a minimum of 120 cleaning cycles over the same area without measurable coating deterioration.

6. Shall not increase dirt pick-up of substrate.

7. Meet the following test results for the following chemicals:
   a. MEK No effect after 5-days.
   b. Carboxylic Acid No effect after 5-days.
   c. 75% Phosphoric Acid No effect after 5-days.
   d. 37% HCL 3 hours blister.
   e. 50% Sulfuric Acid No effect after 5-days.
   f. 20% NIT 68 hours blister.
1.6 JOB CONDITIONS

A. Environmental Requirements: Comply with coating manufacturer’s recommendations for environmental conditions regarding coating application. Do not apply coating in areas where dust is being generated.

B. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating application.

C. Provide drop cloths, shields, barricades and other protection necessary to safeguard adjacent surfaces not to be painted. Post signs immediately after coating application.

D. Provide and maintain protection as required to protect finished work from damage until final acceptance.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in manufacturer’s original, unopened packages and containers bearing manufacturer’s name and label with the following information:

1. Name or title of material.

2. Product description (generic classification or binder type).

3. Manufacturer’s stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.

5. Thinning instructions.

6. Application instructions.

7. Color name and number.

8. Handling instructions and precautions.

B. Store materials in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45-deg. F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.
1.8 WARRANTY

A. Warrant graffiti-resistant coatings to be free from defects in materials and workmanship for a period of 10-years from date of Substantial Completion. Graffiti-resistant coatings shall continue to repel graffiti after repeated cleaning during the 10-year warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1.9 EXTRA MATERIALS

A. Furnish extra graffiti removal materials in quantity equal to twelve 16-ounce bottles. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

B. Deliver materials and an inventory list just prior to Substantial Completion and store where directed by the Owner.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. American Polymer Corporation “Graffiti Solution System” (GSS) or approved equal.

2.2 GRAFFITI-RESISTANT COATINGS

A. Provide materials that comply with local Air Quality Management District’s VOC classification.

B. Coatings shall meet the following requirements:

1. ASTM B117 and ASTM D714 (salt spray minimum acceptable of 8000 hours).

2. ASTM D530 (hardness).

3. ASTM D412 (tensile strength and elongation).


5. ASTM D968 (abrasion test).
6. ASTM E96 (vapor transmission).

7. Water clear, non-yellowing, free of waxes and urethanes.

8. Non-toxic, non-flammable, biodegradable, with a PH 7 to 8.5.

9. Shall allow moisture vapor transmission.

C. Undercoating: GSS-10 Undercoating, Clear VU High Solids Base Coating (AP307); a water-based high-performance under coating used as a sealer. For metal, marble, slate and tile surfaces use Sure Bond (AP308).

D. Topcoating: GSS-10; permanent anti-graffiti top coating.

1. Clear Finish: AP100 Clear Matte or AP101 Clear Semi-Gloss or AP102 Clear Gloss as selected by the Architect.

E. Graffiti Remover: GSS Erasol; non-flammable, biodegradable, with a pH 7-8.5 and recyclable, allowing graffiti removal without the use of blasting equipment, hot water, or high-pressure wash equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which graffiti-resistant coatings will be applied.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.

2. Start of application is construed as applicator’s acceptance of surfaces within that particular area.

B. Review other Sections where primers or coatings are provided to ensure compatibility of total systems for various substrates.

1. If potentially incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:

   a. Confirmation of primer’s suitability for expected service conditions.

   b. Confirmation of primer’s ability to be top coated with specified materials.
c. Notify the Architect of anticipated problems before proceeding with application.

3.2 PREPARATION

A. Remove plates, machined surfaces, and similar items in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the work involved.

B. Cleaning: Before applying coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coating according to manufacturer’s written instructions for each substrate condition.

1. Provide barrier coats over incompatible primers or remove primers and re-prime substrate.

2. Cementitious Substrates: Prepare concrete masonry, cement plaster and concrete surfaces. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces. Do not coat surfaces if moisture content exceeds manufacturer’s maximum.

3. Metal Substrates: Clean ferrous metal surfaces that have been shop coated. Remove oil, grease, dirt, and other foreign substances.

D. Material Preparation: Mix and prepare coating materials in accordance with manufacturer’s instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application.

3.3 APPLICATION

A. Apply coatings according to manufacturer’s written instructions.
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1. Use applicators and techniques best suited for the material being applied.
   a. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
   b. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. Apply to a height of approximately 8-feet above grade. Final height shall be approved by the Architect.

B. Application over Cementitious Surfaces:

1. All natural surfaces including concrete, masonry units, brick tile and block shall be treated with a siloxane penetrating water sealer compatible with the graffiti solution system.

2. Base: Minimum of 2 coats or as required to achieve a pinhole free surface, of specified barrier coating, 3- to 4-mils minimum dry film thickness.

3. Finish: Minimum 2 coats of top coating, 3- to 4-mils minimum dry film thickness or as required to comply with specified warranty requirements.

C. Application over Wood and Primed Metal Surfaces:

1. Finish: 2 coats of top coating, 3- to 4-mils minimum dry film thickness.

D. Completed Work: Match approved samples and mock-up for color, texture and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserve the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of the Contractor.

2. Testing agency will perform appropriate tests for the following characteristics as requested by the Owner:
   a. Quantitative materials analysis.
   b. Absorption.
   c. Accelerated weathering.
   d. Accelerated yellowness.
   e. Alkali and mildew resistance.
   f. Abrasion resistance.
   g. Washability.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Remove non-complying coating materials from the Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

   B. Demonstration: Apply alkyd-based graffiti to a 2-foot square treated area selected by the Architect. Allow graffiti to remain on surface for a minimum of 5 days and demonstrate complete removal in the presence of the Architect.

3.5 CLEANING

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

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

3.6 PROTECTION

   A. Protect adjacent work against damage from coating operation. Correct damage by cleaning, repairing, replacing and recoating as approved by the
Architect, and leave in an undamaged condition.

B. Provide “wet paint” signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings.

C. Touch-up and restore damaged or defaced coated surfaces in accordance with manufacturer’s instructions.

*** END OF SECTION ***
SECTION 03 30 01 - CAST-IN-PLACE CONCRETE – SUMMIT STAIRS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. This specification section covers summit stairs, concrete site features and guardrail footings.
   2. Cast-in-place concrete, unless otherwise noted.
   3. Granular base and underslab vapor retarder assembly beneath building slab-on-ground.
   5. Construction joint waterstops.

B. Related Sections:
   1. Section 03 10 01 – Concrete Forming.
   2. Section 03 20 01– Concrete Reinforcing.
   3. Division 02 Sections for concrete for earthwork.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 301.

C. ACI: Standards of the American Concrete Institute (ACI) apply where designated in this section. Use applicable year of adoption or revision as published in ACI 301.
   1. ACI 301 - Specifications for Structural Concrete for Buildings, 2010.
   2. ACI 318 - Building Code Requirements for Structural Concrete, 2011.

E. IAPMO Evaluation Service (IAPMO-ES):

F. ICC Evaluation Service (ICC-ES):

G. State of California, Department of Transportation (Caltrans):

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section, "Submittal Procedures".

B. Mix design for each concrete mixture, including:
   1. Mixture proportions.
      a. When set accelerating and set retarding admixtures may be added to control set time under varying weather conditions, list admixtures for review and acceptance.
   2. Mixture properties.
      a. Include compressive strength, slump, entrained air, and fresh density.

C. Laboratory test reports for concrete mixes.
   1. Compression test data (field experience method) or results of testing (trial batch method) used to establish proportions for each mix.
      a. Submit sufficient data to represent the range of materials intended for use in the work, in accordance with ACI 318, Section 5.3.3.
   2. Alkali-silica reactivity test data where results of aggregate testing are other than innocuous.

D. Material certificates of compliance with specified standards.
   1. Portland cement.
   2. Supplementary cementitious materials, including fly ash and slag cement.
   3. Aggregates, including gradation.
E. Product data for proprietary materials and items, including admixtures, synthetic fiber reinforcement, bonding agents, finish materials, curing materials, vapor retarder, waterstops, and nonshrink grout.

F. Submit ticket to Owner’s Testing Laboratory for each batch of concrete delivered, bearing the following information.
   1. Mix identification.
   2. Date and time of batching.
   3. Types and weights of cementitious materials. Sources, sizes and weights of coarse and fine aggregates. Weight of water added at plant. Types and volume of liquid admixtures added at plant.
   4. Volume of water and liquid admixtures added subsequent to initial batching. Time and place of addition.

G. Samples
   1. Lamp black and Davis colors and data.
   2. Other samples as requested by Testing Laboratory or Owner's Representative.

1.6 QUALITY ASSURANCE

A. Comply with applicable provisions of following codes and specifications, except where more stringent requirements are shown or specified.
   1. ACI 301: Specifications for Structural Concrete for Buildings.
   2. ACI 318: Building Code Requirements for Reinforced Concrete.

B. Concrete batch plant shall comply with the requirements of ASTM C94, Section 10, as certified by the National Ready Mixed Concrete Association.

C. Concrete Supplier’s Testing Laboratory shall comply with the requirements of ASTM E329 and be under the direction of a professional engineer, licensed in the State of California.

D. If the test results of aggregates for potential reactivity (ASTM C289) are other than innocuous, concrete mixtures shall be tested in accordance with ASTM C1567. Tests shall indicate an expansion of less than 0.10 percent at 16 days age.

E. Mock-ups:
   1. Mock-ups for each exposed stair finish and color, including landing and wall.
   2. Provide mock-ups on-site for O.R. review. Landing mock-ups shall 6’x6’x6” finished landing held with 2x6 wood edging. Wall mock-ups shall be 4’x4’x1’.
   3. Mock-ups shall remain on site after review and approval until the project is completed. Contractor shall dispose of mock-up off-site at the close of the project. Approved mock-ups shall serve as quality control benchmarks for
concrete work. Construct mock-up only after approval of mix design, finish, and jointing. Coordinate location of mock-up with O.R.

4. Provide mock-up in sufficient time for concrete to cure, be reviewed, and for additional mock-up(s) to be poured and cured before placement of various concrete types and elements are required to be poured to meet the project schedule.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Cementitious materials and aggregates shall have a proven history of successful use together, or submit evidence satisfactory to Owner's Representative that aggregate will not react harmfully in presence of alkalis in cement.

B. Cementitious materials and aggregates for concrete for exposed surfaces of like elements shall be from same source throughout the work.

C. Cementitious Materials: Combination of Portland cement and supplementary cementitious materials; subject to limitations specified herein.
   1. Portland cement: ASTM C150, Type I, II or V, low alkali.
   2. Fly ash: ASTM C618, Class F; except the maximum loss on ignition shall not exceed 1.0%.
   3. Slag cement: ASTM C989, Grade 100 or 120.

D. Coarse Aggregates:
   1. ASTM C33.
   2. Cleanness value shall not be less than 75 when tested in accordance with California Test 227, "Evaluating Cleanness of Coarse Aggregate".
   3. Aggregate shall contain no thin or elongated pieces. The length of any piece shall not exceed 2½ times the average thickness.
   4. Aggregate for Shrinkage Controlled Concrete shall be from one of the following sources, or approved equal: Orca (as supplied by Cemex), limestone (Hanson), granite (Granite Rock’s Aromas), or Clayton (Hanson or Cemex).
   5. Aggregate for lightweight concrete: ASTM C330, rotary kiln-expanded shale or clay having surface sealed by firing. 3/8 inch size. As manufactured by Trinity Expanded Concrete & Shale, or approved equal.

E. Fine Aggregates:
   1. ASTM C33.
   2. Sand equivalent shall not be less than 75 when tested in accordance with California Test 217, "Sand Equivalent".
F. Water: Combined water consisting of potable water and reclaimed water from mixer wash-out operations; subject to limitations specified herein.
   1. Provide 100% potable water for Architectural Concrete, Shrinkage Controlled Concrete, post-tensioned concrete, and lightweight concrete.
   2. Combined water for other uses may contain maximum 25% reclaimed water meeting requirements of ASTM C1602.

G. Admixtures: Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized. Acceptable Manufacturers: BASF Construction Chemicals, W.R. Grace and Co., or Euclid Chemical Co.
   1. General: Admixtures containing more than 0.05% chloride ions are not permitted.
   3. Water-reducing: ASTM C494, Type A.
   4. Set-retarding: ASTM C494, Type B. Provide in necessary dosage to achieve desired set time.
   5. Set-accelerating: ASTM C494, Type C, non-chloride. Provide in necessary dosage to achieve desired set time.
   6. Mid-range water-reducing: ASTM C494, Type A/F, polycarboxylate formulation designed to minimize shrinkage. Provide in manufacturer’s recommended (mid-range) dosage where specified, or where otherwise requested by Contractor to increase slump to facilitate pumping and/or placement.
   7. High-range water-reducing (superplasticizer): ASTM C494, Type F, polycarboxylate formulation designed to minimize segregation and shrinkage. Where specified, provide in manufacturer’s recommended (high-range) dosage.
   8. Viscosity-modifying (VMA): ASTM C494, Type S. Provide in manufacturer’s recommended dosage to facilitate pumping, subject to approval of Owner’s Representative.
      a. Where floor is intended to be ground and polished, verify compatibility of admixture with hardener.
   10. Color:
       a. Concrete shall be toned with Davis Color, Sierra 61078 or other as determined by Owner through Mock-up process
       b. Should Owner determine concrete shall not be toned with Davis Color, Lamp Black may be utilized. Provide up to 2 pounds per cubic yard as directed by Owner’s Representative.
2.2 RELATED MATERIALS

A. Granular Base: Broken stone or crushed or uncrushed gravel, angular, free of deleterious matter. Gradation conforming to the following: 100% passing the 3/4-inch sieve, less than 10% passing the No. 4 sieve, and less than 2% passing the No. 200 sieve.

B. Vapor Retarder: ASTM E1745, Class A plastic sheeting, with a water vapor permeance less than 0.02 perms in accordance with ASTM E1745, Section 7. Minimum 15 mil film thickness. Acceptable products: Moistop Ultra 15 by Fortifiber Corporation, Stego Wrap 15 mil by Stego Industries, or approved equal.
   1. Provide manufacturer’s recommended tape, mastic and boots for sealing of edges, seams, and penetrations.

C. Waterstop: Sodium bentonite and butyl rubber compound formed into strips. Compound shall expand to seal and fill voids in construction joints to prevent water infiltration under continuous immersion and wet/dry cycling.
   1. Typical: 1-1/4” x 1/2” trapezoidal strip reinforced with a poly scrim. Use at construction joints in concrete sections thicker than 8 inches with two layers of reinforcing steel. Acceptable products: Waterstop RX 101T by CETCO, Swellstop No. 594 by Greenstreak, or approved equal.
   2. Thin Section: 3/4” x 3/8” half circle. Use at construction joints in concrete sections less than 8 inches thick or with a single layer of reinforcing steel. Acceptable products: Waterstop RX 102 by CETCO, Swellstop No. 596 by Greenstreak, or approved equal.
   3. Adhesive: As recommended by waterstop manufacturer. Acceptable products: CETSEAL by CETCO, Swellstop primer adhesive by Greenstreak, or approved equal.

D. Evaporation Reducer: Monomolecular film-forming compound to prevent rapid drying of fresh concrete. Subject to compliance with requirements provide one of the following, or equal.
   
   Eucobar, by Euclid Chemical, Co.
   Confilm, by Master Builders, Inc.

E. Moisture-retaining Cover (for curing):
   2. Laminated Polyethylene Burlap: 4 mil white opaque polyethylene laminated to 10 oz. burlap or nonwoven polypropylene fabric; conforming to ASTM C171, Type 1.1.3. Acceptable products: Curlap™ by Midwest Canvas Corp, Transguard™ 4000 by Raven Industries, or equal.
F. Curing Compounds:
1. Type CC-1: Dissipating resin curing compound conforming to ASTM C309, Type 1, Class B, with a VOC less than 100 g/L. Acceptable products: 1100-Clear by WR Meadows, Kurez DR-100 by Euclid Chemical Co., or approved equal.

1. Primer: Product of underlayment manufacturer recommended for substrate conditions.
2. Aggregate: Where thickness exceeds 1-inch, add well-graded, washed aggregate, of gradation and amount as recommended by underlayment manufacturer.

H. Nonshrink Grout: Premixed, nonmetallic, noncorrosive product, conforming to ASTM C1107. Minimum usable working time of 30 minutes at flowable consistency over temperature range of 50 deg F to 85 deg F. Acceptable products: Masterflow® 555 by BASF, Five Star® Grout by Five Star Products, Inc., or approved equal.

2.3 MIXES

A. Lean Concrete: Not used. Refer to Section 31 23 01, "Structural Excavation and Fill", for controlled low strength material (CLSM).

B. Mix “A”: For slab-on-ground, stairs, and retaining walls.
1. Compressive strength: 4,000 psi at 28 days (ASTM C39).
2. Slump: 6 inches, plus or minus 1-inch tolerance (ASTM C143).
3. Cementitious material: Total cementitious material shall not be less than 550 lbs per cubic yard.
4. Aggregate: Size 57 (1-inch) coarse aggregate.
   a. Coarse aggregate shall be from specified source for Shrinkage Controlled Concrete. Do not blend pea gravel with shrinkage controlled aggregates.
5. Admixtures:
   a. Mid-range, water-reducing admixture at necessary dosage to provide adequate slump and workability at specified water content.
   b. Provide set-retarding admixture with dosage as required due to distance of project site from batch plants.
6. Limit total water to 275 lbs maximum.
7. Limit water-to-cementitious material ratio to 0.45 by weight.

C. Mix “B”: For guardrail footings.
1. Commercial grade mixture of Portland cement and aggregates designed to produce concrete with compressive strength of 5,000 psi; prepackaged in sacks. Acceptable products: Quickcrete 5000 concrete mix, or approved equal.

2. In lieu of the above mix, Mix “A” may be used at guardrail footings.

D. Patching Mortar: One part Portland cement to two parts sand. At exposed surfaces, substitute white cement as necessary to match color of surrounding concrete.

1. Intended for use for patching of form ties and bug holes. Not suitable for repair of large defects; provide pre-packaged repair mortar suitable for size and shape of defect and approved by Owner’s Representative.

2.4 PROPORTIONING

A. Contractor shall determine the mix proportions for concrete in conformance with these specifications.

B. Proportion mixes in accordance with ACI 318, on the basis of field experience or trial batches.

1. When trial batch method is used, trial batches shall be proportioned by Contractor’s Design Laboratory that conforms to specified quality assurance requirements.

C. Proposed mixes shall produce concrete to strengths specified with adequate workability and proper consistency to permit concrete to be conveyed by pumping and worked into forms and around reinforcement without excessive segregation or bleeding.

D. The total chloride ion content, calculated on the basis of mix proportions, shall not exceed the limits specified in ACI 318 Table 4.4.1. The total chloride ion content shall not be allowed to exceed 0.30% for any use.

E. Mix design adjustments may be requested by Contractor when job conditions or test results warrant. Revised mix design must be submitted to and accepted by Owner’s Representative before using in work.

1. Approved set-accelerating and set-retarding admixtures may be used to control set times when warranted by weather conditions, without resubmittal of mixes.

2. Batching weight of lightweight aggregates shall be adjusted to maintain a constant volume of aggregate, without resubmittal of mixes.

2.5 CONCRETE MEASUREMENTS AND MIXING

A. Materials for concrete shall be measured by weighing the aggregates and cement using equipment that is suitable, designed and constructed for this purpose. Each size of aggregate and the cement shall be weighed separately. The accuracy of all measuring
devices shall be such that quantities be measured to within the following percentages of the desired amount: 1% for cement and water, 2% for aggregates, and 3% for admixtures. Mixing water and all admixtures shall be measured by volume.

B. All concrete shall be machine mixed in accordance with ACI 318, Section 5.8. Deposit concrete into final position within 90 minutes of introduction of cement, except where retarder is used to delay set for transport.
   1. Mixing time shall be reduced in hot weather in accordance with Hot Weather Concreting provisions of this Section.
   2. Mixing time shall be increased to accommodate project conditions, only with prior written approval of Owner’s Representative and subject to use of set retarders, control of revolutions of mixing drum and monitoring of concrete temperature.

C. After initial batching, additions shall be limited to water, high range water reducers and non-chloride accelerators, subject to the following:
   1. Additions shall be made only in the presence of Testing Laboratory, using suitable calibrated devices.
   2. Water additions shall not exceed water-to-cementitious ratio requirements.
   3. Following addition of HRWR or accelerator admixtures, complete a minimum of 70 revolutions or 5 minutes of mixing to assure a consistent mixture.

D. Site-Mixed Concrete for Guardrail Footings: For prepackaged concrete option for guardrail footings, mix concrete on site using machine mixer or hand mixing in accordance with manufacturer’s instructions.
   1. Add 2/3 of manufacturer’s recommend volume of water prior to mixing. Add remaining water during mixing as required to achieve a workable consistency.
   2. Continue mixing until the mix reaches a uniform consistency.

PART 3 – EXECUTION

3.1 CONSTRUCTION JOINT PREPARATION

A. Horizontal Joints: Remove entire surface to expose clean aggregate solidly embedded in mortar matrix to full 1/4-inch amplitude. Do not leave laitance, loosened particles of aggregate or debris at surface.
   1. At Contractor’s option, use chemical surface retarder as an aid to joint preparation.

B. Vertical Joints: Remove formwork and coatings to expose clean and sound concrete. Joints that are formed and keyed in accordance with drawings need not be intentionally roughened.
C. Waterstops: Provide at construction joints in below grade pits and where indicated on Drawings. Install waterstops in accordance with manufacturer’s written instructions, using adhesive. Tightly butt ends of adjoining sections; do not overlap. Protect waterstop from wetting prior to concrete placement; replace waterstop that has partially hydrated.
   1. Place typical waterstop with 3 inches minimum cover to concrete surface exposed to water, and between layers of reinforcing.
   2. At thin sections, place waterstop with 2 inches minimum cover nearest to face of concrete exposed to water.

3.2 PREPARATION FOR SLAB-ON-GROUND CONSTRUCTION

A. Place granular base to thickness specified on Drawings when specified on Drawings. Consolidate and smooth surface with a vibratory plate.

B. Where shown on Drawings, place underslab vapor retarder in accordance with recommendations of ASTM E1643 with longest dimension parallel with direction of pour, lapping seams 6 inches and sealing with manufacturer’s recommended adhesive or pressure sensitive tape.
   1. Seal around penetrations through vapor retarder, such as utilities, to create a monolithic membrane between the surface of the slab and the subgrade. Repair damaged vapor retarder prior to placement of concrete.
   2. Where vapor retarder is interrupted at interior or edge footings, lap vapor retarder 2 inches minimum over footing.

C. Repair vapor retarder damaged during placement of reinforcement or concrete with patch of vapor retarder material. Lap beyond edges of damaged area a minimum of 6 inches and seal edges as prescribed for seams.

D. Do not place concrete until Owner’s Representative has observed vapor retarder and damaged areas have been repaired.

3.3 PLACING

A. Examine units of work to be cast and verify that:
   1. Construction of formwork is complete.
   2. Required reinforcement, inserts, and embedded items are in place and securely held.
   3. Concrete-receiving places are free of debris and excess water.

B. Protect finished surfaces adjacent to concrete-receiving places.

C. Notify Owner’s Representative at least 24 hours before placing concrete.
D. Placing Record: Record time and date of casting concrete in units of building; maintain record open to inspection by the Owner's Representative.

E. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent segregation.

F. Cold Weather Placement: When concrete is likely to be subjected to freezing temperatures within 24 hours or when placing concrete at air temperatures less than 40 deg F, the temperature of the concrete at the point of placement shall be at least 55 deg F for sections thinner than 12 inches and 50 deg F for sections thicker than 12 inches. Do not exceed this temperature by more than 20 deg F. Use only approved accelerating admixtures.

G. Hot Weather Placement: When air temperature exceeds 80 deg F, take special precautions to prevent slump loss, rapid setting, and plastic shrinkage; including but not limited to:
   1. Cool ingredients before mixing to maintain concrete temperature at point of placement below 90 deg F.
   2. Convey and deposit concrete as rapidly as practicable, such that concrete temperature does not exceed 90 deg F at point of placement.
   3. Apply evaporation reducer immediately after screeding.

H. Placing Concrete in Forms:
   1. In depositing concrete in columns or walls, place concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or metal reinforcement above the level of the concrete.
   2. Deposit concrete in horizontal layers and in a manner to avoid inclined joints. Place each layer while preceding layer is still plastic to avoid cold joints.
   3. Keep forms and reinforcement clean above pour line.
   4. Do not use vibrators to transport concrete in forms.

I. Consolidating:
   1. Use internal vibrators for thorough consolidation of all concrete.
   2. Use size and power recommended by ACI 309 for the element of work.
   3. Use consolidation techniques that minimize entrapped air; refer to ACI 309.
   4. Do not place vibrators against reinforcement or forms.

J. Construction joints shall conform to typical details and be located where shown on Drawings or approved by the Owner’s Representative. Horizontal joints in walls and columns shall be at the underside of slabs. Place beams, girders, brackets, column capitals, haunches, and drop panels at the same time as the slabs.

K. Floor Slabs on Steel Framing:
1. Deposit concrete working outward from beam centers to avoid overloading steel deck.
2. Maintain specified concrete thickness over steel deck as a minimum. Increase thickness as required to compensate for deflection of steel deck.

3.4 FINISHING FOR NON-FORMED SURFACES

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces.

B. Finish Schedule: Refer to Article 3.11, "Finish Schedule" for finish types and locations. Refer to Division 03 Section “Concrete Finishing” for specialty finishes of exposed to view concrete.

1. Flatness: Measure floor surfaces using the 10-foot straightedge method of ACI 117. Achieve an average tolerance of 5/16 inch, based on five consecutive tests.
2. Corrective action: Failure to achieve the specified tolerances will require remedial action, including grinding and/or application of leveling materials. The cost of remedial action will be borne by the Contractor.

C. Slab Finishes:
   1. Scratch Finish: Place, consolidate, strike off, and level concrete. Roughen surface with stiff brooms or rakes prior to final set.
   2. Float Finish: Place, consolidate, strike off and level concrete. Do not work further until concrete is ready for floating. Consolidate surface with a bladed power float with float shoes or a powered disk float, or by hand floating if area is small or inaccessible to power driven floats. Repeat float passes until surface conforms to specified tolerances and is left with a uniform, smooth, granular texture.
   3. Trowel Finish: After applying float finish, power-trowel the surface. Continue troweling passes until surface is planed to the specified tolerance and uniform in texture. Do not burnish floors intended to receive floor coverings. Hand trowel the surface smooth and free of trowel marks.
   4. Broom Finish: After applying float finish roughen surface by drawing a fiber bristle broom, not less than 24 inches wide, across surface perpendicular to main traffic route. Produce even texture from edge to edge, lapping adjacent strokes slightly to produce uniform pattern.
      a. Obtain Owner’s Representative’s approval for texture of final finish before application.

3.5 FINISHES FOR FORMED SURFACES
A. General: Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.

B. Surface Finish – 1.0 (Rough Formed):
1. No formwork facing material is specified.
2. Patch voids larger than 1½ in. wide or 1/2 in. deep.
3. Remove projections larger than 1 in.
4. Tie holes need not be patched.
5. Surface tolerance Class D as specified in ACI 117.

C. Surface Finish – 2.0 (Smooth-formed):
1. Plywood formwork facing.
2. Patch voids larger than 3/4 in. wide or 1/2 in. deep.
3. Remove projections larger than 1/4 in.
4. Patch tie holes.
5. Surface tolerance Class B as specified in ACI 117; except Class C shall be acceptable where finish surface is not exposed (pits, surfaces to receive waterproofing, etc.) subject to leveling abrupt offsets as required to accept application of finish materials or waterproofing.

D. Surface Finish – 3.0 (As-cast exposed-to-view): Concrete shall have uniform as-cast surface with minimal additional finishing being anticipated or required.
1. Patch voids larger than 3/4 in. wide or 1/2 in. deep, surface blemishes will not be filled.
2. Remove projections larger than 1/8 in. by grinding without marring surface.
3. Fill tie holes and strike flush with adjacent surfaces, except as otherwise noted.
4. Surface tolerance Class A as specified in ACI 117.
5. Mockup of concrete surface appearance and texture required.

E. Sandblasted Finish: After obtaining as-cast, exposed-to-view surface, light sandblast, sufficient to expose fine aggregate with occasional exposure of coarse aggregate, to produce uniform color and a degree of reveal of approximately 1/16 inch.

F. Sacked Finish: After stripping formwork, thoroughly wet concrete surface, apply grout to fill surface blemishes. Remove all traces of grout from surface by rubbing with clean burlap. Continue curing.
1. Grout: Combine one part cement to one and one-half parts sand by volume, and a 50:50 mixture of acrylic bonding admixture and water to form the consistency of a thick paint. Blend standard Portland cement and white cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
G. At tops of walls and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

3.6 CURING AND PROTECTION

A. General: Start initial curing as soon as free water has disappeared from concrete following finishing. Keep concrete continuously moist for 7 days minimum after placement.

1. Subject to approval of Owner’s Representative, application of curing compound may be delayed when specialty compound for moisture vapor emission is used for curing, usually 4 to 24 hours. Slab shall be carefully monitored for moisture content at the surface and compound shall be applied prior to evaporation rate exceeding moisture emission rate.

B. Curing Methods:

1. Curing compound: Apply specified curing compound as soon as final finishing operations are complete. Uniformly apply two coats of compound in a continuous operation with second coat at right angles to first. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer’s written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Recoat concrete surfaces subjected to rainfall within 3 hours after the curing compound application. Maintain compound on the concrete surface throughout the curing period and immediately repair any damage.
   a. Use Type CC-1 compound, unless otherwise designated.

2. Moisture-retaining cover: As soon as concrete is sufficiently set to permit application without marring surface, unroll cover over the entire area, laid smooth without folds or bunches of material. Lay blanket in accordance with manufacturer’s instructions, overlapping edges a minimum of 6 inches and extending ends 12 inches beyond area of concrete to be cured. Immediately repair holes or tears that occur within first 5 days using sheeting material and waterproof tape.
   a. Curing paper is preferred cover for slabs to receive adhered floor finishes.
   b. Laminated burlap is preferred cover for concrete with water to cementitious material ratio less than 0.42.
   c. Prewet laminated burlap sheeting as installation progresses.
   d. Maintain cover in place for 7 days for normal weight concrete; cover may be removed in 5 days for lightweight concrete.

3. Moist curing: Continuous misting, sprinkling or ponding. Intermittent wetting is not acceptable.
C. Limitations: Accomplish curing by one of the specified methods, subject to the following limitations.
   1. Compound curing will not be permitted for surfaces to which other concrete, mortar or plaster is bonded.

D. Cold Weather Requirements: Protect concrete from freezing during the first 7 days after placement.

E. Hot Weather Requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.7 SAW-CUT JOINTS

A. Construct contraction joints in slabs-on-grade using saw cuts 1/8 inch wide by one inch deep, unless otherwise indicated.

B. If joint pattern is not shown, provide joints to create approximately square panels not exceeding 30 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bay, etc.).

C. Sawcut as soon as concrete will bear the weight of equipment and operator, usually 1 to 4 hours after finishing. Perform sawcut with early-entry dry-cut saw. Ensure that saw does not ride up over hard or large coarse aggregate. Change saw skid plates in accordance with manufacturer’s recommendations as required to control raveling and spalling at joint edges.

D. Perform all cuts cleanly and smoothly to a constant and equal depth in as continuous an operation as possible to avoid misalignment of joints. Use only experienced personnel and forms or templates as required to achieve consistent lines.

3.8 CLEANING, PATCHING AND DEFECTIVE WORK

A. Cleaning: Remove curing compounds, form release agents and other materials employed in concrete work that prevent proper application of finishes, sealants, waterproofing materials, or other treatments. Use positive method, as recommended by manufacturer, to achieve complete removal.
   1. For floors scheduled to receive glue-adhered floor finishes, chemically strip Type CC-1 curing compound 7 days minimum to 14 days maximum following placement.

B. Repair of formed surfaces: Immediately after form removal, cut out honeycombs, rock pockets, and voids. Make edges of cuts perpendicular to concrete surface. Clean,
dampen with water, and brush-coat surface of void with neat cement paste. Immediately fill and compact with patching mortar.
1. Use patching mortar for form ties for minor repairs.
2. Use pre-packaged, shrinkage-compensated structural repair mortar, acceptable to Owner's Representative, for larger repairs.

C. Repair of Floor Slabs for Flatness and Levelness: Repair floors as necessary to achieve specified finish tolerances and as otherwise required for proper installation of building components.
1. After concrete has cured at least 28 days, correct high areas by grinding.
2. Correct low areas with underlayment installed according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

3.9 GROUTING BASEPLATES

A. Prior to erection, clean and roughen concrete surface beneath baseplate; clean bottom surface of baseplate of bond-reducing materials. After columns have been positioned and plumbed, flow nonshrink grout solidly between bearing surfaces to ensure no voids remain. Comply with manufacturer's recommendations for mixing, placing, finishing and curing of grout.

3.10 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality Requirements".

B. Testing Laboratory will:
1. Collect and review tickets for each batch of concrete delivered. Annotate water or admixtures added subsequent to batching.
2. Special Inspect concrete placement, as required by CBC Table 1705.3, for conformance with the Contract Documents.
3. Compressive strength: Sample and test concrete for compressive strength at the frequency prescribed by ACI 318, Section 5.6.2. A sample shall be the average of two 6 by 12 inch cylinders or three 4 by 8 inch cylinders. Cylinders shall be molded and cured in accordance with ASTM C31 and tested in accordance with ASTM C39 at 28 days.
   a. On first day's placement of each concrete mix, mold two additional cylinders and test at 7 days. 7-day testing is not required thereafter.
   b. Where design strength is specified at 56 days, perform testing at 56 days. On first day’s placement of concrete mix, mold four additional cylinders; test 2 at 7 days and 2 at 28 days. 7-day and 28-day testing is not required thereafter.
4. Slump: ASTM C143; one test at start of placement and every two hours thereafter.
5. Temperature: ASTM C1064; one test every two hours during hot weather. Make additional tests when warranted by delays in delivery.
6. Air content: ASTM C173; one test hourly at point of placement for mixes with more than 3% air.
7. Nonshrink grout:
   a. Inspect mixing and placing of nonshrink grout.
   b. Test for compressive strength in accordance with ASTM C109. Make one sample for each 2 hours of grout placement.

C. The Contractor shall pay Testing Laboratory for investigating of low-strength compressive test results in accordance with ACI 318, Section 5.6.5, except where results of test cylinders are not representative of in-place concrete.

3.11 FINISH SCHEDULE

A. The concrete finish types specified in "Table 1 - Finishes for Non-Formed Surfaces" and "Table 2 - Finishes for Formed Surfaces", which follow, shall be used except as otherwise designated on drawings.
1. Exposed surfaces that are scheduled to receive paint, sealers or other thin finish coatings shall be considered "Exposed-to-View".
2. Exposed-to-view Curbs and Stair Risers: Provide monolithic finish by stripping forms while concrete is green and steel-troweling surfaces to a dense, hard finish with corners intersections and terminations slightly rounded.

B. Refer to Section 03 10 01, "Concrete Forming", for formwork requirements for exposed-to-view surfaces.

| TABLE 1: FINISHES FOR NON-FORMED SURFACES |
| Surface                                      | Finish         | Tolerances   | Curing       |
| Exposed concrete (unless otherwise noted)    | Light Sandblast| Per Article 3.4.B | CC-1 cure    |
| Exposed concrete (stair treads)              | Light Broom    | Per Article 3.4.B | CC-1 cure    |
# TABLE 2: FINISHES FOR FORMED SURFACES

<table>
<thead>
<tr>
<th>Surface</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concealed, except as otherwise noted.</td>
<td>SF-1.0</td>
<td>CC-1 curing where required per Concrete Forming</td>
</tr>
<tr>
<td>To receive waterproofing</td>
<td>SF-2.0</td>
<td>CC-1 curing where required per Concrete Forming, removed</td>
</tr>
<tr>
<td>Pits (inside face)</td>
<td>SF-2.0</td>
<td>CC-1 curing where required per Concrete Forming</td>
</tr>
<tr>
<td>Exposed to view, public areas</td>
<td>SF-3.0</td>
<td>CC-1 curing where required per Concrete Forming</td>
</tr>
</tbody>
</table>

END OF SECTION 03 30 01
SECTION 31 23 01 - STRUCTURAL EXCAVATION AND FILL – SUMMIT STAIRS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Available Information: “Geotechnical Recommendations, Mt. Umunhum – Restoration Project, Santa Clara County, California, dated 5/6/16, by Cornerstone Earth Group, is available in Appendix A.

1.2 SUMMARY

A. This Section Includes:
   1. This specification section covers summit stairs, concrete site features and guardrail footings
   2. Excavation for foundations and pits.
   3. Backfilling structural excavations as required.

B. Related Sections:
   1. Division 03 Section “Concrete Formwork” for formwork for footings.
   2. Division 02 Section “Earthwork” for mass excavation, geotechnical remediation of unconsolidated fills at stairway, and/or fill for stair pad.

1.3 REFERENCES


B. American Concrete Institute (ACI):
   1. ACI 301 - Specifications for Structural Concrete for Buildings, 2010.
   2. ACI 229R – Controlled Low Strength Materials, 2013.

C. California Department of Transportation’s (Caltrans):

1.4 DEFINITIONS

A. MROSD refers to Midpeninsula Regional Open Space District (MROSD), which is the lead agency. MROSD or MROSD’s Representative (O.R.) for the project refers to
Midpeninsula Regional Open Space District (MROSD) project managers, associates, or agents.

1.5 SITE CONDITIONS

A. Notify Owner’s Representative when site conditions differ from findings of Geotechnical Investigation Report.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete: Concrete materials and proportions shall be in accordance with ACI 301 to produce concrete with minimum compressive strength of 2500 psi at 28 days.

B. Structural Fill: CSS Section 26, Class 2 Aggregate Base rock, 3/4” size.

C. Controlled Low Strength Material: Machine mixed, self-compacting, low-strength fill consisting of fine aggregate, cementitious materials, entrained air and water. Mix and mixing shall conform to recommendations of ACI 229 to achieve the following properties:
   1. Slump: 8 to 10 inches.
   2. Compressive Strength:
      a. For backfill: Minimum 150 psi to maximum 300 psi at 30 days.
      b. For fill beneath footings: Minimum 300 psi at 30 days.
   3. Fresh Density: 115 to 145 pounds per cubic.
   4. Subsidence: Minimal; a maximum of 1/16” per foot of thickness.

D. Pea Gravel: ASTM C 33, Size No 7.
   1. Fill material (over mat foundation): Crushed rock of uniform gradation, 100% passing 3/4 inch sieve.

PART 3 – EXECUTION

3.1 PREPARATION

A. Take measures to prevent surface water from entering excavations.

B. Notify Geotechnical Engineer at least 48 hours prior to commencing and upon completion of excavations.

3.2 EXCAVATION
A. Accurately cut foundation excavations to dimensions and elevations shown on Drawings to tolerances of ACI 301.

B. Where sides are unstable or excavations are not accurately cut, over-excavate to permit placement and removal of formwork.

C. Shore and brace excavations as required to prevent caving and danger to persons and structures. Comply with applicable safety regulations.

D. Prepare bottoms of footing excavations to produce conditions acceptable to Owner’s Representative, based on professional opinion of Geotechnical Engineer.
   1. The bottoms of excavations shall be firm, undisturbed earth, clean and free from loose material, debris and foreign matter.
   2. Remove or recompact disturbed material.
   3. Remove soft or unstable material to a depth satisfactory to Geotechnical Engineer.
   4. Fill over-depth excavations with concrete, flowable fill, or structural fill compacted to minimum 95% relative compaction.

E. Maintain footing conditions approved by Geotechnical Engineer until concrete work is complete.
   1. In periods of wet weather, over-excavate footings and place 2-inches minimum concrete mud-slab as soon as practical after completing excavation.

F. Keep excavations free of water at all times until foundation concrete is cast.

G. Stockpile or remove excavated material from site in accordance with Division 31 Section “Earthwork”.

3.3 BACKFILLING

A. Place and compact fill in accordance with Division 02 Section, “Earthwork”.
   1. Use pea gravel or controlled density material for backfill against sides of footings and pits, where adequate compaction of structural fill cannot be achieved.

B. Backfill footings after formwork is removed. Do not backfill pits until concrete has cured a minimum of 7 days.

3.4 FILL OVER CONCRETE MAT FOUNDATIONS

A. Preparation:
   1. Verify piping is securely supported against vertical and lateral displacement.
   2. Where area is not enclosed prior to placement of fill, make provision for removal of water.
B. Placement: Fill may be placed to the full specified thickness without compaction.
   1. Pipes: Bed pipes in fill up to grade of underside of pipe, taking care not to place material atop pipe. Shovel or slide material under and beside the pipe up to the spring line without moving the pipe.

C. Consolidation: Immediately prior to placement of vapor retarder, consolidate surface with a minimum of 3 passes of a vibratory plate. Achieve specified grade to plus 0 inch to minus 1-1/2 inch tolerance.

3.5 FIELD QUALITY CONTROL

A. The Geotechnical Engineer will observe footing excavations prior to placement of reinforcement; and again, immediately prior to casting of concrete.

B. The Geotechnical Engineer will observe the placement of fill and backfill material.

END OF SECTION 31 23 01