GOLDEN GATE NATIONAL RECREATION AREA
PRESIDIO OF SAN FRANCISCO

Construct and Install Improvements to
West Bluff Trail/Arrival Area
GOGA
PMIS 244458

TECHNICAL SPECIFICATIONS

NATIONAL PARK SERVICE (NPS)
DENVER SERVICE CENTER (DSC)
July 2025

Professional seals by Design Professionals and others responsible for preparing Construction Documents:

Civil Engineer

Structural Engineer

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SECTION 02 41 13 – SITE SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Sawcutting and removal or recycling of existing asphalt concrete pavement.
2. Removal and salvage of existing site features.
3. Demolition, removal, and disposal of existing site features.

B. Related Sections include the following:

1. Section 01 57 23 – Under-an-Acre Pollution Prevention
2. Section 31 10 00 – Site Clearing
3. Section 31 20 00 – Earth Moving
4. Section 31 25 00 – Erosion and Sediment Controls

1.2 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated by the Contracting Officer (CO) to be salvaged, reused, reinstalled, or to remain on Park property in a location approved of by the CO.

B. Remove and Store for Reinstallation: Remove items indicated; clean, service, and otherwise prepare items for reuse; store and protect against damage. Reinstall items in locations indicated in the plans and specifications or as directed by the CO.

C. Existing to Remain: Protect items identified to remain against damage and soiling during demolition. When permitted by the CO, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

D. Abandon: Abandon items indicated. Leave items in place and abandon as specified.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain on the Park property, demolished materials shall become the Contractor's property and shall be removed and legally disposed of at the Contractor's expense.

B. Materials for removal and reinstallation:

1. The following materials shall be removed, cleaned, and prepared for reinstallation at the project site as shown and specified.

a. Parking meter
b. Signage
c. EV charging stations
d. Electrical Panel
e. Belgian block pavers
f. Landscape boulders
g. Bike parking loops
h. Parking area lights
i. Trash receptacle

C. Materials for removal and disposal:

1. The following materials shall be removed from the site and legally disposed of.

a. Asphalt pavement
b. Concrete pavement
c. Pavement striping
d. Concrete curbing
e. Aggregate surfacing
f. Excess excavated material
g. Concrete and rubber wheel stops
h. Signage as shown
i. Bollards

1.4 QUALITY ASSURANCE

A. Comply with the local noise ordinances regarding hours of operations and allowable noise levels. Monitor vibrations generated by the demolition activities and received by the existing structures in the immediate vicinity of the project.

1.5 SCHEDULING

A. Notify the Contracting Officer 48 hours prior to beginning demolition work.

B. Contractor shall coordinate underground utility location prior to beginning demolition work. Contractor is responsible for verifying location of underground utilities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 UTILITY SERVICES

A. Utility requirements: Locate, identify, disconnect, and seal or cap off indicated utility services where indicated.

1. Arrange to shut off indicated utilities with utility companies.

3.2 PREPARATION

A. Install erosion and sediment control measures, as specified in Section 31 25 00 – Erosion and Sediment Controls, prior to demolition.

B. Install site protection fencing, as specified in Section 01 50 00 – Temporary Facilities & Controls, prior to demolition.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, driveways, and other adjacent occupied and used facilities.

   1. Do not close or obstruct roads, or other adjacent occupied or used facilities without permission from the CO and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

D. Conduct demolition operations to prevent injury to people and damage to facilities to remain. Ensure safe passage of people around demolition area.

   1. Erect temporary protection, such as walks, fences, and railings, where required by Contracting Officer.
   2. Protect existing improvements, appurtenances, and landscaping to remain.
   3. Erect protective fencing around drip line of individual trees or around perimeter drip line of groups of trees to remain according to requirements specified in Section 31 10 00 – Site Clearing.
   4. A vertical sawcut shall be made between any existing pavement that is to remain and the portion to be removed. Where sawcutting is required, the sawcut shall be a minimum of 3 inches deep. When the existing pavement is more than 3 inches thick, the portion below 3 inches may be broken after the sawcut is made.

3.3 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

   1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.

   2. The Contractor shall be responsible for ensuring that special precautions are undertaken during sawcutting operations. No concrete (asphalt or cement) or concrete by-products are to be discharged into any storm drain or surface water. Sawcutting operations will increase the pH of water, therefore filtering is not acceptable.

B. Remove and transport debris in a manner that will prevent spillage on site improvements or public roads.

3.4 DEMOLITION

A. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of existing surfaces and construction shown on the plans with soil materials according to requirements specified in Section 31 20 00 – Earth Moving.

B. Damages: Promptly repair damage to adjacent facilities caused by demolition operations.

3.5 DISPOSAL AND RECYCLING OF DEMOLISHED MATERIALS

A. Promptly dispose of or recycle demolished materials: If recycling requires additional time to accomplish, provide for orderly storage of materials. Comply with the waste management requirements in Division 01.

B. Transport demolished materials off Park property and legally dispose or recycle material.

END OF SECTION 02 41 13

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 01 40 00 “Quality Requirements” for materials testing and inspection during construction, including the “Statement of Structural Tests and Special Inspections”.
2. Section 31 23 16 “Structure Excavation and Backfill”.
3. Section 32 13 20 “Site Concrete” for concrete curbs, walks, and similar exterior site work.

1.2 TOLERANCES

A. Formwork, reinforcement fabricating and placing, and cross-section dimension: ACI 117.

1.3 REGULATORY REQUIREMENTS

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 301 – Standard Specifications for Structural Concrete.

1.4 SUBMITTALS

A. Product data: for each type of product used.

B. Reinforcing steel shop drawings:

1. Complete drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. The steel reinforcement detailer shall generate all shop drawing bending and installation details from the contract drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.
2. Shop drawing re-submittals shall clearly identify all revisions to previous submittals. Provide heavy ink clouded outlines (revision clouds) around revised areas of individual sheets. Information outside of revision clouds on resubmitted drawings will not be reviewed.

C. Mill Test Reports:

1. Reinforcing Steel
2. Cement

D. Manufacturer's Certificates:

1. Aggregate
2. Cementitious materials
3. Air-entraining admixture
4. Chemical admixtures, including chloride ion content
5. Expansion joint filler

E. Concrete mix design.

1. Mix identification number
2. Proportions of mix or mixes, including cement, admixtures, weight of fine and coarse aggregate per cubic yard measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and consistency of each cylinder in terms of slump
3. Compressive strength:

    a. Identify the 28-day mix design compressive strength
    b. Provide certified test data or trial batch test reports indicating mix can meet the design compressive strength.

        1) Certified test data shall include:

            a) Date of mixing: tests shall have been within 1 year of the proposed use of the concrete.
            b) Weight, type, and source for each ingredient
            c) Slump
            d) Air content
            e) Concrete age at the time of testing
            f) Compressive strength for each cylinder tested: 90 percent or more of at least 20 consecutive tests shall exceed the compressive strength and none of the test results shall be less than 95 percent of the design compressive strength
            g) Standard deviation analysis

4. Aggregate Gradation: Submit primary aggregate nominal sizes. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, submit the gradation and proposed proportions of each size combined mathematically to show 1 proposed gradation. Show the percentage passing for each applicable sieve size.
5. Cementitious Materials
6. Admixtures
7. Water

F. Qualification data:

1. Manufacturer qualifications:

    a. Firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

2. Testing agency qualifications:

a. An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Conform to ACI 304.

B. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

C. Weighmaster Certificate: Submit a weighmaster certificate as an informational submittal with each load of concrete delivered to the job site. The weighmaster certificate must show:

1. Mix identification number
2. Nonrepeating load number
3. Date and time the materials were batched
4. Total quantity of water held back from the batch plant for the mix design, if adding water at the site. Do not add more water than held back.
5. For transit-mixed concrete, the revolution counter reading at the time the truck mixer is charged with cement.
6. Actual scale weights, in pounds, for the ingredients batched. Do not substitute theoretical or target batch weights for actual scale weights.

D. Steel reinforcement: deliver, store, and handle steel reinforcement to prevent bending and damage. Prevent earth, ice, oil and other foreign materials that would reduce bond to concrete from coating reinforcement.

1.6 APPLICABLE PUBLICATIONS

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

B. American Concrete Institute (ACI):

117-10 ..... Specifications for Tolerances for Concrete Construction and Materials and Commentary
211.1-91(R2009) ..... Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
214R-11(R2019) ..... Guide to Evaluation of Strength Test Results of Concrete
301-16 ..... Specifications for Structural Concrete
304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete
305.1-14 ..... Specification for Hot Weather Concreting
306.1-90(R2002) ..... Standard Specification for Cold Weather Concreting
308.1-11 ..... Specification for Curing Concrete
318-22 ..... Building Code Requirements for Structural Concrete and Commentary
347R-14 ..... Guide to Formwork for Concrete
SP-66-04 ..... ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
A135.4-2012 .....Basic Hardboard

D. ASTM International (ASTM):
A615/A615M-20 .....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A653/A653M-20 .....Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
A706/A706M-16 .....Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
C31/C31M-19a .....Standard Practice for Making and Curing Concrete Test Specimens in the field
C33/C33M-18 .....Standard Specification for Concrete Aggregates
C39/C39M-20 .....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C143/C143M-20 .....Standard Test Method for Slump of Hydraulic Cement Concrete
C150C150M-20 .....Standard Specification for Portland Cement
C171-16 .....Standard Specification for Sheet Materials for Curing Concrete
C172C172M-17 .....Standard Practice for Sampling Freshly Mixed Concrete
C173/C173M-16... .....Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-19 .....Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
C260/C260M-10a(2016) .....Standard Specification for Air Entraining Admixtures for Concrete
C309-19 .....Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
C494/C494M-19 .....Standard Specification for Chemical Admixtures for Concrete
C618-19 .....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
D1751-18 .....Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
D4263-83(2018) .....Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

E. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008

F. U. S. Department of Commerce Product Standard (PS):
PS 1-07 .....Structural Plywood
PS 20-20 .....American Softwood Lumber Standard

PART 2 – PRODUCTS

2.1 FORMS

A. Plywood: PS-1 Exterior Grade B-B (concrete-form) 5/8 inch, or 3/4 inch thick for unlined contact form. B-B High Density Concrete Form Overlay optional. Furnish in largest practicable sizes to minimize number of joints.

B. Chamfer strips: Wood, metal, PVC or rubber strips, 3/4 by 3/4 inch. 3/4 inch radius may be substituted.

C. Form Lining:

1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side.
2. Plywood: Grade B-B Exterior (concrete-form) not less than 1/4 inch thick.
3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

D. Form-release agent: commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties with a minimum working strength of 3000 pounds when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 3/4 inch diameter, or a depression in exposed concrete surface, or leave metal closer than 1 1/2 inches to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent. Do not exceed more than 25 percent total cementitious content by weight.

C. Slag cement: ASTM C989, Grade 100 or 120.

D. Silica fume: ASTM C1240, amorphous silica.

E. Coarse Aggregate: ASTM C33.

1. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

F. Fine Aggregate: ASTM C33.

G. Mixing Water: Fresh, clean, and potable. Do not add water at the site that is not specifically held back at the batch plant.

H. Admixtures:

1. Provide admixtures to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.
2. Admixtures of any type shall not be used unless identified in the approved mix design.
3. Water Reducing Admixture: ASTM C494, Type A.
4. Retarding Admixture: ASTM C494, Type B.
5. Water Reducing, Retarding Admixture: ASTM C494, Type D.
6. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F.
7. High-Range Water-Reducing and Retarding Admixture: ASTM C494, Type G.
8. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
9. Air Entraining Admixture: ASTM C260.
10. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
11. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
12. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Epoxy Coated Reinforcing Bars: ASTM A775.

L. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

M. Expansion Joint Filler: ASTM D1751.

N. Sheet Materials for Curing Concrete: ASTM C171.

O. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315.Compound shall be compatible with scheduled surface treatment and shall not discolor concrete surface.

P. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.

Q. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

2.3 CONCRETE MIXES

A. Mix Designs:

1. Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
2. Provide concrete with a 28-day compressive strength of 4000 psi unless otherwise noted in the Plans.

B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify the CO immediately when change in source is anticipated.

1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.

C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of the CO or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same.

D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with maximum of 25 percent replacement by weight in all structural work. Increase this replacement to 40 percent for mass concrete and reduce it to 10 percent for drilled piers and caissons. Fly ash shall not be used in high-early mix design.

Table I – Cement and Water Factors For Concrete

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. psi	Min. Cement lbs/c. yd	Max. Water Cement Ratio	Min. Cement lbs/c. yd	Max. Water Cement Ratio
4,000psi	580	0.48	630	0.45

1. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II – MAXIMUM SLUMP, INCHES

Type of Construction	Slump (Normal Weight Concrete)
Reinforced Walls	6 inches

F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 9 inches. A high-range-water-reducing admixture may be added to increase the slump to the approved level.

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

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

Nominal Maximum Size of Total Coarse Aggregate	Percentage Air Content by Volume
3/8 in	6 to 10
1/2 in	5 to 9
3/4 in	4 to 8
1 in	3.5 to 6.5
1 1/2 in	3 to 6

H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

I. Lightweight structural concrete shall not be used on this project.

J. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

K. Durability: Use air entrainment for exterior exposed concrete and buried concrete within 1 foot of finished grade.

L. Enforcing Strength Requirements: Test as specified in Section 01 40 00 “Quality Requirements”, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 500 psi below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, the CO may require any one or any combination of the following corrective actions, at no additional cost to the Government:

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

M. If early strengths tests are desired by the Contractor, the Contractor shall be responsible for determining the number of additional test specimens and testing times and frequency at no additional cost to the Government. The Contractor shall notify the CO about the plan for early strength test specimens prior to pouring concrete.

2.4 BATCHING AND MIXING

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

Atmospheric Temperature	Minimum Concrete Temperature
30 degrees to 40 degrees F	60 degrees F
0 degrees to 30 degrees F	70 degrees F

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the CO for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise the CO.

PART 3 – EXECUTION

3.1 FORMWORK

A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.

1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the CO approves their reuse.
2. Provide forms for concrete footings unless the CO determines forms are not necessary.
3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

B. Treating and Wetting: Treat or wet contact forms as follows:

1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
3. Use sealer on reused plywood forms as specified for new material.

C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.

D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 6 inches apart.

E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 8 inches on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 6 inches above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 18 inches on center.

1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

G. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by the CO. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the CO, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

H. Construction Tolerances:

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

3.2 PLACING REINFORCEMENT

A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.

B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.

1. Place reinforcing bars accurately and tie securely at intersections and splices with 16 gauge black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 12 inches in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 6 inches in slabs on grade.
3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.

C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 1 inch or 1-1/3 times maximum size of coarse aggregate.

D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:

1. Lap splices: Do not use lap splices for bars larger than Number 11. Minimum lengths of lap as shown.
2. Welded splices: Not allowed unless otherwise approved by the CO.
3. Mechanical Splices: Not allowed unless otherwise approved by the CO.

E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the CO. Do not field bend bars more than once.

F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose, flaky rust, mud, oil, or similar coatings that will reduce bond.

G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 CONSTRUCTION JOINTS

A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 80 feet in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 24 hours to elapse between pouring adjacent sections unless this requirement is waived by the CO.

3.4 EXPANSION JOINTS AND CONTRACTION JOINTS

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

3.5 PLACING CONCRETE

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by the CO before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles. Intentionally roughen to 1/4” amplitude.

1. Preparing surface for applied topping:

a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
b. Broom clean and keep base slab wet for at least four hours before topping is applied.
c. Use a thin coat of one-part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of the CO.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
6. On bottom of members with severe congestion of reinforcement, deposit 1 inch layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

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

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.
3. Provide at least one backup vibrator on the project site prior to each concrete pour. Ensure primary and backup vibrators are functional prior to each concrete pour. If multiple vibrators are used during the pour, one of the in-use vibrators may be considered the backup if the remaining pour can be accomplished with the loss of one vibrator.

3.6 HOT WEATHER

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

3.7 COLD WEATHER

A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05

percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the CO.

3.8 PROTECTION AND CURING

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by the CO.

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

3.9 REMOVAL OF FORMS

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.10 CONCRETE SURFACE PREPARATION

A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.

B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement

mortar for patching of same composition as that used in concrete. Use white or gray Portland cement and specified color admixture as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 1 inch. Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 6 inches surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one-part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.11 CONCRETE FINISHES

A. Concrete Retaining Wall:

1. Unfinished areas: For faces and open faces more than 1 foot below finished ground surface, apply Surface Finish SF-1, per ACI 301-20 as follows:
   (a) Patch voids larger than 1-1/2 in. wide or 1/2 in. deep
   (b) Remove projections larger than 1 in.
   (c) Tie holes need not be patched
   (d) Surface tolerance Class D as specified in ACI 117
2. Exposed faces and faces less than 1 foot below finished ground surface: Apply Surface Finish SF-2 as follows:
   (a) Patch voids larger than 3/4 in. wide or 1/2 in. deep
   (b) Remove projections larger than 1/4 in.
   (c) Patch tie holes
   (d) Surface tolerance Class B as specified in ACI 117
   (e) Follow color matching procedure described in 3.10B, this section.

3.12 RETAINING WALLS

A. Use air-entrained concrete.

B. Expansion and contraction joints, and reinforcement installed and constructed as shown.

C. Place backfill as shown and required by the Geotechnical report.

D. Meet general concrete requirements unless shown or specified otherwise.

END OF SECTION 03 30 00

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing trees.
3. Clearing and grubbing.
4. Surface material, weedy scrape, and organic material.
5. Disposal of material from clearing, grubbing, thinning and demolition in approved off-site disposal areas.
6. Filling of voids and excavations resulting from the work.

B. Related Sections:

1. Section 01 57 23 “Under-an-Acre Pollution Prevention”
2. Section 02 41 13 “Selective Demolition”
3. Section 31 20 00 “Earth Moving”

1.2 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain on the Owner's property, cleared materials shall become Contractor's property and shall be removed and disposed of legally. When possible, the Contractor should re-use or sell materials generated by Site Clearing such as timber, firewood, or wood chips.

1.3 SITE CONDTIONS

A. Site conditions existing during the bidding period will be maintained by the government insofar as practical.

B. Actual site condition variations that differ from those of the bidding period and which affect site clearing operations shall be brought to the attention of the Contracting Officer (CO) prior to the commencement of any site work.

1.4 SUBMITTALS

A. The Contractor shall submit the following information to the CO for review before commencing work:

1. Permits for transport and disposal of debris.
2. Demolition procedures and operational sequence.

B. Product Data: Tree protection fencing.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Tree protection fencing shall be an orange plastic web fence, 4 feet high minimum. Wood stakes shall be six (6) foot long by 1 inch by 1 inch square driven a minimum of two (2) feet into the ground. Posts shall be spaced eight (8) feet on center, maximum.

PART 3 - EXECUTION

3.1 PROTECTION

A. The Contractor shall flag the limits of clearing shown on the drawings by accurate field survey with marked stakes or other means acceptable to the CO. Trees to be removed and trees to remain shall be clearly identified during this staking process. The CO shall be notified a minimum of five (5) working days prior to scheduled commencement of clearing operations to review the flagged limits. Adjust the clearing limits as directed by the CO.

B. Install erosion-control measures prior to start of any other construction to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and roadways in accordance with Section 01 57 21 – Under-an-Acre Pollution Prevention.

C. Before clearing begins, protect designated trees to remain with tree protection fencing to the approximate diameter of foliage (dripline of the tree) to prevent damage to the trunk, foliage and root system by construction equipment and procedures.

D. Place tree protection fencing as required to protect other plants, adjacent property areas to remain uncleared, monuments, and existing improvements from damage.

E. The Contractor shall repair or replace immediately any damage to existing trees or root systems that are to remain. The Contractor shall employ an arborist licensed in the State of Washington to determine the repair and replacement needs and methods for approval by the CO.

F. Replace damaged shrubs and other vegetation designated to remain with the same size and species.

G. The tree protection fencing shall be maintained for the duration of construction operations. The work shall include immediate replacement of any damaged fence. Fencing shall be removed from the site at the completion of construction operations. The fencing disposal shall be in accordance with local, state, and federal laws and regulations for the disposal of the material.

3.2 UTILITIES

A. Notify all corporations, companies, individuals, or local authorities owning or having jurisdiction over utilities running to, through, or across areas to be affected by site clearing operations.

B. Call 811 to locate existing underground utilities in the project area. Locate and identify existing utilities that are to remain and protect them from damage.

C. For utilities to be disconnected, have utility services disconnected in accordance with the requirements of the utility owner.

3.3 CLEARING AND GRUBBING

A. Clearing shall include cutting, removal, and off-site disposal of trees, bushes, shrubs, stumps, fallen timber, brush, refuse, trash, fencing and other incidental materials not required for reuse on the site.

B. The Contractor shall grub the area within the clearing limits to completely remove stumps and root systems, except for those to remain. Stumps and roots of trees to be removed that are within soil prep areas may remain.

C. Depressions, excavations and voids resulting from the removal of stumps or roots shall be filled with suitable material and compacted as specified under Section 31 20 00 – Earth Moving.

3.4 DISPOSAL

A. Remove all material resulting from site clearing and demolition operations from site.

B. No burning of any material will be allowed.

END OF SECTION 31 10 00

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for trails, curbs, drive and parking.
2. Subbase and base course for trails, guardrail, and concrete curbs.
3. Subbase and base course for asphalt paving.
4. Excavating and backfilling for utility trenches.
5. Topsoil salvage and replacement in areas as shown.

B. Related Sections include the following:

1. Section 01 57 13 “Under-an-Acre Pollution Prevention”
2. Section 03 30 00 “Cast-in-Place Concrete”
3. Section 31 10 00 “Site Clearing”
4. Section 31 25 00 “Erosion and Sediment Control”
5. Section 32 12 16 “Asphalt Paving”
6. Section 32 13 20 “Site Concrete”

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: The layer or layers of specified material placed on a subbase or subgrade to support a surface course.

C. Bedding Material: Granular material placed over the excavated subgrade in a trench above and below a pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Earth Grade: The elevation of the completely graded roadway before placing the pavement structure.

F. Engineered Fill: Clean, crushed, granular material that will support structures. Structural fill material will be material that is considered an all-weather fill material.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by CO. Unauthorized excavation, as well as remedial work directed by CO, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Pavement Structure: All combinations of subbase, base course, and surface course, including shoulders, placed on a subgrade.

J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency, according to ASTM D 1586.

K. Scarification: The tilling or ripping of the soil across the ground surface using farming or construction equipment. The purposes of this treatment are to loosen and mix the soil profile in order to improve infiltration, reduce stratification of soil layers, and where present, reduce any compaction that may have occurred due to construction activities or previous surface treatments.

L. Structures: Buildings, footings, foundations, retaining walls, curbs, or other man-made stationary features constructed above or below the ground surface.

M. Subbase Course: The layer of specified material placed on the subgrade as a part of the pavement structure.

N. Subgrade: The portion of the earth grade upon which the pavement structure is placed.

O. Topsoil Replacement: Reconstruction of the shallow (typically 12-inch) rooting zone by replacing topsoil removed from the site prior to construction and replacing the topsoil after site grading.

P. Utilities: On-site underground pipes, conduits, ducts, and cables.

Q. Earthwork Terminology: Terms used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM D653.

R. Embankment: Soil or soil-rock material placed to raise the subgrade or natural grade of the site for embankment construction.

S. Native Soil: Sand or silt naturally occurring on site that was never imported to the site, is weed free, and supports local native habitats.

T. Unsuitable Material: Excavated material or material below the natural ground surface in embankment areas or below subgrade elevation in excavated areas, which is unsuitable for its planned use as determined by the Contracting Officer. Unsuitable material is further defined as material determined to be:

1. Of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content.
2. Too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the Work.
3. Not meeting requirements specified in Part 2 of this Section.

4. Otherwise unsuitable for the planned use.

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable.

Q. Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of fill materials as compacted in the field to the maximum dry density of the same material.

R. Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.

1.3 LAWS AND REGULATIONS

A. Work shall be accomplished in accordance with regulations of local, township, county, state and federal agencies or utility company standards as they apply.

1.4 SUBMITTALS

A. Delivery Tickets: Submit a delivery ticket with each load of imported material delivered to the site, stating the type of fill material, source, and the quantity.

B. Product Data: For the following:

1. All aggregates proposed for use.
2. Import fill.
3. Filter fabric.

C. Material Test Reports: The Contractor shall conduct testing at their own expense for material testing of material that does not come from a pre-approved quarry. The test information shall be provided to the CO for approval prior to material import. Material test reports shall be from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and import soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each on-site and import soil material proposed for fill and backfill.

D. Compaction test results.

E. Pre-excavation Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

F. Cast-in-Place Concrete Wall Excavation and Backfill Plan: Reference the available subsurface data provided in the geotechnical report prepared for this project.

1. Construction sequence
2. Excavation equipment and lift limits

1.5 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

B. Tolerances:

1. Construct finished subgrades to plus 0 or minus 1/2-inch of the elevations indicated.
2. Construct finished grade of slopes not steeper than 2:1 plus or minus 1/2 inch and on slopes steeper than 3:1 plus or minus two inches (2″).
3. Maintain the moisture content of fill material as it is being placed within plus or minus 2% of the optimum moisture content of the material as determined by the laboratory tests herein specified.

C. Topsoil Replacement

1. Grades: Inspect to verify rough grading is within +/- 0.1 foot of grades indicated and specified.
2. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the CO.
3. Surface Grade: Remove weeds, debris, and clods. Dispose of accumulated debris in accordance with the requirements for Green Waste in Section 01 74 19 – Construction Waste Management and Disposal. Any rocks larger than 8" shall be stockpiled to be replaced on site after topsoil replacement.
4. Runoff: Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water. Ensure that all water will run off grades.

1.6 PROJECT CONDITIONS

A. A geotechnical engineering evaluation has been prepared by Terracon, dated September 1, 2023. This report is specifically not part of the Contract Documents but is available to bidders for informational purposes.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

D. Unfavorable Weather Conditions:

1. Excavating, filling, backfilling, and grading work shall not be performed during weather conditions that might damage or be detrimental to the condition of existing ground, in-progress work, or completed work. When the Work is interrupted by rain, freezing weather, or other conditions deemed unsuitable by the Project Representative, excavating, filling,

backfilling, and grading work shall not resume until the site and soil condition (moisture content) are suitable for compaction.

2. Subgrade shall be free from mud, snow, ice, and deleterious material when work is resumed.
3. Soil material that is too wet for compaction shall be left to drain, to be aerated and dried by disking and harrowing or other approved method until the moisture content of the area is uniform and within the specified limits.

E. Erosion Prevention: Protect stockpiles, ditches, embankments, filled, backfilled, and graded areas to prevent erosion until such time as permanent drainage and erosion control measures have been installed per the requirements of Section 01 57 23 – Under-an-Acre Pollution Prevention.

F. Control of Dust: Employ construction methods and means that keep flying dust to the minimum throughout the entire Contract period. It may include watering and sprinkling, or other approved methods at the construction site of such frequency that will satisfactorily control the dust caused by construction operations.

G. Control of Dirt: Promptly remove from existing roadways all dirt and other materials that have been spilled, washed, tracked, or otherwise deposited thereon by construction operations whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements, or create a traffic hazard.

H. Indicated locations of existing facilities and systems are approximate. Investigate and determine exact location and nature of utilities, facilities, and systems, and be solely responsible for damages caused by construction activities.

I. Excavation in areas that have or may have underground facilities:

1. Delineate with white paint, flags, or other methods the area to be excavated and contact Underground Location Service to request that facility owners mark the location of underground utilities.
2. Identify temporary survey markings using PINK colored markings in accordance with Underground Service alert requirements.
3. Facility owners will field mark approximate location and number of subsurface installations affected by excavation using the following colors:

    a. Safety RED – Electric power, distribution, and transmission installations, or municipal electric installations.
    b. High Visibility Safety YELLOW – Gas distribution and transmission installations, oil distribution and transmission installations containing or transporting dangerous materials, products, or steam.
    c. Safety Alert ORANGE – Telephone and telegraph installations, police and fire communication installations, and cable television installations.
    d. Safety Precaution BLUE – Water installations and slurry pipelines.
    e. Safety GREEN – Sewer installations.
    f. Do not use above listed colors for Contractor’s temporary markings suck as survey points; use U.S.A. designated PINK color.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General fill for uses not otherwise specified:

1. On-site borrow.
2. Fill must be free of rocks or lumps in excess of 6 inches in diameter, trash, debris, roots, vegetation, or other deleterious material.

B. Structure backfill (for concrete retaining walls):

1. Structure backfill must be non-expansive and free of organic or other unsatisfactory material.
2. Structure backfill compacted to a relative compaction of at least 95 percent and material placed behind retaining walls must have a sand equivalent value of at least 20 and comply with the following gradation requirements:

Sieve Size	Percentage Passing
3”	100
No. 4	35-100
No. 30	20-100

C. Permeable aggregate for retaining wall back drain: Open-graded, clean, crushed rock or angular gravel; nominal size ¾” or less.

D. Select permeable aggregate subdrain for wall:

1. Class 2 Permeable Material complying with the following gradation requirements:

Sieve Size	Percentage Passing
1”	100
3/4”	90-100
3/8”	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

E. Aggregate for Base Course:

1. Class 2 Aggregate Base complying with the following gradation requirements:

Sieve Size	Percentage Passing
2”	100
1-1/2”	90-100
¾”	50-85
No. 4	25-45
No. 30	10-25
No. 200	2-9

2.2 FILTER FABRIC

A. Fabric shall be permeable and nonwoven

B. Fabric shall be manufactured from one of the following:
   1. Polyester
   2. Polypropylene
   3. Combined polyester and polypropylene

C. Treat fabric to resist degradation from exposure to sunlight. Furnish geosynthetics in covers to protect against damage from moisture, sunlight, and shipping and storage.

D. Fabric shall have the following properties:

Quality Characteristic	Test Method	Requirement
Permittivity (min, sec^{-1})	ASTM D4491	0.5
Apparent opening size, average roll value (max, US standard sieve size)	ASTM D4751	40
Grab breaking load, 1-inch grip, in each direction (min. lb)	ASTM D4632	157
Apparent elongation, in each direction (min, percent)	ASTM D4632	50
Puncture strength (min, lb)	ASTM D6241	310
Trapezoid tearing strength (min, lb)	ASTM D4533	56
UV resistance, retained grab breaking load, 500 hours (min, percent)	ASTM D4355	70

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation for earthwork operations including removal of vegetation, topsoil, debris, and obstructions, from ground surface is specified in Section 31 10 00 – Site Clearing.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust.

D. Topsoil Salvage

   1. Remove vegetation prior to stripping of topsoil.

   2. Limits of topsoil stripping shall be verified with the CO prior to removal.

E. Clear site of vegetation, surface obstructions (e.g., pavements, aggregate, base, etc.), rubble and debris, abandoned utilities, and other deleterious materials.

3.2 STAKING AND GRADES

A. Layout the work, establish all necessary markers, benchmarks, grading stakes, and other stakes as required, in accordance with the lines and grades of the Plans.

B. Obtain approval for the staking of grading limits prior to excavation operations.

3.3 UTILITIES

A. Verify on site the location and depth (elevation) of all existing utilities and services before performing any excavation work. Use the 811-call utility service and other means required to verify locations.

B. Active utility lines encountered, which are not indicated in the Contract Documents, shall be reported immediately to the Contracting Officer and utility owners involved. The Contracting Officer and utility authorities shall be permitted free access to determine the measures deemed necessary to repair, relocate, or remove the utility.

C. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.4 EARTHWORK GENERAL REQUIREMENTS

A. Erosion Protection: Prevent erosion of the site and turbidity in adjacent waterbodies of the site at all times. Conform to all the requirements as per Section 01 57 23 “Under-an-Acre Pollution Prevention” and Section 31 25 00 “Erosion and Sediment Controls”.

B. Construction Traffic: Protect exposed soil layers with high moisture content from excessive wheel loads.

C. On-Site Excavation:

1. Do not excavate or remove any material from the project site which is not within the designated excavation.
2. The Contractor is responsible for retaining enough excavated material for reuse for any actions and for disposing excess material off-site.
3. Soil characteristics may be variable and should be further reviewed and possible tested by the Contractor’s geotechnical engineer prior to re-use on site.

D. Disposal of Surplus Material:

1. Excess earth materials, unsuitable materials, and debris shall be removed from the site and disposed of in a legal manner. The Contractor is to provide the CO with copies of the documentation for the legal disposal of materials.

E. Maintenance of Excavations, Slopes, and Embankments:

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Maintain slopes and embankments until final completion and acceptance of the Work. Promptly repair slides, slipouts, washouts, settlements, and subsidence that occur for any reason, and refinish the slope or embankment to the indicated lines and grades.

F. Safeguarding of Walls: Heavy equipment and rollers shall not be operated within four feet (4′) of walls.

G. Dust and Dirt Control: Provide satisfactory control or remove dust and/or dirt at the project site and adjacent roadways whenever traffic or buildings that are occupied or in use, are affected.

3.5 ROUGH GRADING AND FILLING

A. Fill or backfill holes, swales, and low points that will not otherwise be removed in the course of the Work, to the indicated grades.

3.6 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Discharge locations shall be identified in a preconstruction submittal and approved by the CO. All discharge shall avoid turbidity or erosion into adjacent water bodies.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.7 EXPLOSIVES

A. Explosives: Do not use explosives.

3.8 EXCAVATION

A. The bottoms of excavations shall be level, firm, undisturbed earth, clean and free from loose material, debris, and foreign matter.

B. Protect existing structures during excavation.

C. Excavate to the lines and grades shown.

D. Support and maintain excavation so that sides are stable and will not move in accordance with the Excavation Rules and Regulations (29 Code of Federal Regulations, Part 1926) stipulated by the Occupational Safety and Health Administration.

E. Limits of excavations shall allow for adequate working space for installing forms, and as required for safety of personnel.

F. Excavation and its restoration, when conducted for convenience of the Contractor, shall be at no additional expense to the Owner.

G. Place excavated material at sufficient distance from edge of excavation so as not to cause cave-ins or bank slides, but in no case closer than three feet (3′) from the edge of excavations.

H. Condition excavated earth material that is suitable for backfill or embankment for re-use. Test, screen, and mix as necessary to meet specified requirements.

I. Footing excavations shall be free of any loose, soft, or disturbed material, and water prior to placement of reinforcing bars and concrete.

J. Remove any material that comes into an excavation from outside the excavation limits.

K. Obtain acceptance from the Contracting Officer of completed structure excavation prior to placing any concrete or reinforcement.

3.9 STRUCTURE EXCAVATION

A. General:

1. Remove any material that comes into an excavation from outside the excavation limits.
2. Obtain acceptance from the COR of the completed structure excavation prior to placing any concrete or reinforcement.

3.10 STRUCTURAL FILL SUBGRADE PREPARATION

A. The subgrade surface shall be free of any water, debris, organic, loose, soft, disturbed, or other deleterious material prior to placement of fill, reinforcing bars, and concrete.

B. If grading or excavation to the subgrade during construction reveal highly variable conditions within the foundation footprint, subgrade shall be over excavated and replaced with compacted engineered fill to achieve a uniform subgrade surface.

C. Native subgrade that is wet, unsuitable, or that has become loosened by the contractor’s operation shall be properly moisture conditioned and compacted or over-excavated and replaced with a suitable engineered fill. Caution should be exercised if compacting by means of proof rolling so as not to damage the subgrade.

D. Notify CO when excavations have reached required subgrade and before placing any fill material. If CO determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

E. For pavement, slab, structural fill, or foundation subgrade, any suitable material loosened during excavation or other activities prior to placement of structural fill, pavement or slab materials, or foundations shall be compacted.

F. If wet fine-grained soils are encountered at the subgrade, geotextile meeting the requirements of Caltrans Section 96-1.02D shall be installed prior to backfilling.

G. Where fill will be placed adjacent to an existing slope, steps shall be excavated into the existing slope to help “key” the new fill into the slope.

H. Structural fill shall be placed on firm, un-yielding subgrade prepared in accordance with these specifications.

I. Perform all cutting, blading, and shaping as required to cut and shape the subgrade to the grades and elevations indicated.

J. Subgrade preparation includes fine grading, reworking as necessary, and preparation of cut, fill, or embankment upon which structure and equipment foundations, pipe, base, and pavement will be placed.

K. The upper 8 inches of subgrade under pavements shall be moisture conditioned and compacted to at least 95 percent relative compaction and should be smooth and unyielding.

L. After the material has been thoroughly mixed and moisture-conditioned, accurately construct and fine grade the subgrade to indicated line, grade, and contour with high and low spots eliminated. Compact for full width to the specified density. Remove soft spots developed during working, fill with approved material, and re-compact.

M. If soil moisture conditions allow, after exposing the subgrade for pavement, slab, or structural fill, proof-rolling the subgrade with a loaded dump truck or other heavy wheeled vehicle to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5km/h).
2. Proof-roll with loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by CO and replace with compacted backfill or fill as directed.

N. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

O. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by CO, without additional compensation.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Temporary stockpiles shall be no higher than 5 feet.

3.12 BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place backfill in horizontal layers not to exceed 8 inches of loose material and compact each layer to at least 90 percent of maximum ASTM D1557 dry density before the next layer is placed.

C. Place backfill material in such a manner that unbalanced horizontal loads will not be applied to a newly placed structure or portion of a structure, utilities, or pipelines.

D. Do not backfill on or against structural concrete until the specified 28-day concrete strength has been attained.

E. Do not use compaction equipment and methods that produce excessive horizontal or vertical earth pressures.

F. Concrete Backfill: Place concrete backfill in drilled holes from the bottom of the hole to the elevation of the bottom of lagging.

3.13 STRUCTURE BACKFILL

A. General:

1. Place structure backfill in uniform layers. Bring backfill up uniformly on all sides of structures. Backfill layers must be at most 0.67 foot thick before compacting.
2. Do not use compaction equipment or methods that may cause excessive displacement or damage structures.
3. Do not place structure backfill until footings or other parts of the structure or facility are inspected by the COR and authorized for backfilling. Do not place backfill against the back of retaining walls until the concrete has attained a compressive strength of at least 2500 psi or the concrete has been in place for 28 days.
4. Any material placed outside the excavation pay limits shall comply with the material and compaction requirements of the adjacent structure backfill.

3.14 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Trenches shall be graded uniformly sloped between pipe elevations as shown on the drawings.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Place and compact initial backfill of pipe bedding material to a height of 6 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

F. Backfill and compact over excavations to ninety (90) percent relative compaction with bedding material. There shall be no additional payment to the Contractor for over excavations not directed by the CO. Remove unsatisfactory material encountered below the grades shown as directed by the CO and replace with bedding material. Payment for removal and replacements of such unsatisfactory material directed by the CO shall be made in accordance with the provisions of the General Conditions.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer for the parking lot/picnic area or trail before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in horizontal layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Fill compaction shall be verified by means of in-place density tests performed per ASTM D6938 (or appropriate alternative when ASTM D6938 is not suitable for the fill material) during fill placement so that compaction may be evaluated as earthwork progresses.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Fill Application	**Location**	**Minimum Compaction %**
Subgrade	Below fill, slabs, and walkways	90
	Below sidewalks and pavements	95
General Fill	Within 2 feet of finish grade for sidewalks and pavements	95
	In locations not already specified	90

Structure Backfill	Behind retaining walls	95
Aggregate base and subbase	Pavement section	95
Asphalt pavement	Pavement section	95

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase and base course to required crown elevations and cross-slope grades.
3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. The subgrade must be protected from other construction activities, traffic, and weather conditions. The subgrade will degrade and become unsuitable if the soil gets too wet or too dry. Construction activity and equipment of all types have the potential to disturb and negatively impact the prepared subgrade. The contractor shall implement suitable procedures to protect the subgrade, such as excavating without tracking on the native soils, use of a crushed rock or gravel-working mat, dewatering, soil admixing, geotextiles, or other suitable procedures during construction.

B. Pavement and foundation subgrade shall be maintained in a well-compacted state and protected from degradation prior to paving or placing concrete. Protection measures may include restricted traffic, perimeter drain ditches, or placement of a protective gravel layer on the subgrade. Disturbed or wet areas in the subgrade shall be removed and replaced with suitably compacted structural fill.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by CO; reshape and recompact.

E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it.

B. Disposal: Remove and legally dispose of all miscellaneous debris, trash, construction materials off Park property.

3.22 TOPSOIL

A. Stripping and Stockpiling

1. Prior to site grading, strip in-situ topsoil to the depth shown. Avoid over-excavation that mixes heavy subsoil with the excavated topsoil.
2. Stockpile salvaged topsoil in staging areas shown or as directed by CO. Coordinate stockpile location with CO.
3. Redirect any concentrated flow around stockpiles using an approved erosion control measure from the Under-an-Acre Pollution Prevention Plan required by Section 01 57 13.
4. Stockpiles shall be a maximum height of five feet and have a maximum side slope of 3H:1V.
5. Limits of stockpiles and stockpile protection shall be a minimum of ten feet from the dripline of any existing trees.

B. Protection

1. Stockpile Cover
   a. Cover any stockpiles to remain for longer than 3 months with erosion control matting following manufacturer's recommendations, or drawing details, whichever are more stringent.
   b. Upon reuse of topsoil, remove any undecomposed netting and recycle or dispose of according to the Construction Waste Management Plan.

2. Stockpile Perimeter Controls
   a. Install fiber rolls around each stockpile following manufacturer's recommendations or according to drawing details, whichever are more stringent.
   b. Once all topsoil has been reused, recycle or dispose of fiber rolls according to the Construction Waste Management Plan.
   c. Repair/replace perimeter controls and stockpile cover as needed to keep them functioning properly.

C. Topsoil Replacement

1. When the area to receive topsoil can be protected from further disturbance, but before replacing the stockpiled topsoil, scarify the at-grade subsoil to the depth shown.
2. Spread stockpiled topsoil to depth shown over the loose subsoil.
3. The final surface may be lightly firmed or leveled to achieve grade.

END OF SECTION 31 20 00

SECTION 31 25 00 – EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Perimeter erosion control.
2. Site erosion control.
3. Inlet protection.

B. Related Requirements:

1. Section 01 57 23 “Under-an-Acre Pollution Prevention”
2. Section 31 10 00 “Site Clearing”.
3. Section 31 20 00 “Earth Moving”.
4. Standard Specifications published by Department of Transportation (Caltrans), latest Edition.

1.2 SUBMITTALS

A. Product data for the following:

1. Silt fence.
2. Wattles.
3. Erosion control blanket.
4. Rock for temporary construction entrance.
5. Inlet protection.

PART 2 - PRODUCTS

2.1 GENERAL

A. To the extent feasible, use wildlife safe materials for erosion control products.

2.2 SILT FENCE

A. Posts shall be either wood or steel. Wood posts shall have minimum dimensions of 1 ¼ inches by 1 ¼ inches

B. Silt fence fabric must comply with the requirements shown in the following table:

Quality Characteristic	Test Method	Requirement
Grab breaking load, 1-inch grip in each direction, (min, lb)	ASTM D4632	120
Apparent elongation, in each direction (min, percent)	ASTM D4632	50
Water flow rate, average roll value, (min and max, gal per minute/sq ft)	ASTM D4491	100-150
Permittivity, (min, sec^{-1})	ASTM D4491	1.1
Apparent opening size, average roll value, (max, inches)	ASTM D4751	0.012
UV resistance, retained grab breaking load, 500 hours, (min, percent)	ASTM D4355	70

2.3 WATTLES

A. Wattles shall consist of cylinders of plant material such as wee-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased in netting made of natural plant fibers unaltered by synthetic materials. Wattles shall be a minimum of 8 inches in diameter. Netting material shall be clean, evenly woven, and free of encrusted concrete or other contaminating materials such as preservatives. Netting material shall be free from cuts, tears, or weak places and shall effectively perform the intended erosion control function until permanent vegetation has been established or for a minimum of 6 months, whichever comes first.

B. Stakes for wattles shall be made of wood from untreated Douglas fir, hemlock, or pine species.

2.4 EROSION CONTROL BLANKET

A. Erosion control blanket shall be Type B and made of 100% woven coir (coconut) fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by two natural nets.

B. Erosion control blanket must be designed for slope gradients of 1:1 (H:V) and must comply with the requirements shown in the following table:

Quality Characteristic	Test Method	Requirement
Roll width (min, inches)		72
Matrix (%) – Woven coir (coconut fiber)		100
USLE C-Factor for a 1:1 (H:V) unvegetated slope		$\leq$ 0.20
Shear stress (max, psf)	ASTM D6460	1.75
Tensile strength (min, psf)	ASTM D5035	75
Functional longevity (months)		12

2.5 TEMPORARY CONSTRUCTION FENCE

A. Type A rock complying with the requirements in the following table:

Square Screen Size (inches)	**Percentage Passing**	**Percentage Retained**
6	100	0
3	0	100

B. Class 8 RSP fabric.

2.6 INLET PROTECTION

A. Below Inlet Grate: Below Inlet Grate devices shall be prefabricated units specifically designed for inlet protection and shall remain securely attached to the drainage structure when fully loaded with sediment and debris, or at the maximum level of sediment and debris specified by the manufacturer.

B. Above Inlet Grate: Above Inlet Grate devices may be silt fence, sandbags, or prefabricated unit specifically designed for inlet protection. The device shall remain securely in place around the drainage structure under all conditions.

C. Inlet Grate Cover: Inlet Grate Cover devices shall be prefabricated units specifically designed for inlet protection and have the following features:

1. Be a sewn geotextile fabric unit fitted to the individual grate and completely enclosing the grate.
2. Have a built-in lifting device to allow manual access of the stormwater system.
3. Utilize an orange monofilament geotextile fabric.

PART 3 - EXECUTION

3.1 SILT FENCE

A. Silt fence shall be black in color. Silt fence shall be installed at locations show in the Plans. The geotextile shall be securely attached to the posts and support system.

B. Geotextile material shall meet the requirements of Section 2.2, above, and be sewn together at the point of manufacture, or at a location approved by the CO, to form geotextile lengths as required. All sewn seams and overlaps shall be located at a support post.

C. Posts shall not be located closer than 5 feet apart or further than 6 feet apart.

D. Place silt fence parallel with the slope contour. For any 50-foot section of temporary silt fence, do not allow the base elevation of the fence to vary by more than 1/3 of the height of the fence above the ground.

E. Place the bottom of the fabric in a 6-inch-deep trench.

F. Secure silt fence fabric with the posts placed on the downhill side of the fabric. A minimum of 4 staples shall be installed per post.

G. Backfill the trench with soil and compact by hand or mechanical methods to secure the fabric in the trench.

H. When sediment deposits reach approximately 1/3 the height of the silt fence, the deposits shall be removed and stabilized.

I. If trenching is not feasible due to rocky soils or not advisable due to proximity to a downslope sensitive area, a different sediment control device that does not require trenching shall be used in place of silt fence.

3.2 WATTLES

A. Wattles shall be installed as soon as construction will allow or when designated by the CO. Wattle installation and trenching shall begin from the base of the slope prior to any topsoil placement. Excavated material from trenching shall be spread evenly along the uphill slope and be compacted using hand tamping or other method approved by the CO. On gradually sloped or clay-type soils trenches shall be 2 to 3 inches deep. On loose soils, in high rainfall areas, or on steep slopes, trenches shall be 3 to 5 inches deep, or half the thickness of the wattle, whichever is greater.

B. Wattles shall be laid out, spaced, and staked as shown. If trenching and staking is not possible due to rocky soils, compost socks shall be used instead of wattles.

C. The Contractor shall exercise care when installing wattles to ensure the method of installation minimizes the disturbance of waterways and prevents sediment or pollution discharge into water bodies.

3.3 EROSION CONTROL BLANKET

A. Ensure subgrade has been graded smooth with no depressed voids.

B. Remove any obstructions from the ground such as tree roots, projecting stones, or other foreign matter greater than 1 inch in diameter.

C. Seeding and fertilizing shall be done prior to blanket installation.

D. Install erosion control blanket according to the manufacturer’s recommendations.

3.4 TEMPORARY CONSTRUCTION ENTRANCE

A. Grade the ground surface to a uniform plane with positive drainage.

B. Remove sharp objects that could damage the fabric.

C. Compact the top 18 inches of soil to at least a 90 percent relative compaction.

D. Position the fabric along the length of the entrance. Overlap the sides and ends of the fabric by at least 12 inches.

E. Spread rock over the fabric in the direction of traffic. The fabric shall be covered with rock within 24 hours of installation.

F. Maintain a 6-inch layer of rock over the fabric at all times.

G. Make repairs if fabric is exposed, depressions develop in the surface, or if rock is displaced.

3.5 INLET PROTECTION

A. Inlet protection shall be installed below or above, or as a prefabricated cover per manufacturer's recommendations at each inlet grate, as shown. Inlet protection devices shall be installed prior to beginning clearing, grubbing, or earthwork activities.

B. When the depth of accumulated sediment and debris reaches approximately ½ the height of an internal device or 1/3 height of the external device (or less when so specified by the manufacturers), or as designated by the Contracting Officer, the deposits shall be removed and stabilized on site. The Contractor shall immediately implement source control BMP adaptive management when accumulated sediment is observed within inlet protection to prevent further erosion and sedimentation impacts.

END OF SECTION 31 25 00

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Constructing minor asphalt pavement, hot mix asphalt (HMA) for parking areas, roadways, trails, and miscellaneous paving.
2. Furnish asphalt pavement mixture (pavement) composed of mineral aggregate, performance graded asphalt binder (PGAB), recycled asphalt, mineral filler, antistrip additives and, if applicable, manufactured warm mix asphalt (WMA) additive and/or WMA plant process modifications. Pavements must be mixed in a central mixing plant and placed on a prepared surface(s) in accordance with these specifications. Use an aggregate mix and asphalt binder of a quality conforming to those normally used and approved locally by either Federal or State agencies, within the last 12 months, for the type of work being constructed.
3. Apply an asphalt tack coat to contact surface of pavements, curbs, gutters, manholes, and other structures

B. Related Sections

1. Section 02 41 13 “Site Selective Demolition”
2. Section 31 20 00 “Earth Moving”
3. Section 32 13 20 “Site Concrete”
4. Section 32 17 00 “Paving Specialties”

C. Furnish asphalt pavement mixture (pavement) composed of mineral aggregate, performance graded asphalt binder (PGAB), recycled asphalt, mineral filler, antistrip additives and, if applicable, manufactured warm mix asphalt (WMA) additive and/or WMA plant process modifications. Pavements must be mixed in a central mixing plant and placed on a prepared surface(s) in accordance with these specifications. Use an aggregate mix and asphalt binder of a quality conforming to those normally used and approved locally by either Federal or State agencies, within the last 12 months, for the type of work being constructed.

1.2 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials

1. AASHTO M 320 - Standard Specification for Performance-Graded Asphalt Binder
2. AASHTO R 26 - Standard Practice for Certifying Suppliers of Performance-Graded Asphalt Binders
3. AASHTO R 35 – Standard Practice for Superpave Volumetric Design for Asphalt Mixtures
4. AASHTO T 84 – Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate

5. AASHTO T 85 – Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
6. AASHTO T-166 – Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens
7. AASHTO T 283 – Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
8. AASHTO T 308 – Standard Method of Test for Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
9. AASHTO T 312 – Standard Method of Test for Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor

B. ASTM - ASTM International, formerly known as American Society for Testing and Materials

C. FAR - Federal Acquisition Regulations

1. FAR 46.105 Contractor responsibilities
2. FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements
3. FAR 52.246-12 Inspection of Construction

1.3 SUBMITTALS

A. When operations affect traffic, traffic control shall be provided as specified.

B. Product Data for the following:

1. Asphalt, aggregate, asphalt binder, asphalt mix design. The job mix formula shall be submitted in writing by the Contractor at least 7 days prior to the start of paving operations. The submittal shall include design parameters and related specifications for the asphalt mix. Include copies of laboratory test reports that demonstrate the properties of the aggregates, asphalt binder, additives and mix meet the Federal or State agency requirements. Include the maximum specific gravity of the mix in accordance with AASHTO T209. Include State agency approvals for the mixing plant, or proof of conformance to AASHTO M156.

C. Results from tests described in Section 3.4.

1.4 QUALITY ASSURANCE

A. The provisions of FAR 52.246-12 Inspection of Construction shall apply.

B. Quality Control Plan (QCP): Comply with the requirements specified in Section 01 40 00 “Quality Requirements.”

C. Inspection – The minimum frequency for inspections shall be as shown in the approved QCP. The results and findings of QC inspections shall be documented on Inspector daily reports (IDRs).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Asphalt mixture deliveries shall be scheduled so that placing and compacting of pavement mixtures is continuous, with minimal stopping and starting of the paver.

B. Coordinate trucks dispatched from the plant to ensure that all asphalt mixtures delivered to the project is placed and compacted during daylight hours. Provide for reliable two-way radio or cellular phone communication between the project site and the plant.

C. Do not use or combine asphalt mixes produced from different plants unless they are produced using the same JMF, are materials from the same sources, and have been approved. Construct a separate control section for each plant from which production is intended.

D. The temperature range of the asphalt mixture when delivered to the project site will be established in the Contractor QCP utilizing the approved JMF. Monitor the temperature of the mixture for each load, in the haul vehicles, in the paver hopper or windrow, and behind the laydown. Use approved methods and instruments for measuring temperature. Record results on IDRs. Visually inspect the delivered asphalt mixture for crusting or segregation. Reject material that is crusted, segregated, or which is not within the delivery temperature range established in the Contractor QCP.

1.6 PROJECT CONDITIONS

A. Place HMA on a prepared dry, unfrozen surface when the air temperature in the shade is above 35ºF and rising for a minimum 2.1 inches: above 40°F and rising for minimum 1.5 inches; above 50°F and rising for less than 1.5 inches and, and the temperature of the road surface in the shade conforms to Table 1-4.

B. Place WMA on a prepared dry, unfrozen surface and only when weather conditions allow for proper production, placement, handling and compaction for the specific WMA technology used.

Table 1-4
HMA Placement Temperatures

HMA Placement Temperature Compacted Lift Thickness Road Surface Temperature ºF	**<2 Inches**	**2.1-3 Inches**	**>3.1 Inches**
	Minimum Lay-Down Temperature (1) ºF		
< 35	*(2)*	*(2)*	*(2)*
35 - 39.9	*(2)*	*(2)*	280
40 - 49.9	*(2)*	285	275
50 - 59.9	295	280	270
60 - 69.9	285	275	265
70 - 79.9	280	270	265
80 – 89.9	270	265	260
≥ 90	265	260	255

1. Never heat the asphalt mix above the temperature specified in the approved mix design.
2. Paving not allowed.

C. Rain and Surface Conditions:

1. Immediately cease transportation of asphalt mixtures from the plant when rain begins at the project.
2. Do not place asphalt mixtures while rain is falling, or when there is water on the surface.
3. Placing asphalt may continue, when the rain has stopped, and water has been removed from the tacked surface to the satisfaction of the CO and if the temperature of the asphalt meets the specification requirements.
4. Information regarding the air temperature, average wind speed, overcast conditions, mix delivery temperature, and existing moisture conditions shall be evaluated by the CO and a Contractor's representative located at the paving operation prior to placement.
5. The Contractor assumes responsibility for constructing the pavement to meet compaction, bonding to the underlying surface and specification requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. HMA shall be 3/4" Type A PG 64-10 unless noted otherwise on the drawings. HMA shall conform to the requirements below.

Quality Characteristic	Test Method	Requirement
Air voids content (%)	AASHTO T 269 [a]	$N_{initial} > 8.0$ $N_{design} > 4.0$ ($N_{design} = 5.0$ for 1-inch aggregate) $N_{max} > 2.0$
Gyration compaction (no. of gyrations)	AASHTO T 312	$N_{initial} = 8$ $N_{design} = 85.0$ $N_{max} = 130$
Voids in mineral aggregate (min, %) [b] Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch With NMAS = 1-inch With NMAS = 3/4-inch	MS-2 Asphalt Mixture Volumetrics	 16.5-19.5 15.5-18.5 14.5-17.5 13.5-16.5 13.5-16.5 14.5-17.5
Dust Proportion	MS-2 Asphalt Mixture Volumetrics	0.6-1.3
Hamburg wheel track (min number of passes at 0.5-inch rut depth), Binder grade = PG 64	AASHTO T 324 (Modified) [c]	15,000

Hamburg wheel track (min number of passes at the inflection point), Binder grade = PG 64	AASHTO T 324 (Modified) [c]	10,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283 [c]	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283 [c, d]	70

[a] Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity. Use AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Use a digital manometer and pycnometer when performing AASHTO T 209.
[b] Measure bulk specific gravity using AASHTO T 275, Method A.
[c] Test plant-produced Type A HMA.
[d] Freeze thaw required.

B. 3/4-inch Aggregate shall meet the following requirements:

Sieve Size	Percentage Passing	Allowable Tolerance
1″	100	--
3/4″	90-98	± 5
1/2″	70-90	± 6
No. 4	42-58	± 5
No. 8	29-43	± 5
No. 30	10-23	± 4
No. 200	2.0-7.0	± 2.0

C. Tack Coat

1. Use an Emulsified Asphalt. An equivalent anionic grade emulsion may be substituted for a cationic grade and vice versa. The sieve test in AASHTO M 140 and M 208 is not required.
2. Anionic emulsions: Conform to AASHTO M 140. For RS-1h and RS-2h, conform to AASHTO M 140 for RS-1 and RS-2, except conform to the following for the penetration on the residue: Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm min.
3. Cationic emulsions: Conform to AASHTO M 208. For CRS-1h and CRS-2h, conform to AASHTO M 208 for CRS-1 and CRS-2, except conform to the following for the penetration on the residue: Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm min.

D. Prime coat will not be required.

E. Superpave performance graded asphalt binders shall meet the quality conforming to those normally used locally by either Federal or State agencies for the type of work being constructed.

F. All other manufactured, non-project produced materials shall require Commercial Certification such as mineral filler, antistrip and WMA additives.

G. Recycled Asphalt Pavement (RAP) Material may be used as a component of the asphalt mixture as allowed by local or state agencies.

H. If WMA is proposed, use a WMA technology that has been approved by the state in which the project is being constructed. Provide evidence of the state approval.

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Provide mix design for HMA in accordance with the following requirements.

Type A HMA Production Testing Frequencies

Quality Characteristic	Test Method	Minimum Testing Frequency
Asphalt binder content	AASHTO T 308, Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day
Air voids content	AASHTO T 269	1 per 4,000 tons or 2 every 5 paving days, whichever is greater
Voids in mineral aggregate	MS-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project, whichever is greater
Dust proportion	MS-2 Asphalt Mixture Volumetrics	
Density of core	California Test 375	2 per paving day
Nuclear gauge density	California Test 375	3 per 250 tons or 3 per paving day, whichever is greater
Hamburg wheel track	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project, whichever is greater
Moisture susceptibility	AASHTO T 283	

Type A HMA Acceptance in Place

Quality Characteristic	Test Method	Requirement
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.30, +0.50
HMA moisture content (max, %)	AASHTO T 329	1.00
Air voids content at N_{design} (%) [a, b]	AASHTO T 269	4.0 $\pm$ 1.5
Voids in mineral aggregate on laboratory-produced HMA (min, %) [d] Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch With NMAS = 1-inch With NMAS = 3/4-inch	MS-2 Asphalt Mixture Volumetrics	 16.5-19.5 15.5-18.5 14.5-17.5 13.5-16.5 13.5-16.5 14.5-17.5
Voids in mineral aggregate on plant-produced HMA (min, %) [a] Gradation: No. 4	MS-2 Asphalt Mixture Volumetrics [c]	 15.5-18.5 14.5-17.5

3/8-inch 1/2-inch 3/4-inch 1-inch With NMAS = 1-inch With NMAS = 3/4-inch		13.5-16.5 12.5-15.5 12.5-15.5 13.5-16.5
Dust Proportion	MS-2 Asphalt Mixture Volumetrics	0.6-1.3 [g]
Density of core (% of max theoretical density) [e, f]	California Test 375	91.0-97.0
Hamburg wheel track (min number of passes at 0.5-inch rut depth), Binder grade = PG 64	AASHTO T 324 (Modified)	15,000
Hamburg wheel track (min number of passes at the inflection point), Binder grade = PG 64	AASHTO T 324 (Modified)	10,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283	70

[a] Prepare 3 briquettes. Report the average of 3 tests

[b] The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A.

[c] Determine bulk specific gravity under AASHTO T 275, Method A.

[d] The Engineer determines the laboratory-prepared Type A HMA value for only mix design verification.

[e] The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275 to determine in-place density of each density core
2. AASHTO T 209, Method A to determine theoretical maximum density instead of calculating test maximum density

[f] The engineer determines theoretical maximum density under ASSHTO T 209, Method A, at the frequency specified in California Test 375, part 5, section D.

[g] For lime-treated aggregates, the dust proportion requirement is 0.6-1.5.

2.3 EQUIPMENT

A. Hauling Equipment

1. Use vehicles with tight, clean, and smooth metal beds for hauling asphalt mixtures. Thinly coat the beds with an approved material such as a small amount of lime solution or an approved soap solution or detergent to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather and thermal segregation and during hauling on public roads.
2. When necessary to maintain temperature, use insulated truck beds and securely fastened covers pinned on the sides. Provide a minimum of two (2) access port or holes for checking

temperature of asphalt mix in the truck, located near the midpoint of the body, at least 12 inches above the bed. Provide access for checking temperature of asphalt mix in the truck.

B. Pavers: Use pavers that are:

1. Self-contained, power-propelled units with adjustable vibratory screeds with full width screw augers, and capable of placing the mix uniformly and in accordance with the drawings and specifications.
2. Do not use diesel or other petroleum products during paving operations as a release agent on any parts that come in contact with the mix.

C. Rollers – The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

1. The Contractor shall exercise caution when using vibratory rollers so as not to cause damage to buried infrastructure or adjacent infrastructure. Damage to buried or adjacent infrastructure will be the responsibility of the Contractor.

2.4 MIXES

A. Asphalt Mixture Production

1. Do not heat asphalt binder above 3500F unless approved by the manufacturer.
2. Weigh or meter aggregates, additives and asphalt binder material and introduce into the mixer in the proportions specified by the JMF.
3. Mix the combined materials until the aggregate are uniformly coated with asphalt binder and thoroughly distributed throughout the mixture.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall place Minor Asphalt Pavement at the locations, widths, thickness and to the grades shown.

B. Maintain all equipment in safe and satisfactory operating condition.

C. Protection and Restoration of Property and Landscape:

1. Protect adjacent work from contamination by paving materials and placement activities. Remove any stains or damage from adjacent work, structures, curbing, or other facilities, resulting from such contamination. Remove and dispose of all waste and spillage.
2. Do not damage or disturb existing improvements, facilities, features or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work.

4. Check frames, covers, grates, water valve boxes and other miscellaneous castings that are in the proposed pavement areas to ensure that they have been correctly positioned and set to the proper slope and elevation.

D. Provide alternate routes around closed or obstructed traffic ways.

E. Conduct paving operations in a manner to minimize interference with roads and used facilities. Do not close or obstruct roads or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

F. Where HMA is placed in areas not retained by curb faces, walls, and other vertical surfaces, the closed edges of the asphalt concrete shall be compacted to meet the same density requirements as the other asphalt surfaces.

G. Where a new asphalt surface joins an existing asphalt surface, tack coat shall be applied to the existing surface at the rate of 0.1 gallons per square yard. Fine building sand shall be swept into the joint to function as filler. Joints shall be trimmed to form near vertical surfaces and neat lines prior to asphalt placement.

3.2 PREPARATION

A. Notify the CO at least 14 days prior to beginning paving work. A prepaving conference will be scheduled at least 7 days prior to starting pavement placement. All CO, Contractor and supplier representatives critical to the paving operation will be required to attend this meeting. At this meeting be prepared to discuss work schedule, traffic control, proposed equipment to be used, production and placement quality control, final acceptance procedures and requirements, and any other elements critical to the successful execution of paving operations.

B. Preparation of the Underlying Surface

1. Prepare the underlying course prior to placement of the asphalt mixtures. Ensure that the surface to receive the asphalt mixture has been approved by the Contracting Officer (CO), is properly compacted and, when placing the asphalt mixture over existing pavement or other hard surfaces ensure that the surface is free from dust and debris or other deficiencies that might affect the quality of the final pavement course.
2. The Contractor shall furnish and set controls necessary to guide the paving equipment. Prevent damage by construction operations to gutters, catch basins, curbs, concrete structures, pavement surfaces and other facilities adjacent to the work. If damage occurs, repairs shall be made to the satisfaction of the CO at no additional cost to the Government.
3. Soil subgrades should be proof-rolled with a loaded dump truck or heavy compactor to verify density. Any areas of yielding subgrade disclosed during this proof-rolling operation should be over-excavated and replaced with a suitable structural fill material.
4. The upper 2 feet of soils underlying pavement section should be compacted to at least 95 percent, and all soils below 2 feet should be compacted to at least 90 percent (based on ASTM D-1557).
5. The subgrade and base course material shall be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557).
6. Contractor shall be responsible for protection of the subgrade.

3.3 CONSTRUCTION

A. Placement of Asphalt

1. Place all courses of pavement mixture with an asphalt paver or device approved by the CO.
2. On bridge decks or concrete pavement, remove excess crack and joint material by trimming the excess material flush with the pavement surface prior to placing the pavement mixture.
3. Remove all excess joint or crack material on any pavement surface in excess of 1/16 inch in depth prior to placing new pavement courses.

B. Prevent damage by construction operations to gutters, catch basins, curbs, concrete structures, pavement surfaces and other facilities adjacent to the work. If damage occurs, repairs shall be made to the satisfaction of the CO at no additional cost to the Government.

C. Tack coat will not be measured and paid for as a separate quantity but considered subsidiary to the work and included in the bid price for Minor Asphalt Pavement.

D. Transportation, Placing and Finishing

1. Verify the depth of each layer behind the laydown machine and adjust if the compacted thickness does not meet the specified thickness.
2. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 6 inches. The joint in the top layer shall be at the designed centerline of the pavement. Transverse joints in one layer shall be offset by at least two (2) feet from transverse joints in the previous layer.
3. The Contractor shall furnish, set, and maintain all line and grade stakes, string lines or other controls necessary to guide and control the paving equipment.
4. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to an internal temperature of 140°F (60°C) minimum.
5. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed using hand tools. Luting shall be performed in such a manner as to prevent segregation.

E. Asphalt Compaction; Furnish rollers of sufficient size, number and type, to support the production rate and meet compaction requirements.

F. Pavement Uniformity and Smoothness

1. Uniformity and Smoothness: The finished mat and surfaces of the pavement shall be smooth, dense and uniform in appearance, free from irregularities in contour and texture and shall present a smooth-riding surface.
2. Use a 10-foot metal straight edge to measure at right angles and parallel to the centerline. Defective areas are deviations between the surface and the bottom of the straightedge in excess of 0.25 inches, measured between any two contacts of the straightedge, or deviations in excess of 0.25 inches measured at the end of the straightedge.

3.4 FIELD QUALITY CONTROL

A. Quality Control Plan (QCP): Comply with the requirements specified in Section 01 40 00 "Quality Requirements."

B. Asphalt testing shall be performed by technicians with at least 2 years' experience with relevant testing, and who are certified by NICET Level II or equivalent local state DOT certification program. All testing equipment shall be properly functioning, calibrated within 6 months of use, and certified to meet ASTM and AASHTO standards. Provide evidence of all certifications, accreditations and calibrations to the CO.

C. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may require inspection, sampling and testing to verify conformance with contract requirements.

D. The Contractor shall sample and test the mix for all properties at a minimum frequency of one test per production day.

E. Placement temperature

1. Sample temperature of first load and as determined by the CO thereafter.
2. Sampling shall occur in hauling vehicle before dumping.

F. Density Testing

1. Take nuclear gauge density readings.

a. Density testing shall be in accordance with AASHTO T 166.
b. Sampling frequency shall be one per 100 tons.
c. Sample in-place after compacting.

G. Monitor the compaction process with nuclear density gauges and compact according to:

1. The lower specification limit is 91.0 percent of the maximum specific gravity (density) determined according to AASHTO T 166 and AASHTO T 209.

H. The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day.The mix and constructed pavement will be accepted by visual inspection, verifying conformance to contract requirements and industry standards for workmanship and materials. In addition, it will be accepted by testing as specified. At the sole discretion of the CO the Contractor's QC tests may be used for the purposes of acceptance.

1. Joint and mat density shall meet the Federal or State agency requirements for minor asphalt pavement applications. If none exists, the minimum longitudinal joint density shall be 91.0% of T 209 density and the minimum mat density of multiple tests shall be 92% of T 209 density.

3.5 ADJUSTING

A. Defective Area Correction

1. Correct defective areas at no additional cost to the Government. Either grind, mill a minimum of one half the pavement depth and fill with an approved asphalt mix, or cut and remove the pavement and repave with an approved asphalt mix. When correction by any other method is proposed, submit a proposal to the CO for approval.

END OF SECTION 32 12 16

SECTION 32 13 20 – SITE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and special concrete flatwork finish, for the following:

1. Concrete curbs.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete.

1.2 DEFINITIONS

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

B. Sand Finish Concrete Paving: For all flatwork and curbs, an even, lightly exposed finish.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Qualification Data: For manufacturer testing agency.

E. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.

10. Repair materials.

F. Joint Plan: Submit plan illustrating proposed locations of concrete joints.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

H. Field quality-control reports.

I. Colored Concrete Samples:

1. At least five weeks prior to placing concrete, cast and cure three test sections. Provide three separate concrete pads as test sections, with each pad containing 1 cubic yard of sample material. Construct the test sections at a location within the general vicinity as determined by the CO.
2. Each test section shall demonstrate concrete color and surface finish. Test sections shall be constructed using 0.5 lb and 1.0 lb of color admixture per 94 lbs of cement, in accordance with the requirements in this section.
3. In the event that NPS does not want the test panels to remain in place, remove and dispose of the test panels at no additional cost to the Government.

1.4 QUALITY ASSURANCE

A. Testing will be performed by an independent testing laboratory selected by the Contractor. All tests will be paid for by the Contractor.

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

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

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. The form-release agent shall be natural, organic, VOC compliant, and biodegradable.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. Cementitious Material

1. Cementitious Material shall meet the requirements of Caltrans Standard Specifications Section 90-1.02B.
2. Use one of the following cementitious materials, of the same type, brand, and source, throughout Project:

a. Combination of Type II or Type V Portland Cement and SCM.
b. Blended Concrete.

B. Silica Fume

1. ASTM C 1240, amorphous silica.

C. Aggregates

1. Aggregates shall be in accordance with Caltrans Standard Specifications Section 90-1.02C. Micro aggregate shall be sourced locally to approximate the appearance of the geology in the proximity of the work.

D. Water

1. ASTM C 94/C 94M and potable.

2.3 ADMIXTURES

A. Air-Entraining Admixtures must comply with ASTM C260.

B. Chemical Admixtures must comply with ASTM C494.

C. Color Admixture: Concentrated pigments specially processed for mixing into concrete and complying with ASTM C979.
1. Davis Colors, Outback 677 or equal.
2. Brand Name or Equal Salient Characteristics that an equal must meet are delineated below.
3. Physical: Color admixture made from metal or mineral oxides. Color additives containing carbon black are not acceptable.
4. Functional: Used in cast-in-place concrete structures, concrete paving and slabs, masonry mortar, shotcrete, and plaster.
5. Performance: Must be lightfast, alkali-resistant, and weather-resistant.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

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

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1 or 2, Class A or B.

2.5 RELATED MATERIALS

A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned based on laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Provide concrete with an ultimate strength of 4000 psi.
3. Air entrainment shall be between 4.5% min. and 7.0% max.
4. Use a locally-obtained sand to match the geology of the park location.

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

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

D. Concrete Surface Retarder and Finishing Aids.

1. Spray Applied, film forming top surface retarder designed for specific sized aggregates and finish requirements.

2.7 REINFORCING STEEL

A. Refer to Section 03 30 00 Cast-in-Place Concrete.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Use either fixed forms or slip forms.

B. Provide straight, full depth, un-warped forms that will resist springing during concrete placement.

C. Firmly stake fixed forms.

D. Construct forms tight enough to prevent loss of concrete mortar.

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

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

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

H. Form liners shall not be used for the final finish.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete shall be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Contracting Officer (CO).

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 REINFORCEMENT

A. Reinforcement: Place according to Section 03 30 00 – "Cast-in-Place Concrete".

3.5 JOINTS

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

3.6 CONCRETE PLACEMENT

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

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

temperatures.

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

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

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

3.7 FINISHING CONCRETE

A. All curbs and flatwork to receive sand finish using film-forming top surface retarder, designed for specific sized aggregates and finish requirements.

1. Soon after the final seal finish has been completed spray surface retarder using a low-pressure sprayer with a 0.5gpm tip at a rate of 200—350 sq./ft. per gallon in a full hiding coat.

2. Wash surface with water rinse using stiff brooms and water hose or by high pressure washing with power equipment as early as 4-16 depending on weather conditions. Retarder removal intervals are dependent upon strength of the concrete mix, aggregate size and desired washing techniques. Earlier washing on the light etches may be necessary.

B. See Section 03 30 00 for retaining wall finishing.

3.8 CONCRETE PAVING SAW-CUT JOINTS

A. All control joints and construction joints shall be saw-cut. Only isolation joints and expansion joints may have tooled joints. Saw-cutting shall employ a light walk-behind machine cutting to the width and depth shown on the plans. Joints shall be saw-cut as soon as the concrete is cured sufficiently to support a light walk-behind machine without marking the surface or within 4 hours unless approved by the CO. In no case shall concrete paving be left overnight without being saw-cut.

3.9 CONCRETE PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces to deter moisture loss due to hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

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

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

E. Cure concrete according to ACI 308.1, by the following method:

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

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173 volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Test results shall be reported in writing to CO, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by CO but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by CO. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by CO.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.12 INSPECTIONS

A. Accessibility Inspection: Accessibility inspection shall be performed by the Contractor in a two-part process to ensure compliance of final installation. The two-part process inspections shall

occur pre-installation and post-installation.

1. Pre-installation inspection shall examine slopes, dimensions, base materials and preparation work prior to concrete placement. Check formwork, embedded items, reinforcing, etc. Pre-installation work shall conform to National Park Service Accessible Route Design Standards.
2. Post-installation inspection shall examine completed concrete placement. Report non-compliance with ABAAS for running and cross slopes, landings, vertical changes in elevation, transitions, imperfections or flaws, improper drainage, slippery surfaces, and dimensional accuracy.

B. Contractor shall utilize the National Park Service CQC Accessibility Inspection Report as basis for recording findings. Any non-compliant conditions shall be documented. Supplement Report with digital images, notation, red-line drawings, sketches and dimensions, product literature, submittal, etc. to explain installed work. Submit completed Report to CO within 24 hours of commencing inspection.

END OF SECTION 32 13 20

SECTION 32 14 00 – UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Salvaged stone pavers set in mortar setting beds.

B. Related Requirements:

1. Section 32 13 20 “Site Concrete” for concrete base under unit pavers.

1.2 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at project site after existing stone paving units have been removed, but prior to formwork installation for the concrete base.

1.3 SUBMITTALS

A. Product Data:

1. Mortar and grout materials.
2. Materials other than water and aggregates.

B. Samples for Initial Selection:

1. Joint materials involving color selection.

C. Samples for Verification: For full-size unit paver, assemble no fewer than three samples of the following:

1. Joint materials.
2. Salvaged, prepared, and cleaned paving stones.

1.4 QUALITY ASSURANCE

A. Mockups: Build a minimum 10 square foot paving mockup to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

E. Store asphalt cement and other bituminous materials in tightly closed containers.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

    a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of joint material and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 STONE PAVERS

A. Pavers: Rectangular paving slabs salvaged, cleaned, and stored on site.

B. If quantity of salvaged stone paving slabs is insufficient mat new materials to the color, finish, and other aesthetic characteristics as closely as possible to existing/salvaged paving slabs.

2.3 MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144.

D. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

E. Water: potable.

2.4 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, made of white or gray cement and white or colored aggregate as required to produce color indicated.

1. Colored Mortar Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved, through testing and experience, to be satisfactory for use in portland cement grout.

B. Standard Cement Grout: ANSI A118.6, sanded.

C. Grout Colors: As selected by Contracting Officer from manufacturer’s full range.

D. Water: potable.

2.5 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.

C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

D. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.

E. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.

1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.

F. Packaged Grout: Proportion and mix according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Proof-roll prepared subgrade according to requirements in Section 31 20 00 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive concrete base.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. If adding new materials to salvaged materials, mix newly obtained stone slabs with salvaged pieces to produce a uniform blending of colors and textures. If using only newly obtained slabs, mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment, then hand-work to create a ‘rock face’ finish. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: Radial pattern to match that found on existing traffic circle. Set center of radial pattern at the center of traffic circle.

3.4 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.

E. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

F. Spaced Joint Widths: Provide1/2-inch (13-mm)] nominal joint width with variations not exceeding plus or minus 3/16 inch (4.5 mm)].

G. Grouted Joints: Grout paver joints complying with ANSI A108.10.

H. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

I. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

3.6 CLOSEOUT

A. Transport any excess salvaged pavers to stockpile location coordinated with the Contracting Officer.

END OF SECTION 32 14 00

SECTION 32 17 00 – PAVING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: This section covers the following:
   1. Pavement markings.
   2. Traffic signs.
   3. Stabilized aggregate surfacing.

B. Related Requirements:
   1. Section 32 12 16 – Asphalt Paving
   2. Section 32 13 20 – Site Concrete
   3. Standard Specification published by department of Transportation (Caltrans), latest Edition, Sections 82 and 84 and other sections as specified or applicable.
   4. California Manual on Uniform Traffic Control Devices (CA MUTCD), latest Edition.

1.2 SUBMITTALS

A. Submit material certificate to the Contracting Officer (CO), signed by the material producer and Contractor, certifying that materials comply with these specifications and have been approved for use by Caltrans for pavement markings and signs.

B. Product data: traffic signs, pavement markings, stabilized aggregate surfacing.

C. Maintenance Data: For stabilized aggregate surfacing.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of paving specialty through one source from a single manufacturer.

B. Aggregate materials shall meet all requirements recommended by paving manufacturers.

C. Accessibility Requirements: Stabilized aggregate surfacing shall meet Architectural Barriers Act Accessibility Standards (ABAAS).

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. General: Provide a hot-melt, anti-skid, retroreflective, thermoplastic traffic marking material that is suitable for producing durable traffic stripes and pavement markings on portland cement concrete or asphalt concrete pavements. This material is heated and applied to road surfaces in a

molten state using a mechanical applicator. While still hot, reflectorizing glass beads are applied to the surface of the applied thermoplastic striping material. Thermoplastic application shall contain anti-skid properties to secure friction for bicycle and pedestrian users.

B. Composition: The thermoplastic material shall be composed of 100% solids. The binder shall consist of a maleic-modified glycerol ester of rosin which is homogeneously blended together with all necessary prime pigments, fillers, glass beads and additives to produce a traffic striping material that meets the requirements as specified herein. All thermoplastic material shall be free from; lead, chromium, cadmium, barium and other toxic metals.

C. White Material: White thermoplastic shall contain a minimum of 10% (by weight) titanium dioxide pigment meeting ASTM D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM Designations; D 5380 and E 1621. White thermoplastic must meet the Retroreflectivity requirement when applied with drop-on glass beads.

D. Lead-Free Yellow Material: Lead-Free (L/F) yellow thermoplastic shall contain proper amounts of C.I. Pigment Yellow 83 (opaque version) and titanium dioxide (Rutile) to produce a yellow material that has a weather-fast and heat stable yellow color which meets local requirements. The L/F yellow thermoplastic material shall appear yellow during both daytime and nighttime conditions when applied with drop-on beads.

E. Other Colors: Achieved by adding pigments as necessary to White Material described above to achieve the closest possible match to the following Federal standard colors listed in AMS-STD-595-COLOR:

Blue: 35180

Green: 34090

F. Other Ingredients: The remainder of the thermoplastic composition shall be determined by the manufacturer. It shall be the manufacturer's responsibility to produce a thermoplastic material containing the necessary plasticizers, antioxidants, and all other additives so that the thermoplastic will retain its color, viscosity and all other properties as specified herein. In addition to being essentially lead and chromium free, the thermoplastic shall not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste under Title 22, Division 4, section 66261.20 of the California Code of Regulations. Spec.# PTH-02ALKYD (February 2024) Page 3 of 8 3.2

G. Form: The thermoplastic material shall be supplied in either granular or pelletized form: Two viscosity grades of thermoplastic material shall be available for purchase; Extruded-Viscosity and Low-Viscosity. Extruded-Viscosity grade is more suitable for screed type applicators and thicker applications (+ 98 mils), including recessed applications. Low Viscosity grade material is commonly used with ribbon or spray type applicators. Percent by weight

H. Glass beads shall meet AASHTO Designation: M 247, Type I, except the glass beads shall not contain more than 200 ppm (total) arsenic, 200 ppm (total) antimony, nor more than 200 ppm (total) lead, when tested according to EPA Methods 3052 and 6010B. Other suitable x-ray fluorescence spectrometry analysis methods may be used to screen samples of glass beads for arsenic, antimony and lead content 30-35 30-35 3.4.2

I. This material shall comply with all applicable air pollution control rules and regulations. The thermoplastic material shall not emit fumes that are toxic or injurious to persons or property when it is heated to application temperature. The material shall not emit excessive smoke during heating or application.

2.2 TRAFFIC SIGNS

A. General
1. The sign face shall be uniform, flat, smooth, and free from defects, scratches, chips, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles.
2. The front, back, and edges of sign panels must not have bends, router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over-spray, or aluminum marks.
3. Do not store sign panels directly on the ground. Keep sign panels dry at all times and store:
   a. In a dry environment.
   b. On edge vertically whether indoors or outdoors.
   c. In enclose, climate-controlled trailers or containers in areas of high heat and humidity.
   d. Indoors whenever the panels will be stored for more than 30 days.

B. Aluminum Sheeting
1. Sheet aluminum signs shall be constructed of an alloy and temper conforming to ASTM B209 and shall be aluminum alloy 6061-T6 or 5052-H38.
2. Aluminum sheeting must be pretreated for corrosion resistance as specified in ASTM B449.
3. The surface of the sheeting must be cleaned, deoxidized, and coated with a light, tightly adherent chromate conversion coating free from powdery residue. The conversion coating shall be Class 2 with a weight from 10 to 35 mg/sq ft and an average weight of 25 mg/sq ft.
4. Aluminum sheeting shall be protected from exposure to grease, oils, dust, and contaminants.
5. The aluminum sheeting must be free from buckles, warps, dents, cockles, burrs, and other defects resulting from fabrication.
6. The base plate for standard route markers must be die cut.
7. The aluminum sheeting must be attached to the frame with 3/16-inch-diameter rivets. The rivets must be placed at least 1/2 inch from the web channel edges. The rivets must be made of aluminum alloy 5052 and be anodized or treated with a conversion coating to prevent corrosion.

C. Retroreflective Sheeting
1. Retroreflective sheeting used for the background and legend must comply with ASTM D4956 and must be on the Authorized Material List for signing and delineation materials.
2. Type II retroreflective sheeting may have Class 1, 2, 3, or 4 adhesive backing.
3. Type III, IV, VIII, IX, and XI retroreflective sheeting must have Class 1, 3, or 4 adhesive backing.
4. Adhesive backing shall be pressure sensitive and fungus resistant.
5. Reflective sheeting shall be applied to in the manner specified by the sheeting manufacturer. The applied sign face shall not have bubbles, wrinkles, or foreign material beneath the reflective sheeting.

6. Splices in the retroreflective sheeting shall overlap by at least 1 inch unless otherwise specified by the manufacturer.
7. The retroreflective sheeting on either side of a splice must not exhibit a color difference under incident and reflected light.

D. Signposts
1. Signposts shall be 4″ x 4″ treated Douglas Fir or treated Hem-Fir, Construction grade. Douglas Fir and Hem-Fir post shall be given a treatment in accordance with AASHTO M133. Preservative and retention shall be as follows:

Minimum Retention in Pounds per Cubic Foot	
Preservative	**Wood Posts**
Creosote	10.00
Pentachlorophenol	0.50
ACZA	0.40
CCA	0.40

E. Sign covering
1. The covering shall consist of 4 mils minimum thickness black polyethylene sheeting of sufficient size to entirely cover the sign and shall extend over the edges of the sign and fastened to the back.

F. Mounting hardware:
1. Lag screws, nuts, bolts, and washers shall be made of commercial-quality steel and hot-dip galvanized after fabrication.
2. Braces and wood block spacers shall be made of commercial-quality, mild steel and hot-dip galvanized after fabrication.

2.3 STABILIZED AGGREGATE SURFACING

A. Surface material shall be sourced from a Northern California quarry and be processed on site.

B. Surface mix shall be brown weathered, poorly graded gravel with silt, sand, clay and aggregates ranging from 0.001” to 1.2”.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply parking stall or traffic lane markings until layout and placement have been verified by CO.

B. Use only skilled workmen who are experienced and normally employed in the work of installing pavement markings. Supply all the necessary equipment and materials required for the work.

C. Pavement markings shall be applied in accordance with the layout shown on the Drawings. No paint shall be applied to new bituminous pavement until the top course has cured at least one week and allow two weeks curing for newly installed bituminous concrete curbing.

D. Pavement marking shall be applied during a period of favorable weather to clean, completely dry surfaces when the pavement surface temperature is above 39°F and the ambient temperature is above 36°F. Comply with the paint manufacturer's instructions for temperature of the paint during application.

E. Use mechanical wire brushing to remove dirt, contaminants, and loose material from pavement surface receiving the pavement marking.

F. A completed traffic stripe must:
   1. Be straight on a tangent alignment
   2. Be a true arc on a curved alignment
   3. Not deviate from the width shown by more than:
      1/4 inch on a tangent alignment
      1/2 inch on a curved alignment

G. The length of the gaps and individual stripes that form a broken traffic stripe must not deviate by more than 2 inches from the lengths shown. The gaps and stripes must be uniform throughout the entire length of the traffic stripe.

H. Protect newly placed traffic stripes and pavement markings from traffic and work activities until the traffic stripes and pavement markings are dry or hard enough to bear traffic.

I. Use abrasive blast cleaning to remove laitance and curing compound from the surface of new concrete pavement before applying the traffic stripe or pavement marking.

J. Glass beads with integral color must match the color of the stripe or pavement marking.

K. Allow enough overlap distance between new and existing striping patterns to ensure continuity at the start and end of the transition.

L. Apply primer or surface preparation adhesive under the manufacturer's instructions:
   1. To all roadway surfaces except for asphaltic surfaces less than 6 months old
   2. At a minimum rate of 1 gallon per 300 square feet
   3. To allow time for the thermoplastic primer to dry and become tacky before application of the thermoplastic

M. Preheat thermoplastic using preheaters with mixers having a 360-degree rotation.

N. Apply thermoplastic in a single uniform layer by spray or extrusion methods.

O. Completely coat and fill voids in the pavement surface with the thermoplastic.

P. Apply Type 2 glass beads to the surface of the molten thermoplastic at a rate of at least 8 lb of beads per 100 sq ft. for extruded-viscosity applications, and at least 6 lb of beads per 100 sq ft. for low-viscosity applications.

3.2 TRAFFIC SIGNS

A. Traffic signs shall be installed in accordance with Caltrans Section 82-3.03.

B. Protection and Temporary Covers
   1. Completed sign panels shall be protected and maintained in good condition, free from dirt, scratches, hand marks or other blemishes. The panels shall be transported in a manner that prevents damage.
   2. After erection, if required by the CO, exterior signs shall be covered until the actual use is desired. Material used to temporarily cover any sign panel shall effectively conceal the message, be non-injurious to the panel, its finish, its structural integrity, and shall be of sufficient durability for the time period required.

C. Installation
   1. Erection of all signs shall be performed by experienced sign erectors. Signs shall be installed true, plumb, and level, located where shown on the Drawings or as required by the CO. No field cutting of any sign work will be allowed. Exercise extreme care in all handling and stacking of signs to avoid chipping.
   2. All work shall be rigidly anchored to the supporting construction in accordance with the approved shop drawings.

D. Clean-up
   1. Surfaces of signs shall be cleaned as recommended by the sign manufacturer after installation.
   2. All defective work shall be removed and replaced with work conforming to the specified requirements.

E. Erection of Posts
   1. Drive or embed posts to ensure sign faces and supports are within 3/16 inch of plumb over 3 feet.
   2. Do not damage the top of posts during driving.
   3. Install signposts in accordance with the contract plans.
   4. If installing posts in new concrete, the Contractor may form holes before placing the new concrete.

3.3 STABILIZED AGGREGATE SURFACING

A. Paving shall be stored as recommended by manufacturer.

B. Paving shall be installed in temperatures from 50 degrees Fahrenheit to 120 degrees Fahrenheit.

C. One cubic yard of paving mix will cover approximately 15 square feet of 6-inch compacted and finished depth.

D. Subgrade shall be prepared as recommended by manufacturer.

E. Installation shall be as recommended by manufacturer.

END OF SECTION 32 17 00

SECTION 33 40 00 – STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Installation of drainage pipes and catch basins.

B. Related Sections:

1. Section 01 57 23 – Under-an-Acre Pollution Prevention
3. Section 31 20 00 – Earth Moving

1.2 SUBMITTALS

A. Product Data: For catch basin, frame, storm drain pipe, pipe fittings, and wall drain pipe.

B. Manufacturer's Certification: Products meet or exceed specifications.

PART 2 - PRODUCTS

2.1 STORM DRAIN PIPE

A. Pipe shall be high-density polyethylene (HDPE) pipe. HDPE pipe shall be manufactured from resins meeting the requirements of ASTM D3350 with a cell classification of 345464C and a Plastic Pipe Institute (PPI) designation of PE 4710.

B. The pipes shall have a minimum standard dimension ratio (SDR) of 32.5.

C. The joints shall not create an increase in the outside diameter of the pipe. The joints shall be fused, snap together, or threaded. The joints shall be watertight, rubber gasketed if applicable, and pressure testable to the requirements of ASTM D3212.

D. Joints to be welded by butt fusion shall meet the requirements of ASTM F2620 and the manufacturer's recommendations. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. All field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the Quality Control records. Electro fusion may be used for field closures, as necessary. Joint strength shall be equal to or greater than the tensile strength of the pipe.

E. Fittings shall be manufactured from the same resins and cell classification as the pipe unless specified otherwise in the Plans or Specifications. Butt fusion fittings and Flanged or Mechanical

joint adapters shall have a manufacturing standard of ASTM D3261. Electro fusion fittings shall have a manufacturing standard of ASTM F1055.

F. The supplier shall furnish a Manufacturer's Certification of Compliance stating that the materials meet the requirements of ASTM D3350 with the correct cell classification with the physical properties listed above. The supplier shall certify that the dimensions meet the requirements of ASTM F714 or as indicated in this Specification or the Plans.

G. At the time of manufacture, each lot of pipes, liners, and fittings shall be inspected for defects and tested for Elevated Temperature Sustained Pressure in accordance with ASTM F714. The Contractor shall not install any pipe that is more than 2 years from the date of manufacture.

H. At the time of delivery, the pipe shall be homogeneous throughout, uniform in color, and free of cracks, holes, foreign materials, blisters, or deleterious faults.

I. Pipe shall be marked at 5-foot intervals or less with a coded number that identifies the manufacturer, SDR, size, material, machine, and date on which the pipe was manufactured.

2.2 CATCH BASINS

A. Precast concrete catch basins shall conform to the requirements of AASHTO M199.

B. The joints may be the tongue and groove type or shiplap type, sufficiently deep to prevent lateral displacement.

2.3 FRAME AND GRATE

A. Castings for metal frames for catch basins shall be cast steel, gray iron, or ductile iron.

B. Castings for metal grates for catch basins shall be cast steel or ductile iron.

C. Grates shall be seated properly to prevent rocking.

D. Metal grates shall be considered "bike safe" or "bike friendly" with slots in grates oriented perpendicular to the trail centerline.

2.4 GEOTEXTILE FOR SEPARATION

A. When tested under ASTM D4491, geotextile permittivity must be at least 0.02 sec^{-1}.

B. Geotextile for separation shall either be polyester or polypropylene.

C. Geotextile for separation shall comply with the requirements in the following table:

Quality Characteristic	**Test Method**	**Requirement**	
		Class A1	**Class A2**
Elongation at break (percent)	ASTM D4632	<50	≥50
Grab breaking load, 1-inch grip in each direction (min, lb)	ASTM D4632	250	160

Wide width tensile strength at 5 percent strength (min, lb/ft)	ASTM D4595	--	--
Wide width tensile strength at ultimate strength (min, lb/ft)	ASTM D4595	--	--
Tear strength (min, lb)	ASTM D4533	90	60
Puncture strength (min, lb)	ASTM D6241	500	310
Permittivity (min, sec^{-1})	ASTM D4491	.05	.05
Apparent opening size (max, inches)	ASTM D4751	.012	.012
UV resistance, retained grab breaking load, 500 hours (min, percent)	ASTM D4355	70	70

2.5 WALL DRAIN PIPE

A. Perforated drain pipe and fittings shall be 3” diameter PVC and conform to ASTM D 2729.
B. Drain pipe and fittings through the wall and fittings shall be 2” diameter, minimum Schedule 40, black PVC and conform to ASTM D 1785.

PART 3 - EXECUTION

3.1 PIPE INSTALLATON

A. General

1. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

B. Transportation, Unloading, Handling, and Storage

1. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.

2. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.

3. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected

to visual inspection at time of delivery and before they are lowered into the trench to be laid.

4. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.

5. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

6. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded.

C. Fusion and Joining

1. Fusion Joining Requirements:

   a. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

   b. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620.Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the CO.

   c. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

2. Fusion Operators:

   a. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for

documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.

b. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

c. For Projects with at least 5,000 feet or with pipe larger than 24 inches, operators or their supervisor must have a current McElroy Fusion Training Certificate for the equipment to be used on the project.

3. Butt Fusion Equipment:

a. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four).

D. Excavation, Trenching, and Backfill

1. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings. Trenches must be of sufficient width in the pipe zone to permit proper installation and bedding of the pipe and to provide the required compaction of backfill.

2. Hand trim excavation for accurate placement of pipe to elevations indicated.

3. All ledgerock, boulders, and stones shall be removed to provide a minimum of 6 inches clearance under all portions of the pipe.

4. Placement of bedding material shall precede the installation of all pipe. This shall include necessary leveling of the native trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade so that the entire length of pipe will be supported on a uniformly dense unyielding foundation.

5. When, after excavating to the foundation level, the material remaining in the trench bottom is determined to be unsuitable by the CO, excavation shall be continued to such additional depth and width as required by the CO. Unsuitable foundation materials shall be disposed of at an approved site. The trench foundation shall be backfilled to the bottom of the pipe zone with sand bedding, or other suitable material, and compacted to form a uniformly dense, unyielding foundation.

6. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

7. Pipe zone bedding material shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe

and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

8. Pipe zone bedding shall be placed in loose layers and compacted to 90 percent maximum density. Bedding shall be placed, spread, and compacted before the pipe is installed so that the pipe is uniformly supported along the barrel. Lifts of not more than 6 inches in thickness shall be placed and compacted along the sides of the pipe. Material shall be worked carefully under the pipe haunches and then compacted.

9. If the CO determines that the material existing in the bottom of the trench is satisfactory for bedding the pipe, the bedding material specified is not required, provided the existing material is loosened, regraded, and compacted to form a dense, unyielding base.

10. Before lowering and while suspended, inspect pipe and each fitting for defects. Installation of defective material is not permitted.

11. Where pipe, fittings or joint materials have been soiled by earth in handling, thoroughly clean soiled surfaces by wire brushing and wiping until all traces of earth are removed before joining pipe.

12. Maintain interior of all pipes thoroughly clean. After each line of pipe has been laid, carefully inspect, identify and remove dirt, trash, rags and other foreign matter from interior. Protect completed work.

13. Install pipe, fittings, and accessories at the locations indicated on layout drawings and in accordance with manufacturer's instructions. Seal watertight.

14. Trenches shall be backfilled as soon after the pipe laying as possible.

15. Pipe zone backfill material shall be clean earth or sand, free from clay, frozen lumps, roots, or moisture in excess of that permitting required compaction. Rocks or lumps larger than 3 inches maximum shall not be used for pipe zone backfill.

16. Pipe zone backfill shall be placed in loose layers and compacted to 90 percent maximum density. Backfill shall be brought up simultaneously on each side of the pipe to the top of the pipe zone. The pipe shall then be covered to the top of the pipe zone and the materials compacted in a manner to avoid damaging or disturbing the completed pipe.

17. Backfill above the pipe zone shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. If pipe is being placed under existing paved areas, or Roadways, backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and compacted to 95 percent maximum density. If pipe is being placed in non-traffic areas, backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and shall be compacted to 85 percent maximum density.

18. Direct Burial

    a. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8.The Design Window identified in AWWA M55 Chapter 5 (page

65 of 2006 version) shall be considered acceptable design and installation conditions.

b. Unless required on the plans, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.

19. Appurtenances

a. All appurtenances (tees, elbows, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.

20. Protection

a. Water is not permitted to run or stand in trench while pipe laying is in progress, before the joints are completely set, or before trench has been backfilled.

b. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

3.2 CATCH BASIN INSTALLATON

A. The excavation for all catch basins shall be sufficient to leave 1 foot in the clear between their outer surfaces and the earth bank.

B. The cover or grating of a catch basin shall not be grouted to final grade until the final elevation of the ditch in which it is to be placed has been established, and until permission thereafter is given by the CO to grout the cover or grating in place. Covers shall be seated properly to prevent rocking. Leveling and adjustment devices that do not modify the structural integrity of the metal frame, grate or cover, and do not void the originating foundry's compliance to these specifications and warranty are allowed. Leveling and adjusting devices that interfere with the backfilling, backfill density, and grouting will not be allowed. The hardware for leveling and adjusting devices shall be completely removed when specified by the CO.

C. Ladder rungs shall be grouted in the precast concrete walls. Rungs shall be uniformly spaced at 12 inches and be vertically aligned.

D. In the event any pipe enters the manhole through the precast concrete units, the Contractor shall make the necessary cut through the manhole wall and steel mesh. The steel shall be cut flush with the face of the concrete and shall be cut in such a manner that it will not loosen the reinforcement in the manhole wall.

E. The ends of all pipes shall be trimmed flush with the inside walls.

F. Rubber gaskets or flexible plastic gaskets may be used in tongue and groove joints of precast units. All other joints and all openings cut through the walls shall be grouted and watertight. Mortar must be composed of cement, sand, and water. The proportion of sand to cement measured by volume must be 2 to 1. Mortar must contain only enough water to allow placing and packing. Sand particles must be no larger than 1/2 the size of the recess or space in which the mortar is to be placed.

G. If gaskets are used, handling of the precast units after the gasket has been affixed shall be done carefully to avoid disturbing or damaging the gasket or contaminating it with foreign material. Care shall be exercised to attain proper alignment before the joints are entirely forced home.

During insertion of the tongue or spigot, the units shall be partially supported to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

H. Backfilling around the Work will not be allowed until the concrete or mortar has thoroughly set.

I. Catch basins shall be watertight.

J. Backfilling

1. Place structure backfill in uniform layers. Bring backfill up uniformly on all sides of structures. Backfill layers must be at most 0.67 foot thick before compacting the thickness must be at most 4 feet when compaction is performed by ponding or jetting.

2. Do not use compaction equipment or methods that may cause excessive displacement or damage structures.

3. Do not place structure backfill the catch basin has been inspected by the CO and authorized for backfilling.

4. Compact structure backfill to a relative compaction of at least 95 percent.

K. Catch basins shall be constructed on a compacted or undisturbed level foundation. If the Contractor elects to use a separate cast-in-place base, the concrete shall be Class 4000.

L. All excavations 4 feet or more in depth shall be shored with structural shoring or shall meet open-pit requirements.

3.3 WALL DRAIN PIPE INSTALLATION

A. Wall drain pipe shall be installed per manufacturer's instructions and as shown in the plans.

END OF SECTION 33 40 00

SECTION 34 71 13 – GUARDRAILS

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies guardrails.

B. Related Requirements:

1. Section 01 22 23 – Submittal Requirements.
2. Section 01 40 00 – Quality Requirements for materials testing and inspections.

1.2 SUBMITTALS

A. Product data.

B. Shop Drawings: Drawings prepared in accordance with conventional detailing practices that detail steel fabrication and placement. At a minimum, include the following:

1. Steel and hardware material designations
2. Fabrication details, including cuts, connections, holes, fasteners and welds.
3. Procedures for welding, assembly and installation.
4. Angles in railing may be accomplished by using beveled washers and/or fabricating posts to accommodate the angels as shown. Provide full details of posts at angle points and indicate method for constructing the angles.
5. Shop drawing re-submittals shall clearly identify all revisions to previous submittals. Provide heavy ink clouded outlines (revision clouds) around revised areas of individual sheets. Information outside of revision clouds on resubmitted drawings will not be reviewed.

C. Qualifications: At least 14 days before starting guardrail work, submit one of the following for the guardrail supervisor:

1. Resume describing at least 3 years' experience in guardrail installation;
2. A certificate showing successful completion of the ATSSA Guardrail Installation Training;
3. A certificate showing successful completion of a state department of transportation guardrail installation training course.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory provided protective coverings and packaging.

B. Deliver, store and handle steel to prevent damage and discoloration.

C. Inspect materials upon delivery for damage.

D. Material that has been damaged or discolored shall not be incorporated into the project. In field assembly of steel parts, the Contractor shall use methods and equipment not likely to twist, bend, deform or otherwise injure the metal. Any member slightly bent or twisted shall be corrected before it is placed. Parts with serious damage will be rejected.

1. Damaged or discolored members may be repaired and incorporated only if approved by the COR.
2. If the Contractor plans to repair damaged or discolored members, the Contractor shall prepare a Repair Plan for approval by the COR.

    a. Repair damage to be indistinguishable from undamaged areas. If damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
    b. Straightening methods shall not fracture or injure the metal.
    c. Distorted members shall be straightened mechanically. A limited amount of localized heat may be applied only if carefully planned and supervised, and only in accordance with the heat-straightening procedure in the approved Repair Plan.
    d. Parts to be heat-straightened shall be nearly free from all stress and external forces except those that result from the mechanical pressured used with the heat.
    e. After straightening, the Contractor shall inspect the member for fractures using a method proposed by the Contractor in the approved Repair Plan.
    f. Member showing sharp kinks and bends will be rejected.

E. Store fabricated steel above ground on platforms, skids or approved supports.

F. Store hardware in weather-tight and dry locations.

G. Store packaged materials in original unbroken containers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. W-Beam Rail: Galvanized steel conforming to AASHTO M 180, Type II, Class B.

B. Guardrail Posts: 8” x 8” x 6’ long wood posts conforming to AASHTO M 168 and treated according to AASHTO M 133. Posts shall not have a through check, shake, or end slit in the same plane as, or a plane parallel to the bolt hole and extending from the top of the post to within 3-inches of the bolt hole.

C. Nuts: 5/8” recess nut conforming to ASTM A563, Grade A.

D. Bolts: 5/8” x 10” long conforming to ASTM A307, Grade A.

E. Washers: 1-3/4” plain round washer conforming to ASTM F436.

PART 3 - EXECUTION

3.1 GUARDRAIL POSTS

A. Complete adjacent earthwork, aggregate placement and other roadway surfaces to line and grade as applicable prior to installation of guardrail posts.

B. Do not damage adjacent pavement, subsurface utilities, or drainage features during post installation.

C. Posts may be installed by either drilling or driving. Posts installed by drilling shall have sufficiently sized holes to allow thorough compaction of backfill around each post.

D. Backfill post holes in 6-inch lifts with approved material. Tamp and compact each lift.

E. Replace posts damaged during driving operations.

F. Install posts plumb and at the location, spacing, and elevation as shown in the plans.

G. Drill ¾” diameter hole as shown in the plans.

3.2 GUARDRAIL

A. Install rail elements in a smooth continuous line with the laps in the direction of traffic flow.

B. Drill holes for splicing and connection to posts as shown in the plans.

C. Use bolts that extend at least ¼ inch, but no more than ½” inch beyond the nuts.

D. Coat scrapes on galvanized surfaces that expose the base metal with two coats of zinc-oxide coating material.

END OF SECTION 34 71 13