

BRYCE CANYON NATIONAL PARK GARFIELD COUNTY, UTAH

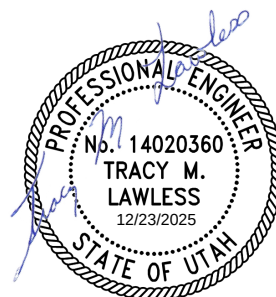
SHUTTLE BUS STOPS & PEDESTRIAN CROSSWALK
BRCA
PMIS Number 310427

PROJECT SPECIFICATIONS (100% Design Submittal)



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

December 2025



BRCA 310427

TABLE OF CONTENTS

DIVISION 01: GENERAL REQUIREMENTS

01 11 00	Summary of Work
01 26 01	Contract Modification Procedures
01 27 00	Definition of Contract Line Items
	<i>Supplement: Contract Price Schedule</i>
01 31 00	Project Management and Coordination
01 32 16	Construction Schedule
01 32 33	Photo Documentation
01 33 23	Submittal Procedures
	<i>Supplement: Submittal List</i>
01 35 23	Safety Requirements
01 40 00	Quality Requirements
01 42 00	Reference Standards
01 50 00	Temporary Facilities and Controls
01 57 19.12	Noise and Acoustics Management
01 57 23	Temporary Storm Water Pollution Prevention
01 67 00	Product Requirements
	<i>Supplement: Affirmative Procurement Reporting Form</i>
01 73 29	Cutting and Patching
01 73 40	Execution
01 74 19	Construction Waste Management and Disposal
01 77 00	Closeout Procedures

*Division 01 Supplements: Project Waste Management Plan Worksheet
Closeout and Operation and Maintenance Requirements*

DIVISION 02: EXISTING CONDITIONS

02 41 00	Demolition and Salvage
----------	------------------------

DIVISION 03: CONCRETE

03 10 00	Concrete Forming and Accessories
03 15 00	Concrete Joints and Accessories
03 21 00	Steel Reinforcement
03 30 00	Cast In Place Concrete
	<i>Supplement: Concrete Mix Design</i>
03 39 00	Concrete Curing
03 63 00	Concrete Doweling

DIVISION 04: Masonry

04 43 00	Stone Masonry
----------	---------------

DIVISION 05: METALS

05 50 00 Metal Fabrications

DIVISION 06: WOOD, PLASTICS & COMPOSITES

06 10 53 Miscellaneous Rough Carpentry

DIVISION 07: THERMAL & MOISTURE PROTECTION

07 41 13.16 Standing Seam Sheet Metal Roof Panels

07 92 00 Joint Sealants

DIVISION 09: FINISHES

09 91 13 Exterior Painting

09 93 00 Staining and Transparent Finishing

DIVISION 10: SPECIALTIES

10 14 00 Signage

DIVISION 26: ELECTRICAL

26 41 13 Lightning Protection System

DIVISION 31: EARTHWORK

31 10 00 Site Clearing

31 23 00 Excavation and Fill

31 37 00 Riprap

DIVISION 32: EXTERIOR IMPROVEMENTS

32 11 23 Aggregate Base Course

32 12 13.13 Asphalt Prime Coat / Tack Coat

32 12 16 Minor Asphalt Pavement

32 13 13 Concrete Paving

32 17 23 Pavement Markings

32 31 26 Wood Fences

32 33 00 Site Furnishings

32 91 13 Soil Preparation

32 92 00 Turf and Grasses

DIVISION 33: UTILITIES

33 41 01 Storm Drain Piping

APPENDICES

Appendix A Bryce Canyon National Park Visitor Center Shuttle Stops Final Geotechnical
Engineering and Pavement Report, Yeh and Associates, Inc., January 28, 2025

End of Table of Contents

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
 - 1. Work Covered by Contract Documents
 - 2. Contractor Use of Site
 - 3. Public Use of Site
 - 4. Conduct of Operations
 - 5. Work Restrictions
 - 6. Special Construction Requirements
 - 7. Soils Investigation Report

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Location: The intersection of Bryce Canyon Road and Bryce Canyon Visitor Center adjacent to the Bryce National Park Visitor Center, near Bryce, Utah. The existing southbound shuttle stop at the northwest corner of the intersection and the existing shuttle stop at the southeast corner of the intersection are to be modified.
- B. The Work consists of:
 - 1. The Work includes shuttle stop improvements along Bryce Canyon Road including additional lanes for the shuttles, culvert extensions and new culverts, multi-use trail realignment, addition of a southbound shuttle bus stop, cast in place retaining wall construction, new shuttle stop shelter, sidewalk and ADA ramp construction, replacement of existing Manual of Uniform Traffic Control Devices (MUTCD) signs, and striping of pavement.
- C. Project will be constructed under a single prime contract.

1.3 CONTRACTOR USE OF SITE

- A. General: Contractor shall have limited use of the Park for construction operations during the construction period. Confine constructions operations to Bryce Canyon Road and Parking area and staging areas as approved by the Contracting Officer (CO).
- B. Storage of Materials: Confine storage of materials to the existing employee parking area behind the Bryce Visitor Center or the Park's Maintenance yard south of the construction site.
- C. Parking: Confine parking to staging areas and active work locations.
- D. Stockpiling: Confine stockpiling to staging areas or as approved by the CO.

E. Preservation of Natural Features:

1. Prevent damage to natural surroundings. No work shall be allowed in natural terrain areas except as necessary work as shown in the plans. Restore damaged areas, repairing or replacing damaged trees and plants, at no additional expense to the Government.
2. Provide temporary barriers to protect existing trees and plants and root zones.
3. Unless shown on the Drawings do not remove, injure, or destroy trees or other plants without prior approval. Consult with CO and remove agreed-on roots and branches that interfere with construction.
4. Do not fasten ropes, cables, or guys to existing trees.
5. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.
6. Fenced enclosures shall be erected around trees to protect crowns from contact by equipment, to preserve roots and soil conditions, and to identify tree protection zones (TPZ) in which no soil disturbance is permitted and activities are restricted unless otherwise approved by CO. Remove all tree protection prior to final acceptance.
7. Preserve existing trees including their roots and all plant materials outside the construction limits and within TPZs. Ensure CO approves all field staking and construction within construction limits. Any damage to trees, plants, or shrubs outside of the construction limits or within a TPZ will be subject to restitution made to the Park as described in Section 31 10 00 "Site Clearing". Ensure all staff are familiar with permitted actions and tree preservation plans prior to construction.

F. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Government employees, and emergency vehicles at all times. Do not use for parking or storage of materials.

1. Schedule deliveries to minimize use of driveways and entrances.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site. Do not schedule deliveries during peak visitor traffic entrance times between 9 A.M. and 12 P.M. (Noon).

G. Construction Camp: Establishment of a camp within the Park will not be permitted.

H. Hauling Restrictions: Comply with legal load restrictions in hauling of materials. Load restrictions on park roads are identical to state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.

I. Bridge Restrictions: No bridges on site. Identify jurisdictions, load restrictions, permit requirements, time and calendar restrictions along haul route as necessary.

J. Construction Equipment Cleaning: Prevent introduction of invasive weeds and non-native plant species into the work site. All vehicles and equipment entering the project area must be clean and free of plant materials, soil, and any seed. Equipment must be free from oil and other fluid leaks. Particular attention must be shown to the undercarriage, truck beds, trailer decks, wheel wells, mower decks (top and bottom) and any surface where soil containing exotic seeds may exist. All equipment shall be subject to inspection by CO. Follow applicable Federal land management agency requirements and state requirements. Maintain cleaning and inspection records.

Equipment found operating on the project that has not been inspected or has oil leaks will be shut down and subject to removal from the project area.

1.4 PUBLIC USE OF SITE

- A. Public use is to be maintained through construction operation.
- B. Contractor shall conduct their operations to ensure the least inconvenience to public. Shoulder closures may be permitted on Bryce Canyon Road near the intersection with Bryce Canyon Visitor Center and on Bryce Canyon Visitor Center near the eastern leg of the intersection with Bryce Canyon Road, when required, upon specific approval of CO. A 3-way stop shall be implemented and maintained throughout construction at the intersection of Bryce Canyon Road and Bryce Canyon Visitor Center. Contractor shall provide traffic control plans to CO before any work commences. Provide a certified Traffic Control Design Specialist to verify the traffic control plan.
- C. Contractor shall provide safe access through the construction zone to maintain pedestrian and cyclist public access to the Visitor Center, Parking area, and shuttle stops at all times during construction.

1.5 CONDUCT OF OPERATIONS

- A. Contractor shall conduct their operations in conformance with rules and regulations promulgated by the Secretary of the Interior for the National Park Service, and applicable park rules and regulations prescribed by Park Superintendent.
- B. Work on Saturdays, Sundays, Federal holidays, Utah Pioneer Day, or at night may not be performed unless stated in the Work Restrictions below or without prior consent from the CO. Submit requests 7 days in advance of the work to the CO for approval.
- C. No signs or advertisements (except those specified herein) shall be displayed on the construction site or within the park unless approved by the CO.

1.6 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 8:00 a.m. to 6:00 p.m., Monday through Friday, except when otherwise indicated. Work hours may be adjusted by the CO based on time of year and visitation rates.
 - 1. Weekend Hours: No work shall be performed on the weekends or NPS Holidays without prior approval.
 - 2. Early Morning Hours: No work shall be performed before 8 a.m. unless approved by the CO.
- B. Existing Utilities
 - 1. Existing Utilities: Notify CO and utility companies of proposed locations and times for excavation.
 - a. Existing known utilities in the area include:

- 1) A potable water line along the West side of Bryce Canyon Road (connecting to the Visitor Center and into the main Park).
 2. Contractor shall be responsible for locating and preventing damage to known utilities. Locate and pothole the water line along Bryce Canyon Road.
 3. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify CO not less than two business days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without CO's written permission.
 3. Disruptions to facilities outside the project limits shall be prevented by investigation of existing utilities and protection during construction. Contractor shall be responsible for all costs associated with remedy of accidental disruptions to facilities outside the project limits.
- D. Nonsmoking Building/Tobacco Use/Vaping: Smoking is not permitted within building or within 25 feet of entrances, operable windows, or outdoor air intakes, or at locations where smoking would be a nuisance to park visitors as determined by CO.

1.7 SPECIAL CONSTRUCTION REQUIREMENTS

- A. Project Management and Communication Software: Software administered by NPS shall be used to manage communication and document sharing during construction.
 1. See Section 01 31 00 "Project Management and Coordination" for requirements on using NPS project management and communication software.
- B. Do not feed or disturb wildlife. To prevent unnatural attractants to wildlife, keep all foods, pet foods, garbage, drinks, trash, or food and drink containers inside vehicles, or enclosed construction equipment, except during actual use. Supply garbage bins, within the construction site that are bear and animal proof. Remove all garbage and food trash from the project site daily.
- C. Utah Prairie Dog Mitigation. Maintain a 50 ft buffer around active burrows shown on Drawings. Contractor cannot operate heavy machinery within 1000 ft of active burrows prior to June 15th or after August 30th.

1.8 SOILS INVESTIGATION REPORT

- A. A report entitled Bryce Canyon National Park Visitor Center Shuttle Stops Final Geotechnical Engineering and Pavement Recommendation Report, dated January 28, 2025 has been prepared by Yeh and Associates, Inc. and is included as Appendix A.
- B. A copy of the report is available to all plan holders with this package.
- C. In case of conflict between report and Drawings or Specifications, the Drawings and Specifications govern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00

SECTION 01 26 01 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of administrative and procedural requirements for contract modifications.

1.2 DEFINITIONS AND ALLOWANCES

- A. Home Office Overhead: Costs incurred in support of all of a contractor's projects and not attributable to a specific job. The cost for home office overhead is only allowed as a percentage of all direct work excluding profit. The following items represent allowable home office overhead costs identified in Part 31 of the Federal Acquisition Regulation (FAR):

1. Rent
2. Utilities
3. Furnishings
4. Office equipment
5. Executive and management staff not exclusively assigned to the project
6. Support, accounting, and administrative staff
7. Preparation of cost proposals, estimating, and schedule analyses connected with Modifications
8. Estimating and preconstruction services
9. Mortgage costs
10. Real estate and corporate taxes
11. Automobile maintenance and travel costs for home office personnel
12. Home office insurances i.e. structure, automotive, umbrella, flood, etc.
13. Depreciation of equipment and other assets
14. Home office supplies (paper, staples, etc.)
15. Legal services
16. Accounting and data processing
17. Professional fees/registration

- B. General Conditions (Field Office Overhead): Management and administrative costs incurred on site for the designated project. Costs associated with preparation of modifications will not be allowed. Costs for these items are to be included only in the general conditions of the modification estimate. Only in the case of a contract time extension are additional general conditions included in modifications. The following items, if applicable, are considered allowable costs for calculating General Conditions:

1. Project Manager (PM), Assistant Project Manager
2. Superintendent, Assistant Superintendent
3. Quality Control, Safety Officer, Environmental Manager, etc.
4. Engineers
5. Travel, lodging, and per diem (as established by Federal Travel Regulations)
6. Scheduling

7. Field Office Trailers and associated temporary utilities
8. Field office supplies

- a. Mailing and couriers
- b. Reproduction costs
- c. Storage
- d. Phones
- e. Computers
- f. Copiers

9. Personal vehicles i.e. Superintendent Pickup trucks

C. General Requirements: Costs directly associated with the project and are necessary to perform the actual work of the modification. These costs shall be shown as direct costs in the estimate. The following items, if applicable, are considered allowable costs for calculating General Requirements:

1. Hoisting
2. Material handling
3. Temporary fencing
4. Port-a-lets
5. Trash removal, dumpsters
6. Barricades
7. Small tools
8. Safety supplies
9. Scaffolding
10. Daily cleaning
11. Traffic control
12. Temporary signage
13. Temporary heating and power

D. Personnel Costs: Costs included in the modification must only be for General Conditions staff and workers actually present and working on project site. Modification costs for salaried workers are only allowed within the structure of a 40-hour week and no overtime or holiday pay will be allowed.

1. Worker Hourly Rates are costs directly associated with the individual worker and consist of the following:

- a. Base Rate: The hourly rate paid directly to the worker
- b. Labor Burden: Employer payments of all applicable burdens; includes insurance and taxes the business must pay on behalf of the worker to government entities and educational forums, such as:

- 1) Social Security
- 2) Medicare
- 3) Workers Compensation – Policy and company calculation to be made available.
- 4) Federal Unemployment Tax Act (FUTA) - Cap Rate and percentage to be proportionally allocated over one year.
- 5) State Unemployment Tax Act (SUTA) - Cap Rate and percentage to be proportionally allocated over one year.

- 6) Union agreement costs - Other costs required under an enforceable collective bargaining agreement.
- c. Fringe Benefits: Various non-wage compensations provided to employees such as:
- 1) Health Care Insurance Premiums
 - 2) Cell Phone
 - 3) Clothing
 - 4) 401K and Pensions
 - 5) Vehicle allowances
 - 6) Gas allowance
 - 7) Life insurance premiums
 - 8) Disability insurance
 - 9) Other Fringe Benefits required under an enforceable collective bargaining agreement
- E. Bonuses or Deferred Compensation: No Bonus or Deferred Compensation will be allowed within any components of pricing including Home Office Overhead, General Conditions, General Requirements, Hourly Worker Rates, or the direct costs of work.
- F. General Liability Insurance: An insurance policy that protects Contractor from claims resulting from bodily injury or property damage to a third party. Include as a separate line item within all modification proposals and provide a current insurance quote upon request.
- G. Performance and Payment Bonds: A performance bond is a surety bond issued by an insurance company or bank to guarantee satisfactory completion of a project. The Payment Bond guarantees the Contractor will pay the labor and material costs incurred. Banks and Insurance companies charge a premium for individual project based on a sliding scale related to the size of the project. Include as a separate line item in modification proposals and provide current company bonding rates upon request.
- H. Builder's Risk Insurance: Covers the contractor's loss due to fire, high winds, or other natural forces. Not reimbursed by the National Park Service (NPS) and shall not be included in modification proposals.
- ### 1.3 MODIFICATION PROPOSAL PRICING REQUIREMENTS
- A. General:
1. Proposal be received in the format and within the time frame specified in the Request for Proposal (RFP) letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
 2. Proposal shall be detailed with itemized lists of equipment, materials, labor, production rates, overhead, profit, and bond markup for each item. Labor costs must be itemized by craft and hourly rate, including Fringe Benefits and Labor Burden. If the costs of Fringe Benefits and Labor Burden are not itemized, it is assumed they are included in the hourly rate shown, or contractor is not requesting reimbursement. Contractor may utilize the government provided [Contractor Estimate Form](#), or their own form, provided that it contains the same information and level of detail as the Government's form.

3. Requests for extensions of contract time as a result of change must be justified with a Time Impact Analysis (TIA). Refer to Section 01 32 16 "Construction Schedule", for time impact analysis requirements. TIA and associated costs shall be received with the proposal by the date shown within the Request for Proposal letter. Contractor's failure to submit within the specified time frame will be construed as the Contractor waiving right for additional time and no time extension will be allowed.
4. All supporting documentation used to justify the proposed modification will be made available to the Contracting Officer (CO) upon request.
5. Contractor shall review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to NPS. All delay costs associated with not reviewing and approving subcontractor/supplier pricing will be borne by the Contractor.
6. All pricing and production rates within the estimate must be based on fair and reasonable pricing and cannot include built-in contingency.

B. Labor:

1. Contractor shall estimate cost of labor by itemizing each craft involved, indicating worker hourly rate (base rate + labor burden + fringe benefits) for each and itemizing hours required for each craft directly engaged in modification work. Any work proposed requiring overtime work or premium pay shall be itemized separately. Rates shall be in accordance with the Davis-Bacon Act as incorporated herein. Labor Burden may include payroll taxes, Social Security, unemployment insurances, workers compensation insurance, Federal Insurance Contributions Act (FICA), FUTA, and other direct costs resulting from Federal, State or local laws.
2. Itemize labor costs for equipment operators separate from equipment costs.
3. Labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. Estimated cost for materials shall include quotes from multiple sources. Material prices shall include applicable fees and credits, including but not limited to, sales tax, freight and delivery charges, and tax rebates.
2. No markup shall be applied to any material provided by NPS.

D. Equipment:

1. Equipment used for the project must be appropriately sized for work being performed.
2. Do not include costs for "miscellaneous tools and equipment", in your proposal for a replacement value of \$500 or less. Costs shown in excess of \$500 shall be broken out separately.
3. Regardless of ownership, rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:
 - a. United States (U.S.) Army Corps of Engineers, Ownership and Operating Expense Schedule (use latest edition and applicable region)
 - b. Construction Blue Book
 - c. Local equipment rental rates, documented by actual invoice charges, or itemized vendor quotes.

4. Estimated equipment rates shall include operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires and tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per Federal Acquisition Regulation (FAR) 31.105(d)(2)), depreciation, storage, insurance, and all incidentals. Mobilization, if applicable, may be included for equipment solely used on the modification work but must be listed separately.
5. Estimate full rate for equipment only for duration that equipment will be utilized to accomplish work of the modification.
6. Standby unit rates used in accordance with paragraph 1.3, D, 2, above. If the U.S. Army Corp of Engineers is utilized then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then 1/2 of equipment costs minus any operating costs, major repair and overhaul will be accepted.
7. If equipment is in standby mode due solely to a documented NPS delay, established standby rate shall apply from the first day of the delay.
8. Equipment not used and on job site for up to five consecutive days may be classified at standby rates, provided the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment still on the jobsite but not in use after five consecutive days will not be considered in the modification pricing.
9. Requests for compensation for equipment stand by time must be justified, documented and itemized separately.
10. The estimated timeframe (daily, weekly, monthly) for use of the equipment must reflect the lowest cost to the Government.

E. Establishment and Application of Overhead and Profit Percentages:

1. Home Office Overhead and Profit (OH&P) shall be applied to direct costs only. Profit shall not be applied to overhead amounts; and overhead shall not be applied to profit. Home office overhead shall contain only allowable, allocable, and reasonable costs per the contract documents and FAR Part 31. Profit percentages are based on risk factors found in FAR Part 31 which have been applied to the specific type of work included in this project. Negotiated rates shall not exceed the following percentages for OH&P for contractor self-performed work:

Overhead.....	10%
Profit.....	7.5%
2. Total aggregate limit of markup (OH&P) for Contractor and Subcontractors on modification work shall not exceed 25%. The NPS will not be responsible for allocation of percentages between contractor and subcontractors at any tier.
3. If Contractors form a partnership, partnership may only receive home office overhead and profit in same amount as an individual Contractor (refer to paragraph 1.3, E,1 above). It is the responsibility of the partners to decide on division of revenue.
4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, overhead and profit mark-ups are required on net increases and deducted on net decreases.
5. At no time can profit be calculated on Overhead or itself, it must be calculated on direct costs of work only.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section explains in general, what is and is not included in a contract line item, and limits or cut-off points where one item ends and another begins.
- B. If no contract line item exists for a portion of work, include costs in a related item.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

- A. Contract Line Item Number [1] - Shuttle Stop and Pedestrian Intersection Improvements
 - 1. This item consists of clearing and grubbing, demolition and salvage, erosion and sedimentation control, concrete and asphalt paving, storm drain replacement, riprap, earthwork and grading, multi-use trail realignment, addition of a southbound shuttle stop, cast in place wall construction, construction of a new shuttle stop shelter, sidewalk and ADA ramp construction, curb and gutter, traffic control, signage, and striping of pavement.
 - 2. Measurement for payment will be based on the percentage of work complete.
 - 3. Payment will be made at the contract lump sum price.

END OF SECTION 01 27 00

Bryce Canyon National Park BRCA 310427

Price Schedule

Supplement to Section 01 27 00 - Definition of Contract Line Items

Contract Line Item	Contract Line Item Title ¹	Quantity	Unit of Measurement	Unit Price	Subtotal
CLIN 1	Shuttle Stop and Pedestrian Intersection Improvements	1	Lump Sum (LS)		
Total Base Bid \$					

¹Refer to Section 01 27 00 for Complete Description

Total Written Amount of Base Bid

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Definitions
 - 2. Construction Coordination
 - 3. Submittals
 - 4. Requests for Information (RFIs)
 - 5. NPS Project Management and Communication Software
 - 6. Project Meetings
 - 7. Environmental Coordination
 - 8. Permits
- B. Related Requirements:
 - 1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. Agency with Jurisdiction: An Agency that has been granted legal authority over a location, action, or resource. This authority includes the ability to issue a permit or other legal permission document.
- B. Construction Permits – Contractor Provided: Permits obtained by the Contractor based on the means and methods to conduct the work. Construction Permits are typically issued by the Agency to the Contractor and not to the National Park Service. Examples of typical Contractor Provided Permits are: National Pollutant Discharge Elimination System (NPDES) Construction Permit (ground disturbance), dewatering permit, permit for work in a roadway (with traffic management plan), temporary utility tap permit, etc.
- C. Government Furnished Permits: Obtained by NPS, usually through the Architect / Engineer (A/E) or a consultant, during the design process (Predesign (PD) through Construction Documents (CD)) and are usually concerned with impacts to resources protected by federal law. However, GF permits can include other permits that are obtained for the convenience of the Government during design. GF permits are "furnished" to the Contractor in the Request for Proposal (RFP) and as part of the final contract documents. The Contractor must comply with GF permit provisions. Examples of typical GF permits: Clean Water Act (CWA) 404 dredge and fill permit, CWA Water Quality Certification (often state administered), Highway Right-of-Way Permit, etc.

1.3 CONSTRUCTION COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Construction Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of components, including mechanical and electrical.
 - 5. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Construction Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to:
 - 1. Preparation of Contractor Construction Schedule
 - 2. Preparation of the Schedule of Values
 - 3. Installation and removal of temporary facilities and controls
 - 4. Delivery and processing of submittals
 - 5. Progress meetings
 - 6. Permit requirements
 - 7. Pre-installation conferences
 - 8. Project closeout activities

1.4 SUBMITTALS

- A. Division 1 documents:
 - 1. Letter designating Project Superintendent
 - 2. Construction Schedule, refer to Section 01 32 16
 - 3. A Comprehensive Schedule of Values, refer to Section 01 32 16
 - 4. Accident Prevention Plan, refer to Section 01 35 23
 - 5. A List of Subcontractors for this project
 - 6. Written statements from Subcontractors certifying compliance with applicable labor standard clauses.
 - 7. Certificates of Insurance and Standard Form SF1413 for Contactor and all Subcontractors
 - 8. Waste Management Plan, refer to Section 01 74 19

9. Quality Control Plan, refer to Section 01 40 00
10. Temporary Storm Water Pollution Prevention Plan (SWPPP), refer to Section 01 57 23

- B. List of Required Construction Permits. Include the following information for each permit:
 - a. Name of Permit
 - b. Agency(ies) with Jurisdiction issuing the permit
 - c. Information required from Government to complete permit application
- C. Provide items listed to CO at least one week prior to Pre-Construction Conference, or as directed by CO.
 1. Failure to submit items may result in:
 - a. Construction conference may be cancelled, Notice to Proceed may not be issued, and CO will consider other contractual remedies.
 - b. Work shall not commence until written Notice to Proceed has been issued and Certificates of Insurance and SF1413 documents are received for Contractor and all Subcontractors.
- D. Informational Submittals:
 1. Submit evidence of Pollution Prevention (P2) training and participation in P2 programs.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit an RFI utilizing form created on NPS project management and communication software.
 1. CO will not respond to RFIs submitted by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in the work.
- B. Content of RFI: Include detailed, legible description of item needing information or interpretation and the following:
 1. RFI number, numbered sequentially
 2. Date
 3. RFI subject
 4. Specification Section number and title and related paragraphs, as appropriate.
 5. Drawing number and detail references, as appropriate.
 6. Field dimensions and conditions, as appropriate.
 7. Contractor's suggested resolution: If suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
 8. Contractor's signature
 9. Requested date for response
 10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. RFI Form: Complete and submit on NPS project management and communication software.
- D. CO's Action: CO will review each RFI, determine action required, and respond. CO will determine critical nature of each RFI and issue response accordingly.
 - 1. The following are not considered to be RFIs and will receive no action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in Contract Documents.
 - e. Requests for adjustments in Contract Time or Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. CO's action may include a request for additional information; time for response will date from time of receipt of additional information.
 - 3. CO's action on RFIs may result in need for a change to Contract Time or Contract Sum. All contract changes will be processed following terms and conditions of contract.

1.6 PROJECT MANAGEMENT AND COMMUNICATION SOFTWARE

- A. Use to manage project communication and document sharing during contract period on:
 - 1. Project directory
 - 2. Project correspondence
 - 3. Meeting agendas and minutes
 - 4. Contract modifications forms and logs
 - 5. RFI form and processing
 - 6. Task and issue management
 - 7. Photo documentation
 - 8. Baseline schedule, schedule updates and calendar management
 - 9. Submittal form and processing
 - 10. Payment coordination documentation
 - 11. Reminder and tracking functions
 - 12. Archiving functions
 - 13. Notification of submittal and RFI statuses and current responsible party
 - 14. Permits and addendums
- B. Some documents are not suitable to be shared using NPS project management and communication software. Documents containing Personal Identifying Information (PII) (i.e. certified payrolls) shall not be shared and shall be coordinated with project team as appropriate.

1.7 PROJECT MEETINGS

- A. Preconstruction Conference: Before start of construction, CO will arrange an on-site meeting with Contractor. Meeting agenda will include the following as a minimum:
 - 1. Roles & Responsibilities / Lines of Authority

2. Park rules and regulations
3. Jobsite Safety
4. Resolution of comments on required Division 1 documents
5. Coordination of Subcontractors
6. Labor law application
7. Modifications
8. Payments to Contractor
9. Payroll reports
10. Contract time
11. Liquidated damages
12. Contractor Performance Evaluation
13. Display of Hotline posters
14. Notice to proceed
15. Correspondence procedures
16. NPS project management and communication software
17. Acceptance/rejection of work
18. Progress meetings
19. Submittal procedures
20. NPS Final Accessibility Inspection
21. Environmental requirements
22. Permit requirements
23. As-constructed drawings/operation and maintenance (O&M) manuals.
24. Saturday, Sunday, holiday and night work.
25. Reference materials
26. Value engineering
27. Schedule of Values

B. Progress Meetings: CO will schedule weekly meetings with Contractor.

1. Attendees: In addition to Government Representatives, each Construction Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Meeting agenda will include:
 - a. Approval of minutes of previous meetings
 - b. Submittal status
 - c. Review of off-site fabrication and delivery schedules.
 - d. Requests for information (RFI) and other issues.
 - e. Modifications
 - f. Work in progress and projected.
 - 1) Status of required inspections (Special Inspections, Accessibility, etc.)
 - g. Inspections of work in progress and projected (Special inspections, Accessibility, etc.)
 - h. Construction Schedule update (provide updated Critical Path Method (CPM)).
 - i. Status of Project Record Drawings and O&M manuals.
 - j. Other business relating to work.
 - k. Permit requirements

- C. Preinstallation Conferences: Conduct at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend meeting. Advise CO of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders
 - e. Purchases
 - f. Deliveries
 - g. Submittals
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

1.8 ENVIRONMENTAL COORDINATION

- A. Contractor's Environmental Manager: Designate on-site party responsible for overseeing Contractor's conformance to environmental goals for project and implementing procedures for environmental protection.
1. Qualifications: Minimum 3 years Construction experience on projects of similar size and scope; with environmental procedures similar to this project; familiar with environmental regulations applicable to construction operations.
 2. Responsibilities: Responsibilities shall include:
 - a. Compliance with applicable Federal, State, and local environmental regulations, including maintaining required documentation.
 - b. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
 - c. Present overview of environmental issues and summarize site specific procedures relating to management plans at Preconstruction conference.
 - d. Training for Contractor personnel in accordance with position requirements.
 - e. Monitoring and documentation of environmental procedures.
- B. Perform project quality control in accordance with requirements specified in Related Sections, including:
1. Quality Requirements
 2. Regulatory Requirements

3. Noise and Acoustics Management
 4. Temporary Storm Water Pollution Prevention Environmental Management
 5. Construction Waste Management
- C. Contractor's Environmental Training Program: Contractor shall provide environmental training for workers performing work on project site. Training shall include:
1. Overview of environmental issues related to Project.
 2. Review of site-specific procedures and management plans:
 - a. Construction Waste Management
 - b. Noise and Acoustics Management
 - c. Temporary Storm Water Pollution Prevention
 3. P2 practices: Submit evidence of P2 training and participation in P2 programs.
 4. Compliance with environmental regulations: As specified in Regulatory Requirements. Submit Contractor 40 CFR (Code of Federal Regulations) employee training records upon request of CO.
- D. Provide documentation for environmental procedures as specified herein and in accordance with approved Waste Management Plan, and Storm Water Pollution Prevention Plan.

1.9 PERMITS

- A. General:
1. Permits and Responsibilities: Contractor shall, without additional expense to the Government, be responsible for obtaining necessary licenses and permits, and for complying with Federal, State and municipal laws, codes, and regulations applicable to the performance of the work. Contractor shall also be responsible for damages to persons or property that occur as a result of Contractor's fault or negligence; and for materials delivered and work performed until completion and acceptance of the work.
 2. For the purpose of this contract, Contractor will not be considered an agent of the Government. Contractor shall comply with appropriate Federal, State and local laws.
 3. It is assumed soil-disturbing activities will be more than 1 acre.
 - a. Assume a UPDES General Permit (*General Permit for Storm Water Discharges from Construction Activities Permit No. UTRC00000.*) will be needed.
- B. Potential Permits: Permits listed below were identified during the design process as likely to be required based on typical means and methods of construction. The list is provided to assist Contractor in determining which permits will be required for contract's chosen means and methods. The list shall not be considered complete; it is the Contractors' responsibility to determine means and methods and obtain required permits. Contractor shall obtain all permits required to legally conduct work.
1. UPDES General Permit for Discharges from Construction Activities Permit No. UTRC00000. Utah Department of Environmental Quality has jurisdiction.
- C. Coordination with Agency(ies) with Jurisdiction Issuing Permits

1. Coordination: Contact the Agency(ies) with Jurisdiction as needed and sufficiently in advance to avoid delaying work: Coordinate meetings, reporting requirements, inspections, and other requirements.

D. Administrative Procedures:

1. Coordinate scheduling and timing of required administrative provisions of project permits with Agency(ies) with Jurisdiction, Construction Manager, and Park to avoid conflicts.
2. Supply needed information to Agency(ies) with Jurisdiction issuing permits, pay fees required and provide material needed to comply with permit's conditions and provisions.
3. Upload permits to NPS project management and communication software when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 16 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of Construction Schedule requirements including:
 - 1. Schedule of Values
 - 2. Construction Schedule Requirements.
 - 3. Construction Schedule Updates.
 - 4. Time Impact Analysis.
- B. Purpose: The Construction Schedule ensures adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. It shall assist the Contractor and CO in monitoring the progress of the work, evaluating proposed changes, and processing Contractor's monthly progress payments. It shall include the dates in the contract, phases, milestones, occupancies, holidays, weather consideration, a critical path, and the requirements of this section.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: Allocation of the Schedule of Values for completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by the CO.
- C. Critical Path Method (CPM): Method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: Longest connected chain of interdependent activities through the network schedule that establishes minimum overall Project duration and contains no float.
- E. Float: Measure of leeway in starting and completing an activity.
 - 1. Float: Not for the exclusive use or benefit of the Government or Contractor but is jointly owned.
 - 2. Free Float: Amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total Float: Measure of leeway in starting or completing an activity without adversely affecting planned Project completion date.
- F. Resource Loading: Allocation of manpower and equipment necessary for completion of an activity as scheduled.
 - G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

- A. Electronic Copies: Schedules and reports submitted shall be posted on the NPS project management and communication software as PDF (portable document format) files. The intent of the Government is to limit the number of printed reports to those determined by the project team as essential.
- B. Schedule of Values: After contract award and a minimum of two weeks before Pre-Construction conference, submit schedule of dollar values based on Contract Price Schedule.
- C. Construction Baseline Schedule: After contract award and a minimum of two weeks before Pre-Construction conference, submit two paper copies of baseline schedule, large enough to show entire schedule for entire construction period. Utilize Schedule of Values in preparation of Construction Baseline Schedule.
- D. Critical Path Method (CPM) Reports: Concurrent with CPM schedule, submit three paper copies of the following computer-generated reports. For each activity, include activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of predecessor and successor tasks for activities sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updates: On or before 7th day preceding progress payment request date, submit estimates of percent completion of each schedule activity and necessary supporting data. Provide two paper copies.
- F. Construction Schedule Revisions and Time Impact Analysis: For each Construction Schedule revision, submit two paper copies of a Time Impact Analysis. Incorporate a Fragmentary Network (Fragnet) into currently accepted Construction Schedule demonstrating proposal to incorporate a modification, change, delay, or Contractor request.

1.4 QUALITY ASSURANCE

- A. Contractor shall meet with CO on day of the preconstruction conference to go over:
 1. Review software limitations, content and format for reports.

2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including interim milestones and Government occupancy/substantial completions.
4. Review delivery dates for Government-furnished products.
5. Review schedule for work of separate Government contracts.
6. Review time required for review of submittals and re-submittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review time required for obtaining and activating permits.
10. Review and finalize list of construction activities to be included in schedule.
11. Review baseline schedule comments, resolve issues and progress on incorporating them
12. Review procedures for updating schedule.
13. Discuss reporting requirements and establish protocol for naming and transmitting electronic schedules.

- B. Contractor's Schedule Representative: Before the preconstruction conference, designate an authorized representative to be responsible for preparing and maintaining the Construction Schedule. Submit resume outlining qualifications of Scheduler to CO for acceptance. Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency of using scheduling software. Authorized representative will be responsible for preparing the Baseline Schedule, required updates, revisions, Time Impact Analyses, and reports.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.
- B. Coordinate Construction Baseline Schedule with Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
1. In developing Construction Baseline Schedule, ensure Subcontractor's work at all tiers, and prime Contractor's work, is included and coordinated.
 2. Secure time commitments for performing critical elements of work from parties involved.
 3. Coordinate each construction activity in network with other activities and schedule in proper sequence.

PART 2 - PRODUCTS

2.1 SCHEDULE OF VALUES

- A. Breakdown each lump-sum item into component work activities used in the schedule for which progress payments may be requested. Work activities broken out within schedule of values shall be integrated into and made a logical part of the construction baseline schedule. Total costs for the component work activities shall equal contract price for that lump-sum item. CO may request data to verify accuracy of dollar values. Include mobilization, general condition costs, overhead

and profit in the total dollar value of unit price items and in the component work activities for each lump-sum item. Do not include mobilization, general condition costs, overhead or profit as a separate item.

- B. Do not break down unit price items. Use only the contract price for unit price items.
- C. Total cost of all items shall equal the contract price. The Schedule of Values will form the basis for progress payments and the Construction Schedule.

2.2 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Construction Baseline Schedule: Prepare Construction Baseline Schedule using a computerized, cost and resource-based, time-scaled Critical Path Method network analysis diagram for the Work.
 - 1. Develop and finalize Construction Baseline Schedule so it can be accepted for use no later than 30 days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing work within applicable completion dates, regardless of Governments acceptance of schedule.
 - 2. Establish procedures for monitoring and updating Construction Baseline Schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
- B. Construction Baseline Schedule Preparation: Prepare a list of all activities required to complete the Work. Using preliminary Critical Path Method network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate estimated duration, sequence requirements, and relationship of each activity in relation to other activities.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the Critical Path Method schedule within the limitations of the Contract Time.
 - 4. Show sequence and interdependence of activities required for completion of work. Ensure work sequences are logical and Construction Baseline Schedule shows a coordinated plan of the work.
 - 5. Resource loading of each activity shall include personnel by labor category and equipment type and capacity proposed to complete the activity in duration shown.
 - 6. Consider seasonal weather conditions in planning and scheduling work influenced by high and low ambient temperatures, wind, or precipitation to ensure completion of work within contract time.
 - 7. Time Frame: Proposed duration assigned to each activity shall be Contractor's best estimate of time required to complete activity considering the scope and resources planned for activity.

- a. An early finish date may be shown but the late finish date shall be same date as last day of contract period. An early completion schedule shall contain:
 - 1) Insert an activity titled "Project Float" as a successor to last activity in early project completion schedule network.
 - 2) Add a milestone titled "Contract End Date" as a successor to the activity "Project Float".
 - 3) Add duration to the activity "Project Float" as required so the milestone "Contract End Date" equals the last day of Contract Period.
 - b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
 - c. Contractor shall limit use of lead or lag duration's between schedule activities.
 - d. Project Calendars: Develop and incorporate the following calendars:
 - 1) Administrative Calendar: Include calendar based on a 7-day week to be used on activities based on calendar days. Apply this calendar to administrative tasks or other tasks not affected by non-working days (Federal Holidays, weather, etc.).
 - 2) Project Calendar: Include calendar based on planned work week for the project. Include Federal Holidays, weekends, and non-workdays indicated in contract documents. Apply this calendar to activities not anticipated to be affected by weather. Be clear when identifying number of work days in work week.
 - 3) Weather Calendar: Utilize Project Calendar and show anticipated normal downtime related to weather as non-working time. Weather days shall be based on data for local area from a reliable source like the National Oceanic and Atmospheric Administration (NOAA), National Park Service records, or source acceptable to CO. Apply this calendar to activities anticipated to be affected by weather.
 - e. Activity Duration: Define so no activity is longer than 14 days, except for non-construction activities including mobilization, shop drawings and submittals, fabrication and delivery of materials and equipment.
 - f. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities can include submittals, approvals, purchasing, fabrication, and delivery.
 - g. Submittal Review Time: Include review and re-submittal times indicated. Coordinate submittal review times in Construction Baseline Schedule.
 - h. Substantial Completion: Allow time for Government administrative procedures necessary for certification of Substantial Completion. (For more information, refer to Specification 01 77 00 "Closeout Procedures.")
8. Constraints: Include constraints and work restrictions indicated in Contract Documents and as follows in schedule and show how the sequence of Work is affected.
- a. Work Restrictions: Show effect of the following on the schedule:
 - 1) Uninterruptible services
 - 2) Partial occupancy before Substantial Completion
 - 3) Seasonal variations

- 4) Environmental control
 - 5) Permit provisions
- b. Work Stages: Indicate important stages of construction for each major portion of the Work.
 - 1) Subcontract awards
 - 2) Submittals
 - 3) Purchases
 - 4) Mockups
 - 5) Fabrication
 - 6) Sample testing
 - 7) Deliveries
 - 8) Installation
 - 9) Tests and inspections
 - 10) Adjusting
 - 11) Curing
9. Milestones: Include milestones indicated in Contract Documents in schedule, including, but not limited to, Notice to Proceed, Substantial Completion and the following interim milestones:
 - a. Substantial completion of Sunset Point Road and Parking area
 - b. Substantial completion of Sunrise Point Road
- C. Joint Review, Revision, and Acceptance:
 1. Within seven calendar days of receiving Contractor's proposed Construction Baseline Schedule, CO shall review initial Construction Baseline Schedule.
 2. Within seven calendar days after review, Contractor shall revise and resubmit Construction Baseline Schedule in accordance with comments presented from review.
 3. In the event the Contractor fails to define any element of work, activity, or logic and the CO review does not detect this omission or error, such omission or error, when discovered by Contractor or CO, shall be corrected by Contractor within seven calendar days and shall not affect contract period.
 4. Upon acceptance of the Construction Baseline Schedule, CO saves schedule as a baseline and updates on a monthly basis. Construction schedule update will be used to evaluate Contractor's monthly applications for payment based upon information developed at monthly Construction Schedule update meeting.
- D. Cost Correlation: In the heading of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of dates used to prepare payment requests.
 1. Contractor shall assign cost to construction activities on Construction Baseline Schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with CO's approval, be assigned to fabrication and delivery activities. Costs shall be included for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable).
 2. Each activity cost shall reflect an accurate value based on the Contract Price Schedule.
 3. Total cost assigned to activities shall equal total Contract Price.

- E. Recovery Schedule: When periodic schedule update indicates Work is 14 or more calendar days behind current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule shall also be submitted. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery shall be accomplished.
- F. Computer Software: Prepare schedules using a program developed specifically to manage construction schedules.
 - 1. Use Microsoft Project or Primavera, for Windows 11 and newer.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE LIMITATIONS

- A. Provide a week's notice prior to construction to allow the NPS to survey areas of disturbance for nesting birds. No work for 21 days if a nest is located.
- B. 15-minute project delays to public traffic are allowed.
- C. All seeding activities shall be completed by the NPS and take place between October 1st and November 30th. The Contractor will be responsible for soil preparation ahead of seeding.
- D. Removal of trees greater than 6 inches shall be completed by the NPS outside of the biologically sensitive period (April 1 to July 15th).

3.2 CONSTRUCTION SCHEDULE UPDATES

- A. Progress Meeting Updates: Provide a 2 week look-ahead schedule, derived from the currently accepted schedule, before each weekly progress meeting. Utilize look-ahead schedule to facilitate and take notes on discussions held during progress meeting.
- B. Monthly Schedule Updates:
 - 1. General: Update Construction Schedule on monthly basis to reflect construction progress and activities throughout entire contract period and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
 - 2. Procedure: Contractor shall meet with CO each month at Construction Schedule update meeting to review progress made through the status date of the Construction Schedule update, including dates activities were started or completed and percentage of work completed on each activity started or completed.
 - 3. Reports: Concurrent schedule revisions, prepare tabulated reports showing:
 - a. Identification of activities that have changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays
 - e. Changes in the critical path

- f. Changes in total float or slack time
 - g. Changes in the Contract Time
 - 4. Narrative: Report shall include a brief description of actual progress made during update period; actual and potential delaying activities; impediments to progress; issues related to inclement weather; progress toward established milestones and project float. Report shall include a brief description of work anticipated to be performed in the next month. Minor revisions to the schedule should be identified for evaluation and acceptance or rejection.
 - 5. As Work progresses, indicate Actual Completion percentage for each activity.
 - 6. If schedule update shows a late finish date after contract completion date, include:
 - a. Known delays
 - b. Actions to get back on schedule
 - c. Pending modifications
 - d. Impediments or constraints affecting progress
 - 7. Progress Payments: Monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made. If Contractor fails to provide schedule updates or revisions, a portion of the monthly payment may be retained until corrections have been made.
- C. Distribution: Distribute copies of accepted schedule to CO, COs Representative, Construction Management Representative, Subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
- 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to same parties and post in same locations. Delete parties from distribution when they have completed their assigned portion of the Work.
- D. Construction Schedule Revisions:
- 1. Required Revisions: If, as a result of the monthly schedule update, it appears the currently accepted Construction Schedule no longer represents actual prosecution and progress of the work, CO will request, and Contractor shall submit, a revision to the Construction Schedule. Contractor may also request reasonable revisions to currently accepted Construction Schedule in event the Contractor's planning for the work is revised. If Contractor desires to make changes, Contractor shall notify CO in writing, stating reason for proposed revision. Accepted revisions shall be incorporated into currently accepted Construction Schedule for next monthly schedule update.
 - 2. Procedure: If revision to currently accepted Construction Schedule is contemplated, Contractor or CO shall advise the other in writing at least seven calendar days prior to next monthly schedule update meeting, describing revision and reasons for the revision. Government-requested revisions will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.
 - 3. Reports: Concurrent with making revisions to schedule, prepare tabulated reports showing:
 - a. Identification of activities changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays

- e. Changes in critical path
- f. Changes in total float or slack time

3.3 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS CHANGES DELAYS AND CONTRACTOR REQUESTS:

1. Requirements: When contract modifications or changes are initiated, delays experienced, or Contractor desires to revise currently accepted Construction Schedule, Contractor shall submit to CO a written time impact analysis illustrating the influence of modification, change, delay, or Contractor request on contract time.
2. Time Extensions: Activity delays, resulting in a late completion date projection, shall not automatically mean an extension of contract time is warranted or due to Contractor. It is possible a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in absorbing a part of available total float that may exist within an activity chain of the Schedule, not causing any effect on contract time. Time extensions will be granted in accordance with terms of contract.
3. Extension of contract time will be granted only to the extent the equitable time adjustments to activity or activities affected by modification, change, or delay exceeds total (positive or zero) float available on a particular activity.
4. Procedure: Each time impact analysis shall be submitted within time period stated in a request for proposal, or time period designated under the clauses entitled Changes or Default. In cases where Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Contractor request does not require an extension of the contract time. Upon acceptance, time impact analysis shall be incorporated into currently accepted Construction Schedule at next monthly schedule update.
5. Contract Modifications: Prepare time-impact analysis using fragnets to demonstrate effect of proposed change on overall Construction Schedule for each proposed contract modification concurrent with submission.

END OF SECTION 01 32 16

SECTION 01 32 33 – PHOTO DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for:
 - 1. Existing condition images taken prior to the beginning of construction.
 - 2. Existing condition images of stone headwalls and masonry treatment of stone base around shuttle shelter to facilitate reconstruction of structures.
 - 3. Periodic construction images of all work features.
- B. See Section 01 77 00 "Closeout Procedures" for a complete listing of closeout documents.

1.2 SUBMITTALS

- A. Existing Condition and Construction Images: Submit images electronically within seven days of taking the image. Include:
 - 1. Date, time and number (sequentially number all images) in filename.
 - 2. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 3. Submit digital images exactly as originally recorded in digital camera, without alteration, or modifications using image-editing software.
- B. Closeout: Submit complete set of digital image electronic files as a Project Record Document. Submit on USB drive or electronically.
 - 1. Provide index as separate file on Disc. List each image as a file name with number, date, and time. Include description and or vantage point image was taken.
 - 2. Submit images that have the same aspect ratio as the sensor, un-cropped.

PART 2 - PRODUCTS

2.1 FORMAT REQUIREMENTS

- A. Media: USB drive, sharepoint site or other approved electronic format.
- B. Images: Provide sRGB (standard Red Green Blue) color images in JPEG (Joint Photographic Experts Group) format. Minimum sensor size of 8-megapixels, and at image resolution of not less than 3200 by 2400, and 300 dpi (dots per inch).

PART 3 - EXECUTION

3.1 CONSTRUCTION IMAGES

- A. General: Take digital images using the maximum range of depth of field, in-focus, to clearly show the Work. No blurry or out-of-focus areas accepted.
 - 1. Maintain index with each set of Construction images and identify the number, date, time, and description for each.
 - 2. Maintain one set of images accessible in field office at Project site available for reference.
- B. Existing Condition Images: Before commencement of demolition or take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Flag construction limits before recording construction images.
 - 2. Take a minimum of eight separate images to show existing conditions adjacent to property before starting Work.
 - 3. Adequately document with images of stone headwalls and masonry treatment of stone base around shuttle shelter to facilitate reconstruction of structures.
- C. Periodic Construction Images: Take a minimum of 12 color, digital images weekly, with timing each month adjusted to coincide with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last images were taken.
- D. Additional Images: Contracting Officer may issue requests for additional images.
 - 1. Three days advance, where feasible.
 - 2. In emergency situations, take additional images within 24 hours of request.
 - 3. Additional images include, but are not limited to:
 - a. Immediate follow-up when on-site events result in construction damage or losses.
 - b. Fabrication locations away from Project site.
 - c. Substantial Completion of a major phase or component of Work.
 - d. Extra record images at time of final acceptance.

END OF SECTION 01 32 33

SECTION 01 33 23 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written, graphic information, and physical samples that require Government's responsive action.
- B. Informational Submittals: Written information that does not require Government's responsive action. Submittals may be rejected for not complying with requirements.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 GENERAL SUBMITTAL PROCEDURES

- A. General: Prepare and submit submittals required by individual Specification Sections and in some cases as requested in drawings. Types of submittals are indicated in individual specific sections and the attached Submittal List.
 - 1. CO reserves right to require submittals in addition to those called for in individual sections.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Review for legibility, accuracy, completeness, and compliance with Contract Documents.
 - 1. Coordinate submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- C. Submittal List: Submittal list is attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements. The requirements of individual Specification Sections and terms and conditions of the Contract still apply regardless of what is shown on submittal list.

- D. Processing Time: Allow enough time for submittal review and re-submittals. Contract time extensions will not be authorized if submittals are not transmitted with enough time to permit processing, including re-submittals.
1. Action Submittals
 - a. Initial Review: Allow 30 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
 - b. Re-submittal Review: Allow 14 days for review of each re-submittal.
 2. Informational submittals
 - a. Review: Allow 10 days for review of each submittal.
- E. Approved Equal Submittal Requirements:
1. For each item proposed, submit supporting data, including:
 - a. Drawings and samples as appropriate.
 - b. Comparison of the salient characteristics of the proposed item with that specified.
 - c. Changes required in other elements of the work because of the substitution.
 - d. Name, address, and telephone number of vendor.
 - e. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
 2. A request for approval constitutes a representation that Contractor:
 - a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
 - b. Will provide the same warranties for the proposed item as for the item specified.
 - c. Has determined that the proposed item is compatible with interfacing items.
 - d. Will coordinate installation of an approved item and make changes required in other elements of the work because of the substitution.
 - e. Waives claims for additional expenses that may be incurred as a result of the substitution.
- F. Submittals: Identify and incorporate information in each submittal file as follows:
1. Transmittal Form (CM-16): Utilize [NPS Transmittal Form](#) for all submittals. No action will be taken on a submittal item unless accompanied by this Transmittal Form.
 2. Physical samples: Complete Transmittal Form and deliver physical sample to the CO (or designee) on site for processing. All comments and actions will be documented on the Transmittal Form.
- G. Identification: Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use a sequential number (e.g. .001). Re-submittals shall include alphabetic suffix after another decimal point (e.g. .001.A).

- H. Re-submittals: Make re-submittals using same process used with initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in the title block on the Transmittal Form (CM-16) and clearly indicate extent of revision.
 - 3. Re-submit submittals until they are marked "Approved" or "Approved with notations".
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities.
- J. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved with notations". Ensure notations have been incorporated and, at a minimum, keep one copy of final approved submittal on site for use during construction.

1.4 CONTRACTOR'S USE OF CAD/BIM FILES

- A. General: At Contractor's written request, copies of CAD/BIM (Computer Aided Design/Building Information Modeling) files will be provided to Contractor for use in connection with Project, subject to:
 - 1. Files provided as is; no format or other changes to files or changes to objects in the drawing will be done by the Government.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each submittal to show which products and options are applicable.
 - 3. As applicable, include:
 - a. Manufacturer's product specifications.
 - b. Manufacturer's installation instructions: When Contract Documents require compliance with manufacturer's printed instructions, provide one complete set of instructions to CO and keep another complete set of instructions at the project site until substantial completion.
 - c. Manufacturer's catalog cuts: Submit only pertinent pages; mark each page of standard printed data to identify specific products proposed for use.
 - d. Printed performance curves.
 - e. Compliance with specified referenced standards.
 - f. Testing by recognized testing agency.
 - 4. Submit product data in PDF (portable document format) file format before or concurrent with samples.

- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal of CAD/BIM Drawings is otherwise permitted.
1. Preparation: Fully illustrate requirements in Contract Documents. As applicable, include:
 - a. Dimensions
 - b. Identification of products
 - c. Fabrication and installation drawings
 - d. Roughing-in and setting diagrams
 - e. Templates and patterns
 - f. Schedules
 - g. Notation of coordination requirements
 - h. Notation of dimensions established by field measurement
 - i. Relationship to adjoining construction clearly indicated
 - j. Seal and signature of professional engineer if specified
 2. Submit shop drawings as PDF electronic file
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Complete and post the Transmittal Form (CM-16) on the NPS project management and communication software website for processing and documentation of action on submitted samples.
 3. Identification: Attach label on unexposed side of Samples that includes:
 - a. Generic description of Sample
 - b. Product name and name of manufacturer
 - c. Sample source
 - d. Submittal Number and title of appropriate Specification Section
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. CO will return with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit four sets of Samples. CO will retain three Sample sets; remainder will be returned. Retain Sample set as a Project Record Sample.
- D. Construction Materials: Contractor is encouraged to submit products made out of recycled or environmentally responsible material. Every effort will be made by NPS to approve these materials.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by individual Specification Sections.
 - 1. Post informational submittals as PDF electronic files directly to the NPS project management and communication software.
 - 2. Certificates and Certifications: Provide a notarized statement with signature of entity responsible for preparing certification. Certificates and certifications shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Informational submittals that do not comply with requirements specified in Contract Documents will be rejected and one copy will be returned.
- B. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- D. Accident Prevention Plan: Comply with requirements specified in Section 01 35 23 "Safety Requirements."
- E. Schedule of Values: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- F. Waste Recycling Plan: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- G. Quality Control Plan: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- H. Storm Water Pollution Prevention Plan: Comply with requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Prevention" and storm water permit requirements identified in Section 01 31 00 "Project Management and Coordination."
- I. Qualification Data: Prepare written information demonstrating capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

- K. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying Installer complies with Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- L. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying manufacturer complies with Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Prepare written statements on manufacturer's letterhead certifying product complies with Contract Documents.
- N. Material Certificates: Prepare written statements on manufacturer's letterhead certifying material complies with Contract Documents.
- O. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in Contract Documents.
- P. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of Contract and for compliance with Contract Documents. Note corrections and field dimensions.

3.2 CO'S ACTION

- A. General: Submittals will be disapproved without technical review if identification information is missing, not filled in, or if placed on back of submittal; an incorrect format of submittals is provided; transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Contractor's approval.
 - 1. Any work done or orders for materials or services placed before approval shall be at Contractor's own risk.
- B. Action Submittals: CO will review each submittal, generate comments on corrections or modifications required, and indicate appropriate action on the Transmittal Form (CM-16). Submittal will be marked as defined below:
 - 1. APPROVED: Acceptable with no corrections.
 - 2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. Comments are clear and no further review is required. Contractor shall address review comments when proceeding with the work.

3. DISAPPROVED - RESUBMIT: Rejected as not in accordance with the contract or as requiring major corrections or clarifications. CO will identify reasons for disapproval. Contractor shall revise and resubmit with changes clearly identified.
- C. Informational Submittals: CO will review each submittal and will either accept or reject it.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01 33 23

SUBMITTAL LIST										
Park Acronym/Project Management Information System (PMIS) Number:					BRCA 310427					
Project Title:		Shuttle Bus Stops and Pedestrian Crosswalk								
SUBMITTAL			REQUIREMENTS (Indicate with X)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION			
			CERTS OR LAB TESTS	REPORTS OR CALCS OR PLAN	MFG. DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MFG. DATA AND INSTRUCTIONS	OTHER
01 31 00		Project Management and Coordination								
	1.4	Division 1 Documents				X				
	1.4	List of Required Construction Permits				X				
	1.4	Pollution Prevention Training Program				X				
01 32 16		Construction Schedule								
	1.3	Schedule of Values				X				
	1.3	Construction Baseline Schedule				X				
	1.3	CPM Reports				X				
	1.3	Construction Schedule Updates, Revisions and Time Impact Analysis				X				
01 32 33		Photo Documentation								
	1.2	Existing Condition, Construction and Closeout Images				X				
01 35 23		Safety Requirements								
	1.3	Accident Prevention Plan		X						
01 40 00		Quality Requirements								
	1.4	Quality Control Plan		X						
	1.4	Qualification Data				X				
	1.4	Contractor's Quality Control Daily Reports		X						
	1.4	Daily Test Reports		X						
	1.4	Accessibility Inspection Report		X						
	1.4	Off-Site Inspection Reports		X						
	1.4	Permits, Licenses, and Certificates				X				
01 50 00		Temporary Facilities and Controls								
	1.5	Traffic Control and Access Plan		X						
	1.5	Construction Plan		X						
01 57 23		Temporary Storm Water Pollution Prevention								
	1.3	SWPPP				X				
	1.3	UPDES General Permit				X				
	1.3	Inspection Schedule				X				
	1.3	Erosion Control Products			X					
	1.4	Quality Assurance Plan		X						
01 67 00		Product Requirements								
	1.3	Record Submittals				X				
01 73 29		Cutting and Patching								
	1.2	Cutting and Patching Plan								X
01 73 40		Execution								
	1.2	Certificates	X							
	1.2	Landfill Receipts				X				
	1.2	Certified As-built and Quantity Surveys		X						
01 74 19		Construction Waste Management and Disposal								

SUBMITTAL LIST										
Park Acronym/Project Management Information System (PMIS) Number:						BRCA 310427				
Project Title:		Shuttle Bus Stops and Pedestrian Crosswalk								
SUBMITTAL			REQUIREMENTS (Indicate with X)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION			
			CERTS OR LAB TESTS	REPORTS OR CALCS OR PLAN	MFG. DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MFG. DATA AND INSTRUCTIONS	OTHER
	1.4	Waste Management Plan & Updates								X
	1.4	Progress Documentation				X				
	1.4	Waste Reduction Calculations		X						
	1.4	Landfill and Incinerator Disposal Records				X				
	1.4	Closeout Submittals				X				
01 77 00		Closeout Procedures								
	1.3	Closeout Requirements				X				
	1.3	Warranties, bonds, final certifications				X				
	1.3	Project and Environmental Record Documents				X				
	1.5	Permit Closure and Transfer				X				
02 41 00		Demolition and Salvage								
	1.4	Demolition and Salvage Plan				X				
	1.4	Copies of notifications, authorizations, permits				X				
03 10 00		Concrete Forming and Accessories								
	1.4	Shop drawings						X		
03 15 00		Concrete Joints and Accessories								
	1.3	Shop drawings						X		
	1.3	Product Data								X
	1.3	Certification	X							
	1.3	Manufacturer's Instructions			X					
03 21 00		Steel Reinforcement								
	1.3	Shop drawings						X		
	1.3	Lab test reports	X							
	1.3	Mechanical Threaded Connections Information				X				
	1.3	Epoxy-coated Reinforcing Bars Certification	X							
	1.3	Welding Qualification				X				
03 30 00		Cast In Place Concrete								
	1.4	Mix Designs								X
	1.4	Concrete Samples					X			
	1.4	Product Data								X
	1.4	Cold Weather Curing Plan								X
	1.4	Hot Weather Curing Plan								X
	1.4	Concrete Repair Techniques								X
	1.4	Preinstallation Conference Minutes				X				
	1.4	Statement of Qualifications				X				
	1.4	Field Test Reports	X							
	1.4	Concrete Delivery Tickets				X				
03 39 00		Concrete Curing								
	1.3	Manufacturer's Data							X	
	1.3	Certificates of Compliance	X							
03 63 00		Concrete Doweling								
	1.3	Product Data							X	

SUBMITTAL LIST										
Park Acronym/Project Management Information System (PMIS) Number:						BRCA 310427				
Project Title:		Shuttle Bus Stops and Pedestrian Crosswalk								
SUBMITTAL			REQUIREMENTS (Indicate with X)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION			
			CERTS OR LAB TESTS	REPORTS OR CALCS OR PLAN	MFG. DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MFG. DATA AND INSTRUCTIONS	OTHER
	1.3	Manufacturer's Instructions			X					
	1.3	Installer Certification	X							
04 43 00		Stone Masonry								
	1.4	Samples					X			
05 50 00		Metal Fabrications								
	1.4	Shop Drawings						X		
06 10 53		Miscellaneous Rough Carpentry								
	1.4	Product Data							X	
07 41 13.16		Standing Seam Metal Roof Panels								
	1.4	Product Data							X	
	1.4	Shop Drawings						X		
	1.4	Samples					X			
	1.4	Qualification Data				X				
	1.4	Field QC Reports	X							
	1.4	Warranties				X				
07 92 00		Joint Sealants								
	1.3	Product Data							X	
	1.3	Samples					X			
	1.3	Joint Sealant Schedule								X
	1.3	Qualification Data				X				
	1.3	Preconstruction Field Adhesion Test Reports	X							
	1.3	Sample Warranties				X				
09 91 13		Exterior Painting								
	1.3	Product Data								
	1.3	Samples								
10 14 00		Signage								
	1.3	Shop Drawings						X		
	1.3	Samples					X			
	1.3	Manufacturer's Instructions			X					
26 41 13		Lightning Protection System								
	1.5	Product Data							X	
31 10 00		Site Clearing								
	1.3	Site Plan								X
	1.3	Survey Information Delineating Limits of Debris Disposal				X				
31 23 00		Excavation and Fill								
	1.4	Work Plan								X
	1.4	Test Reports and Supporting Documentation	X			X				
31 37 00		Riprap								
	1.4	Shop drawings						X		
	1.4	Samples					X			
	1.4	Quarry Certificate	X							
	1.4	Trip Tickets			X					
	1.4	Product Data			X					
32 11 23		Aggregate Base								
	1.4	Certified Test Results on Source Materials	X							

SUBMITTAL LIST										
Park Acronym/Project Management Information System (PMIS) Number:						BRCA 310427				
Project Title:		Shuttle Bus Stops and Pedestrian Crosswalk								
SUBMITTAL			REQUIREMENTS (Indicate with X)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION			
			CERTS OR LAB TESTS	REPORTS OR CALCS OR PLAN	MFG. DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MFG. DATA AND INSTRUCTIONS	OTHER
	1.4	Certified In-place Density Tests	X							
	1.4	Certifications for Material Testing Personnel and Laboratories				X				
	1.4	Documentation on CQC Material Testing				X				
32 12 13.13		Asphalt Prime Coat & Tack Coat								
	1.2	Material Invoice or Bill for Lading				X				
32 12 16		Minor Asphalt Pavement								
	1.3	Mix Design								X
32 13 13		Concrete Paving								
	1.4	Concrete Pavement Placement Plan								X
	1.4	Proof of Finisher's ACI Certification	X							
	1.4	Paving machine, grade trimmer and gang drill information				X				
32 17 23		Pavement Markings								
	1.4	Shop drawings						X		
	1.4	Product Data							X	
	1.4	Information on removal methods				X				
	1.4	Manufacturer's Certificate of Compliance	X							
	1.4	Equipment List				X				
	1.4	Manufacturer's Instructions			X					
32 31 26		Wood Fencing								
	1.4	Shop drawings						X		
	1.4	Samples					X			
32 33 00		Site Furnishings								
	1.3	Product Data							X	
	1.3	Samples					X			
32 91 13		Soil Preparation								
	1.3	Samples					X			
32 92 00		Turf and Grasses								
	1.2	Product Data							X	
	1.2	Manufacturer's Instructions			X					
33 44 01		Storm Drain Piping								
	1.4	Manufacturer Certification	X							
	1.4	Manufacturer Data Sheets and Instructions			X					
DWGS		Structural								
	S1	Shop Drawings for Structural Steel						X		
	S1	Welding Procedure Specification								X
	S1	Engineering Designs of Temp Shoring and Bracing (if necessary)								X
	X1	Coodinated Conduit Drawing						X		

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes establishing an effective accident prevention program and providing a safe working environment for personnel and visitors.

1.2 CONDITIONS PRESENT FOR PROJECT

- A. Underground utilities including power, water, communication, and sanitary sewer lines; exposure to public traffic and equipment operations; weather including but not limited to hot and cold conditions, rain, snow, ice, and wind; wildlife including coyotes, bears, and other animals; natural hazards such as falling trees and branches, cliffs, and other existing conditions.

1.3 SUBMITTALS

- A. Accident Prevention Plan (APP): Submit APP after contract award and a minimum of two weeks before Pre-Construction conference. CO will review proposed APP. If APP requires any revisions or corrections, Contractor shall resubmit Plan within 10 days. No progress payments will be made until the APP is accepted.

1.4 QUALITY ASSURANCE

- A. Comply with contract clauses "Accident Prevention" and "Permits and Responsibilities." In case of conflicts between Federal, State, and local safety and health requirements, the most stringent shall apply. Onsite equipment shall meet 29 CFR 1926 (Code of Federal Regulations) (Occupational Safety and Health Administration (OSHA)) requirements. Failure to comply with requirements of this section and related sections may result in suspension of work.
- B. Site Safety Supervisor:
 - 1. Designate authorized onsite representative for preparation and maintenance of the APP.
 - 2. Shall be responsible for:
 - a. Implementation and enforcement of the APP
 - b. Daily safety inspections
 - c. Conducting and documenting weekly and monthly safety meetings
 - d. Review of safety requirements at progress meetings
 - e. Compilation and maintenance of Material Safety Data Sheets (MSDS) and safety reference materials
 - f. Tracking and resolution of safety violations
 - g. Site personnel and visitor compliance with site safety and health requirements and APP
 - h. Investigation and reporting of accidents and injuries

C. Qualifications of Employees:

1. Physically and able to perform their assigned duties in a safe manner.
2. Do not allow employees whose ability or alertness is impaired because of prescription or illegal drug use, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury to perform work.
3. Provide operating instructions for equipment. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, operating instructions, and be fully capable of operating such equipment. Retain copies of operator licenses and certifications onsite.

1.5 ACCIDENT REPORTING

A. Reportable Accidents: Defined as: death, occupational disease, and/or traumatic injury to employees or the public; fires; and/or property damage by accident in excess of \$100.

1. Notify CO immediately in the event of a reportable accident.
2. Fill out and forward an Accident/Property Damage Report Form (CM-22) to CO within 7 days of a reportable accident. Obtain form from CO.

PART 2 - PRODUCTS

2.1 ACCIDENT PREVENTION PLAN (APP)

A. APP shall be written to comply with OSHA and project requirements (generic plan is not acceptable) including but not limited to:

1. Name and qualifications of supervisor responsible to carry out program.
2. Weekly and monthly safety meetings shall be documented with topics and attendees.
3. First aid and rescue procedures.
4. Hazardous material plan including relevant material safety data.
5. Job Hazard Analysis (JHA) for each major phase. List of hazards associated and methods proposed to provide for property protection and safety of the public, National Park Service personnel, and Contractor's employees. Include initial and continuing training.
6. Planning for possible emergency situations, as detailed in Article 1.2. Such planning shall take nature of construction, site conditions, and degree of exposure of persons and property into consideration.
7. Infectious Disease Preparedness:
 - a. Contractors are responsible for their employees' safety and the safety of job site visitors during the performance of this contract. We encourage Contractors to follow guidance from the Department of Labor (DOL), Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), and all other applicable local, city, and state mandates. We encourage Contractors to develop policies for infection prevention and an Infectious Disease Preparedness and Response Plan.
 - b. To the extent appropriate, Contractors should include the protective health and safety measures they intend to implement in any accident prevention or safety

submittals required under this contract. These plans should contain preventive measures the Contractor intends to follow while performing work on government property as well as responsive and corrective actions to be taken if an employee exhibits symptoms or tests positive for contagion.

- c. Upon contract award, Contractors should communicate with CO regarding Contractor decisions and actions to protect the health and safety of workers for the duration of contract performance under which pandemic conditions exist.

2.2 FIRST AID FACILITIES

- A. Provide adequate facilities for number of employees and appropriate to construction hazards.

2.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

- A. Selection shall conform to OSHA Subpart E.

PART 3 - EXECUTION

3.1 DAILY SAFETY INSPECTIONS

- A. Conduct daily safety inspections and maintain daily safety reports which include:
 - 1. Area/operation inspected
 - 2. Date of inspection
 - 3. Identified hazards
 - 4. Corrective actions taken

3.2 EMERGENCY INSTRUCTIONS

- A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at work site.

3.3 FIRE AND LIFE SAFETY

- A. Comply with requirements of National Fire Protection Association (NFPA) 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).

3.4 HAZARDOUS MATERIALS

- A. Hazardous materials: Explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.
- B. Store hazardous materials in accordance with manufacturer's and OSHA Subpart D requirements. Maintain Material Safety Data Sheets (MSDS) for each chemical readily available on site.
 - 1. Immediately report spills of hazardous materials to the Park.

2. Maintain a spill emergency response kit.
3. Train employees how to respond to a spill and use emergency response kit.

3.5 PROTECTIVE EQUIPMENT

- A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair personal items as appropriate before issuing to another individual.

3.6 SAFETY MEETINGS

- A. As a minimum, conduct one weekly 15-minute "toolbox" safety meeting conducted by a foreman or supervisor and attended by construction personnel at worksite. Topics shall coincide with work scheduled for following week. Document and submit meeting minutes to CO within one day after meeting.
- B. Conduct monthly safety meetings for personnel, contractors, and subcontractors performing work on the site. Notify CO of meeting dates and times. Meetings shall be used to: review effectiveness of Contractor's safety effort; resolve current health and safety problems; provide a forum for planning safe construction activities, and for updating Accident Prevention Plan. COs Representative will attend meetings and enter results of meetings into the daily log.

3.7 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

- A. A hard hat use area shall be designated by Contractor. Hard hat area shall be posted by Contractor in a manner satisfactory to CO.
- B. It is Contractor's responsibility to require persons working on or visiting site to wear hard hats and PPE in good repair at all times. As a minimum, maintain six hard hats and other APP required equipment.

3.8 TRAINING

- A. First Aid: Provide training to personnel to ensure prompt and efficient first aid.
- B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage.

END OF SECTION 01 35 23

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements. Quality of work shall be responsibility of the Contractor.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with Contract Document requirements.
 - 2. Contractor shall provide an independent third party testing agency to complete all field and laboratory testing and reporting for all site work.
- C. See Divisions 2 through 49 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate actual products incorporated into the work and completed construction comply with requirements.
- C. Mockups: Full-size physical assemblies constructed on-site. Mockups are constructed from selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Approved mockups establish the standard by which the Work will be judged, unless otherwise indicated.
 - 1. Integrated Exterior Mockups: Mockups of colored concrete retaining wall, curbs and flatwork on Project site, consisting of a minimum of five shades of a color specified for selection of the final color by the CO.
- D. Preconstruction Testing: Tests and inspections performed specifically for project before products and materials are incorporated into work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency

qualified to conduct product testing, to establish product performance and compliance with industry standards.

- F. Source Quality Control Testing: Tests and inspections performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality Control Testing: Tests and inspections performed on-site for installation of work and for completed work.
- H. Testing Agency or Laboratory: Entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

- A. Reference Standards: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to CO before proceeding.
- B. Minimum Quality Levels: Quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quality specified, or it may exceed minimum within reasonable limits. To comply with requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to CO before proceeding.

1.4 SUBMITTALS

- A. Quality Control Plan:
 - 1. After contract award and before Pre-Construction conference, submit a written Contractor Quality Control (CQC) plan.
 - 2. If plan requires revisions or corrections, Contractor shall resubmit plan within 10 days.
 - 3. Government reserves the right to require changes in plan during contract period as necessary to obtain the quality specified.
 - 4. No change in the approved plan may be made without written concurrence by CO.
- B. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in form of a recent report on inspection of testing agency by a recognized authority.

- C. Contractor Quality Control (CQC) Daily Reports: Submit showing inspections and tests on first workday following date covered by report. Quality Control Supervisor shall utilize [DSC Forms](#).
 - 1. Review Construction Management Representative (CMR) Daily report if applicable and reconcile any differences prior to posting.
- D. Test Reports
 - 1. Test reports shall be completed by person performing test.
 - 2. Submit Daily Test Information Sheets with Quality Control Daily Reports.
 - 3. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
 - 4. Submit three copies of complete test results no later than one calendar day after test was performed.
- E. Accessibility Inspection Report:
 - 1. Fill out applicable sections of the Accessibility Inspection Report and attach to Contractor Quality Control Daily Report.
 - 2. Utilize attached Accessibility Inspection form to document compliance with Architectural Barriers Act Accessibility Standards (ABAAS).
 - 3. Inspect at various stages of construction as needed to ensure finished product meets standards.
 - 4. Submit report no later than one calendar day after inspection was performed.
- F. Off-Site Inspection Reports: Submit prior to shipment.
- G. If Contractor Quality Control plan and Quality Control Daily Reports are not submitted as specified, CO may retain payments until such time plan(s) is/are accepted and implemented, or may retain payments for work completed on days with no Quality Control Daily Reports.
- H. Permits, Licenses, and Certificates: For National Park Service (NPS) records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of work.

1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Contractor's Quality Control Staff:
 - 1. Contractor's Quality Control Supervisor may also perform other duties.
 - 2. Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.
 - 3. Contractor's job supervisory staff may be used to assist Quality Control Supervisor supplemented, as necessary, by additional certified testing technicians.

- C. Installer Qualifications: Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent indicated for Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: Firm experienced in manufacturing products or systems similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Fabricator Qualifications: Firm experienced in producing products similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- F. Professional Engineer Qualifications: Professional engineer legally qualified to practice in jurisdiction where Project is located and is experienced in providing engineering services of kind indicated (including Structural Tests and Special Inspections (STSI)). Engineering services are defined as those performed for installations of system, assembly, or products similar to those indicated for Project in material, design, and extent.
- G. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or an independent agency with experience and capability to conduct testing and inspecting indicated, according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by Contract, is acceptable to CO.
 - 1. Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7 (Code of Federal Regulations).
 - 2. National Voluntary Laboratory Accreditation Program (NVLAP): Testing agency accredited according to National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program.
 - 3. Measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NIST requirements. Measuring and testing devices shall be made available for use by Government for verification tests.
- H. Factory-Authorized Service Representative Qualifications: Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products similar in material, design, and extent to those indicated for Project.
- I. Mockups: Before installing portions of work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed work:
 - 1. Build mockups in location and of size indicated; if not indicated, as directed by CO.
 - 2. Notify CO seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate proposed range of aesthetic effects and workmanship.
 - 4. Obtain CO's approval of mockups before starting work, fabrication, or construction.
 - 5. Maintain mockups in an undisturbed condition as a standard for judging the completed work.
 - 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

- A. Contractor is responsible for testing and inspections, including Structural Tests and Special Inspections (STSI). Inspect and test work as needed to ensure quality of materials, workmanship, construction, finish, and functional performance are in compliance with applicable specifications, drawings, and those required by the Building Code.
 - 1. Engage qualified testing agency to perform quality-control services.
 - 2. Submit appropriate report for each quality-control service.
 - 3. Testing and inspecting requested by Contractor and not required by Contract Documents are Contractor's responsibility.
 - 4. CO may designate test locations.
- B. Manufacturer's Field Services: Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction of replaced work that failed to comply with Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with NPS and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify CO and Contractor promptly of irregularities or deficiencies observed in work during performance of services.
 - 2. Determine location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections, State in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit 3 copies of certified written report of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of Work.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide:
 - 1. Access to Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for material mixes that require control by testing agency.
 - 7. Security and protection for samples and testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with minimum delay and to avoid removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 QUALITY CONTROL PLAN

A. Quality Control Plan shall include:

1. List of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications.
2. Copy of letter of direction to Contractor's Quality Control Supervisor(s) outlining assigned duties and authorities designated by principal or owner.
3. Names, qualifications / accreditations, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms from laboratories.
4. Methods of performing, documenting, and enforcing quality control of work including Contractor report forms and acknowledgment of NPS forms.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.
6. Specific discussion regarding mockups, off-site visits, receiving inspections, manufacturers representation, startup requirements, and other aspects of performance specific to Project.
7. Provisions for substantial completion(s) and final inspection(s) per Contract.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

- #### A.
- Items fabricated or assembled off-site shall be inspected for quality control at place of fabrication.

3.2 ON-SITE CONTROL

A. Notification:

1. Notify CO at least 48 hours in advance of preparatory phase meeting.
2. Notify CO at least 24 hours in advance of initial and follow-up phases.

B. Preparatory Phase: Perform before beginning each feature of work.

1. Review control submittal requirements with personnel directly responsible for quality assurance and quantity control of the work. As a minimum, Contractor's Quality Control Supervisor and foreman responsible for feature of work shall be in attendance.
2. Review applicable specifications sections and drawings related to feature of work.
3. Ensure copies of referenced standards related to sampling, testing, and execution for feature of work are available on site.
4. Ensure provisions have been made for field control testing.
5. Examine work area to ensure preliminary work has been completed.
6. Verify field dimensions and advise CO of discrepancies with contract documents.

7. Ensure necessary equipment and materials are at project site and they comply with approved shop drawings and submittals.
8. Document preparatory phase activities and discussions on Contractor's Quality Control Daily Report.

C. Initial Phase:

1. As soon as work begins, inspect and test representative portion of particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document initial phase activities and discussions on Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.

E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on same feature of work for following reasons:

1. Quality of on-going work is unacceptable.
2. Changes in quality control staff, on-site production supervision, or work crew.
3. Work on particular feature of work is resumed after substantial period of inactivity.

3.3 DOCUMENTATION

- A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports of quality control activities and tests. (Download from DSC Workflows website > Forms/Templates/Samples/Guidelines page > [Construction Forms](#) section.)
- B. Quality Control Daily Reports shall not be substituted for other written reports required under clauses of contract, such as Disputes, Differing Site Conditions, or Changes.
- C. Quality Control Daily Reports shall accurately portray all work and materials. The materials shall match the materials as approved from the Construction Documents (CD) requirements. Combustible/flammable materials shall be documented as well.

3.4 ENFORCEMENT

- A. Contractor shall stop work on any item or feature pending satisfactory correction of deficiency noted by quality control staff or CO.

3.5 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Comply with Contract Document requirements for Section 01 73 29 "Cutting and Patching."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 ENVIRONMENTAL DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.
- B. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.
 - 1. Biobased content: Amount of biobased carbon in the material or product as a percentage of weight (mass) of total organic carbon in the material or product.
- C. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.
- D. Deconstruction: Disassembly of buildings for purpose of recovering materials.
- E. DFE (Design for the Environment): A technique that includes elements of resource conservation and pollution prevention as applied in various product sectors. A technique that incorporates approaches which are part of product (or assembly) concept, need and design. Considerations involve material selection, material and energy efficiency, reuse, maintainability and design for disassembly and recyclability. Refer to International Organization for Standardization (ISO) Guide 64 for additional clarification.
- F. Environmentally preferable products: Products and services that have a lesser or reduced effect on the environment in comparison to conventional products and services. Refer to EPA's Final Guidance on [Environmentally Preferable Purchasing Program](#).
- G. Non-Renewable Resource: A resource that exists in a fixed amount that cannot be replenished on a human time scale. Non-renewable resources have potential for renewal only by geological, physical, and chemical processes taking place over of millions of years. Examples include iron ore, coal, and oil.
- H. Perpetual Resource: A resource that is virtually inexhaustible on a human time scale. Examples include solar energy, tidal energy, and wind energy.
- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent Federal Trade Commission (FTC) Guide for Use of Environmental Marketing Claims.

- J. Renewable Resource: A resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource. A renewable resource can be exhausted if improperly managed. However, a renewable resource can last indefinitely with proper stewardship. Examples include trees in forests, grasses in grasslands, and fertile soil.

1.2 QUALITY ASSURANCE

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and standards may establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to CO for decision before proceeding.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities found in Section 01 42 00 Sources for Reference Publications, [Unified Facilities Guide Specifications](#) (UFGS) (accessible via [Masters](#) website > Downloads section > click on UFGS Master (WBDG Website). Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

XX EXAMPLE Association (The)
 www.EXAMPLE.org

- B. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in following list. Names, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABA & ABAAS United States Access Board	Architectural Barriers Act (ABA) Architectural Barriers Act Accessibility Standards (ABAAS) www.access-board.gov
DOC	Department of Commerce www.commerce.gov
DOJ	Department of Justice www.justice.gov
DOE	Department of Energy www.energy.gov
EPA	Environmental Protection Agency www.epa.gov
FCC	Federal Communications Commission www.fcc.gov
GSA	General Services Administration www.gsa.gov
LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NCHRP	National Cooperative Highway Research Program (See TRB (Transportation Resource Board))
NIST	National Institute of Standards and Technology www.nist.gov
OSHA	Occupational Safety & Health Administration www.osha.gov
TRB	Transportation Research Board www.nationalacademies.org/trb/transportation-research-board

- C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in following list. Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABAAS	Architectural Barriers Act Accessibility Standards www.access-board.gov
CFR	Code of Federal Regulations Available from Government Printing Office www.govinfo.gov/app/collection/cfr
DSCC	Defense Supply Center Columbus (See FS (Federal Specification))
FED-STD	Federal Standard (See FS (Federal Specification))
FS	Federal Specification Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.nibs.org
FTMS	Federal Test Method Standard (See FS (Federal Specification))

1.5 ENVIRONMENTAL REFERENCE STANDARDS

A. American Forest and Paper Association:

1. Sustainable Forestry Initiative

B. American Association of State Highway and Transportation Officials (AASHTO):

- M288 Geotextile Specification for Highway Applications
- MP009-06 Standard Specification for Compost for Erosion/Sediment Control (Filter Berms and Filter Socks)
- MP010-03 Standard Specification for Compost for Erosion/Sediment Control (Compost Blankets)

C. American Society for Testing and Materials International (ASTM):

- A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- C128 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)

- C311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
- C33 Standard Specification for Concrete Aggregates
- C593 Standard Specification for Fly Ash and Other Pozzolans for Use With Lime
- C595 Standard Specification for Blended Hydraulic Cements
- C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 foot pound force per cubic foot (ft-lbf/ft³) (2,700 kilonewton meter per cubic meter (kN-m/m³)))
- D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4017 Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method
- D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
- D4444 Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
- D4552 Standard Practice for Classifying Hot-Mix Recycling Agents
- D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Product
- D4840 Standard Guide for Sampling Chain-of-Custody Procedures
- D4887 Standard Test Method for Preparation of Viscosity Blends for Hot Recycled Bituminous Materials
- D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- D5268 Standard Specification for Topsoil Used for Landscaping Purposes
- D5505 Standard Practice for Classifying Emulsified Recycling Agents
- D5539 Standard Specification for Seed Starter Mix
- D6002 Standard Guide for Assessing the Compostability of Environmentally Degradable Plastics
- D6006 Standard Guide for Assessing Biodegradability of Hydraulic Fluid
- D6046 Standard Classification of Hydraulic Fluids for Environmental Impact
- D6081 Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation
- D6155 Standard Specification for Nontraditional Coarse Aggregates for Bituminous Paving Mixtures
- D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)))
- E1609 Standard Guide for Development and Implementation of a Pollution Prevention Program
- E1686 Standard Guide for Selection of Environmental Noise Measurements and Criteria
- E1780 Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source

- D. Environmental Protection Agency (EPA):
 - Comprehensive Procurement Guidelines
 - National Environmental Performance Track
 - Pollution Prevention (P2)
 - Significant New Alternatives Policy (SNAP) Program
- E. Forest Stewardship Council:
 - Chain-Of-Custody
 - Forest Management
- F. US Department of Agriculture:
 - Biobased Products – Definitions and Descriptions

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Contracting Officer (CO), permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures.

1.3 QUALITY ASSURANCE

- A. Electric Service: Comply with National Electrical Contractors Association (NECA), National Electrical Manufacturers Association (NEMA), and Underwriter Laboratories (UL) standards and regulations for temporary electric service. Install service to comply with National Fire Protection Association (NFPA) 70.
- B. Environmental Protection: Provide environmental protection as required by agency(ies) with jurisdiction and as indicated in Contract Documents. Coordinate with requirements of the following:
 - 1. Regulatory Requirements
 - 2. Noise and Acoustics Management
 - 3. Environmental Management
 - 4. Construction Waste Management

1.4 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before NPS acceptance, regardless of previously assigned responsibilities.

1.5 SUBMITTALS

- A. Submittals shall be in conformance with the Contracting Requirements, Drawings and Specifications including Section 01 33 23 – Submittal Requirements.
 - 1. Contractor shall submit a proposed Traffic Control and Access Plan to NPS for review and comments no later than two weeks prior to the pre-construction conference. Construction shall not begin until the Traffic Control and Access Plan has been reviewed and accepted

by NPS. Comply with the submittal requirements, per the applicable Federal Highway Administration FP-24 Standard Specifications (Section 635) for materials to be used in the work.

- a. The site-specific Traffic Control and Access Plan shall be prepared and certified/stamped (*include license, registration, or certification number of certifying person*) by a Civil Engineer or Professional Traffic Operations Engineer (PTOE) licensed to practice engineering in the State of Utah, or an ATSSA certified Work Site Traffic Supervisor. If the Contractor makes significant changes to the accepted Traffic Control and Access Plan during the course of the project, these changes must also be prepared and certified by a licensed/certified person as identified above.
 - b. The Traffic Control and Access Plan shall include measures to maintain pedestrian and cyclist access as well as a 3-way stop at the intersection of Bryce Canyon Road and Bryce Visitor Center throughout the duration of construction.
 - c. The Traffic Control and Access Plan shall incorporate the phasing plan shown in the Drawings.
2. Prior to establishment of any staging, storage and/or laydown areas, or support facilities, or starting clearing and grubbing activities, the Contractor shall submit for review and acceptance of NPS, a Construction Plan. The Construction Plan shall be submitted a minimum of two weeks prior to the pre-construction conference. The plan at minimum shall include maps/figures, a schedule, and describe the locations and methods to be used to establish and maintain all on-site support facilities including but not limited to:
- a. Contractors field office.
 - b. Employee parking, and/or other employee support facilities.
 - c. Staging areas, and stockpile locations.
 - d. Temporary access roads, and proposed haul routes for import and export of construction materials to and from the site.
 - e. Include any off-site support facilities (acquired separately and controlled by Contractor).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary materials may be new or used, but must be adequate in capacity for required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.
- C. Barrier Tape: Yellow tape imprinted with "CAUTION: CONSTRUCTION AREA", manufactured by Reef Industries, Inc. Houston, Texas, or approved equal.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

- B. Toilets: The Contractor shall be responsible for bringing on site portable facilities that are sufficiently lighted and ventilated in weatherproof, sight proof, handicap accessible, sturdy enclosures with privacy locks.

- 1. Provide separate toilet facilities for men and women.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating, Ventilation, and Air Conditioning (HVAC) Equipment: Unless Contracting Officer authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to agency(ies) with jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance and as directed by the Contracting Officer.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Non-potable water for construction is available. Coordinate with the Contracting Officer.
- B. Potable water is available on site. Coordinate with the Contracting Officer.
- C. Sanitary Facilities: Provide temporary toilets, and wash facilities for use by construction personnel.
 - 1. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
 - 2. Maintain and clean toilet facilities at least weekly.
 - 3. Completely remove sanitary facilities on completion of work.
- D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- E. Telephone Service: No telephone service is available on site for Contractor's use.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 50 feet of building lines. Comply with NFPA 241.
 2. Maintain support facilities until near Substantial Completion. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Contracting Officer.
- B. Temporary Roads: Construct and maintain temporary roads adequate for construction operations. Locate temporary roads as indicated on Drawings or as approved by the CO.
1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part 6, latest edition.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
 4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
 5. Protect pedestrian traffic by guardrails or fences.
 6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
 7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
 8. Install Barrier Tape where directed by Contracting Officer. Keep a minimum of two rolls on site.
- D. Parking: Use designated areas of existing parking as shown on Drawings or as approved by the CO.
- E. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry.
1. Provide temporary, directional signs for construction personnel and visitors.
 2. Maintain and touchup signs so they are legible at all times.
 3. Erect and maintain sufficient detour signs at road closures and along detour routes.

- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Cleaning of Equipment: Contractor shall ensure prior to moving on to Project Area, equipment, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Ensure equipment has been pressure washed and is free of exotic species. Equipment shall be considered free of soil, seeds, and other debris when visual inspection does not disclose such material. Disassembly of equipment components or specialized inspection tools are not required.
- C. Temporary Erosion and Sedimentation Control: Refer to Section 01 57 23 "Temporary Storm Water Pollution Prevention".
- D. Tree and Plant Protection: Refer to Section 01 11 00 "Summary of Work".
- E. Pest Control: Follow NPS requirements to minimize attraction and harboring of rodents, roaches, and other pests and perform extermination and control procedures at regular intervals so Project will be free of pests and residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begins, furnish and install a construction limit fence as approved by the Contracting Officer to prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As determined by the Contracting Officer.
 - 2. Locate vehicular gates to avoid interference with traffic on public thoroughfares.
 - 3. Locate pedestrian entrance gates as required to provide controlled personnel entry.
 - 4. Clearly mark construction limits. Ensure all staff are familiar with construction limits. No construction activity is permitted outside of construction limits.
 - 5. Within construction limits, the Contracting Officer will identify trees, shrubs and other vegetation to remain. Clearly mark these areas with flagging, staking or fencing to ensure protection.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of Manual on Uniform Traffic Control Devices (MUTCD), Part 6, latest edition for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Responsible Person: Capable and qualified person shall be placed in charge of fire protection. Responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe torch cutting and welding procedures.
 2. Tobacco Use, Smoking, and Vaping: Smoking within buildings or temporary storage sheds is prohibited.
 3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of NPS. Check with Park; many require "burn permits" for welding.
 4. Develop and supervise overall fire-prevention and -protection program for personnel at Project Site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 5. Provide temporary standpipes and hoses for fire protection. Hang hoses with warning sign stating hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 6. Hazard Control: Take necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in existing buildings. Provide adequate ventilation during use of volatile or noxious substances. Ensure cleanup procedures and storage requirements are followed at close of every work session.
 7. Spark Arresters: Equip gasoline or diesel powered equipment used during periods of potential fire hazards or in potential forest and grass fire locations with spark arresters approved by United States Department of Agriculture (USDA) Forest Service.
 - a. Written determinations of periods and areas of potential fire hazard will be issued by Contracting Officer.
 8. Buildings: Furnish a minimum of one extinguisher for each 1,500 square feet of area or major fraction thereof.
 - a. Travel distance from any work station to nearest extinguisher shall not exceed 75 feet.
 9. Vehicles and Equipment: Provide one extinguisher on each vehicle or piece of equipment.
 10. Service and Refueling Areas: Locate areas a minimum of 50 feet from buildings. Shut down equipment before refueling.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on 24-hour basis where required to achieve indicated results and avoid possibility of damage.

- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. NPS reserves the right to take possession of Project identification signs.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 57 19.12 – NOISE AND ACCOUSTICS MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for noise and acoustics management during demolition and construction operations.

1.2 DEFINITIONS

- A. Ambient noise level: The total noise associated with a given environment, being usually a composite of normal or existing sounds from all sources near and far, excluding the noise source at issue.
- B. Daytime: The hours from 7 A.M. to 7 P.M. on weekdays and 9 A.M. to 7 P.M. on weekends and holidays.
- C. Nighttime: All non-daytime hours.
- D. Receiving noise area: Any real property where people live or work and where noise is heard, excluding the project or source area.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 NOISE MANGEMENT

- A. Noise Control: Perform demolition and construction operations to minimize noise. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer CO).
- B. Repetitive and/or intermittent, high-level noise: Permitted only during Daytime.

2. Do not exceed the following dB(A) limitations at 50 feet:

<u>Sound Level in dB(A)</u>	<u>Time Duration of Impact Noise</u>
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

3. Maximum permissible construction equipment noise levels at 50 feet:

<u>EARTHMOVING</u>	<u>dB(A)</u>	<u>MATERIALS HANDLING</u>	<u>dB(A)</u>
Front Loaders	75	Concrete Mixers	75
Backhoes	75	Concrete Pumps	75
Dozers	75	Cranes	75
Tractors	75	Derricks Impact	75
Scrapers	80	Pile Drivers	95
Graders	75	Jack Hammers	75
Trucks	75	Rock Drills	80
Pavers, Stationary	80	Pneumatic Tools	80
Pumps	75	Saws	75
Generators	75	Vibrators	75
Compressors	75		

C. Ambient Noise:

1. Maximum noise levels (dB (decibel)) for receiving noise area at property line shall be as follows:
 - a. Residential (Campground, Lodge) receiving areas

Daytime:	65 dB
Nighttime:	45 dB
 - b. Commercial (General Store) receiving area

Daytime:	67 dB
Nighttime:	65 dB
 - c. In the event the existing local ambient noise level exceeds the maximum allowable receiving noise level (dB), the receiving noise level maximum for construction operations shall be adjusted as follows:
 - d. Residential receiving area: Maximum 3 additional dB above the local ambient as measured at 250 feet beyond the project limits.
 - e. Commercial/Industrial receiving area: Maximum 5 additional dB above the local ambient as measured at 250 feet beyond the project limits.

D. Utah Prairie Dog Mitigation:

1. 50' buffer to active burrows displayed on plans. Contractor cannot operate heavy machinery within 1000' of the active burrows prior to June 15th or after August 30th.

3.2 FIELD QUALITY CONTROL

- A. Assess potential effects of construction noise on campgrounds, lodges, and adjacent concessioner operations in accordance with ASTM E1686 and as follows:
 - 1. Ambient noise measurement: Measure from a location 250 feet beyond the project limits at a height of at least four (4) feet above the immediate surrounding surface. Average the ambient noise level over a period of at least 15 minutes.
- B. Monitor noise produced from construction operations in accordance with ASTM E1780.

END OF SECTION 01 57 19.12

SECTION 01 57 23 - TEMPORARY STORMWATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Federal Regulations for controlling discharges of pollutants (including chemicals, erodible material, and trash) from municipal separate storm sewer systems, construction sites, and industrial activities, were brought under the National Pollution Discharge Elimination System (NPDES) permit process by amendments to the Clean Water Act (CWA), and promulgation of federal stormwater regulations issued by the United States Environmental Protection Agency (USEPA). The USEPA uses amount of ground disturbance as a measure of a project potential to generate pollution from erosion. NPDES Phase I regulates discharges from construction sites that disturb 5 acres or more. NPDES Phase II regulations expand existing General Permit requirements under Phase I to include/regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity. Construction disturbances 1 acre and above typically require a formal NPDES permit and a formal Stormwater Pollution Prevention Plan (SWPPP) must be submitted to Agency(ies) with Jurisdiction for review and approval.
- B. National Park Service (NPS) Standards and Guidelines require water quality be protected to ensure compliance with Organic Act. Contractor shall prepare an Under-An-Acre Pollution Prevention Plan (UPPP) for each project resulting in less than 1 acre of soil disturbance or not otherwise subject to requirements of NPDES program. ([UPPP Guideline](#))
- C. The work of this section consists of implementing measures to prevent discharges of pollutants, including temporary stormwater pollution during construction activities, either through compliance with NPDES permit program, or in conformance with NPS guidance for UPPPs.
- D. This project is anticipated to result in over 1 acre of soil disturbance. NPDES program and Utah Pollutant Discharge Elimination System (UPDES) General Permit requirements will apply.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of the environment for aesthetic, cultural, or historical purposes.
- C. National Pollution Discharge Elimination System (NPDES) Phase I: Regulates discharges from construction sites that disturb 5 acres or more.
- D. NPDES Phase II: Regulations expand existing General Permit requirements under Phase I to include and regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity.

- E. Stormwater Pollution Prevention Plan (SWPPP): Developed and implemented stormwater management measures to protect surface water from pollutants during construction activities disturbing an acre or more in compliance with federal, state, and local requirements for permit approval under NPDES program.
- F. UPPP: Developed and implemented pollution prevention plan (including stormwater management measures, if needed) to protect environment from pollutants on construction projects with less than one acre of disturbance in conformance with NPS guidelines.
- G. UPDES permits: Utah specific stormwater permitting.

1.3 SUBMITTALS

- A. After contract award and before pre-construction conference, prepare and submit:
 - 1. A SWPPP showing SWPPP satisfies Federal and State NPDES permit requirements.
 - 2. UPDES General Permit satisfying Utah permit requirements.
- B. Inspection Schedule: Submit schedule for inspection and monitoring of stormwater pollution prevention measures.
- C. Erosion Control Products:
 - 1. Submit manufacturer's product information and installation recommendations for silt fence, filter fabric, wattles, straw bales, and other materials proposed for use on this project.
 - 2. Submit Certification of BioPreferred or biobased designated rolled erosion control products.

1.4 QUALITY ASSURANCE

- A. Contractor shall prepare and submit a plan to CO for review and concurrence.
- B. Orientation Meeting: Contractor shall arrange and conduct an Erosion and Sediment Control meeting/briefing to inform parties, scheduled to be on-site during project, of measures to be implemented for proper erosion and sediment control (may be included as part of Pre-Construction Meeting).
 - 1. Installation of silt fences, storm drain protection, and other forms of erosion and sediment control shall not begin until after this meeting has occurred.
- C. Orientation Meeting: Contractor shall be responsible for arranging and conducting Pollution Prevention meeting/briefing to inform parties scheduled to be on-site during project of measures to be implemented for proper pollution prevention and control (may be included as part of Pre-Construction Meeting).
 - 1. Installation of silt fences, storm drain protection, and other forms of pollution prevention controls shall not begin until after this meeting has occurred.
- D. Pollution Prevention and Erosion Control Manager: Contractor shall designate Pollution Prevention and Erosion Control Manager responsible for implementation, inspection, maintenance, and amendments to approved plan.

1. Pollution Prevention and Erosion Control Manager shall be familiar with temporary stormwater pollution prevention procedures and Best Management Practices and ensure emergency procedures and plan are updated as needed and available for inspection.
2. When changes in approved plan are required, Pollution Prevention and Erosion Control Manager shall prepare and certify an amendment and submit to CO for review and concurrence.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION PREVENTION PLAN

A. Provide SWPPP which satisfies Federal and UPDES permit requirements and includes:

1. Site description.
2. Identification and contract information for Pollution Prevention and Erosion Control Manager.
3. Expected sequencing of operations and construction schedule.
4. Weather monitoring procedure.
5. Descriptions and details Best Management Practices for pollution prevention and erosion controls, including dust control.
6. Pollution prevention and erosion control plans.
7. Controls for other potential onsite stormwater pollutants.
8. Applicable specifications.
9. Maintenance and inspection procedures and forms.
10. Description of potential non-stormwater discharges at site.
11. Notice of Intent (NOI) form.
12. Notice of Termination (NOT) form.
13. Contractor and Sub-contractor Certification forms.
14. Other record keeping forms and procedures.
15. Housekeeping Best Management Practices, including vehicle wash-down areas, protection of equipment storage and maintenance areas, and sweeping of roadways related to hauling activities.

2.2 EROSION CONTROL BALES, WATTLES, LOGS, AND ROLLS

- #### A. Use a BioPreferred or biobased designated netting for all rolled erosion control products used on this project.
- #### B. Wattles, logs or rolls:
1. Use natural fibers for all materials. Do not use any products containing materials from wheat or barley. Wattles shall not be filled with straw material. Wattles shall be filled with aspen chip or similar material approved by the Contracting Officer.
 2. Provide certified weed free logs that consist of drainage filter made of curled aspen wood excelsior and rolled into a cylindrical shape with a consistent width of fibers evenly distributed throughout the cylinder. Provide logs that are a minimum of 9 inches and maximum of 12 inches in diameter. Provide logs encased in 100% natural fiber

- biodegradable netting, photodegradable materials will not be permitted. Provide certification that all material in the log is weed free.
3. Place sediment logs in a shallow trench the depth of which shall be 1/3 the diameter of the log. Secure the log every 2 linear feet across the length of the log with a 24-inch wooden 1-inch x 1-inch (or larger stakes) driven a minimum of 14 inches from backfilled grade or 10 inches from the bottom of the wattle, into the ground. Do not use wooden stakes that are severely split. When placing more than one log in a continuous section the logs should overlap 2'. Install perpendicular to the contour, in a staggered overlapping pattern so that an unnatural pattern cannot be detected.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

- A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve natural resources within project boundaries and outside limits of work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by CO.
- B. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to maximum practical extent.
 1. Clearing, excavation, and grading shall be limited to those areas of project site necessary for construction. Minimize area exposed and unprotected.
 2. Clearly mark and delineate limits of work activities.
 3. Equipment shall not be allowed to operate outside limits of work or to disturb existing vegetation.
 4. Excavation and grading shall be completed during dry season to maximum extent possible.
 5. Material shall be stored away from locations where water is present to greatest extent practicable.

3.2 REGULATORY REQUIREMENTS

- A. Permits: Contractor shall obtain required NPDES permits and UPDES General Permit resulting in no impacts to scheduled work. Contractor shall account for possibility of significant lead time in scheduling and executing work.
 1. Implement requirements of NPDES permit and UPDES General Permit for erosion control due to stormwater runoff during construction.
 2. Implement good housekeeping practices, inspections and record keeping.
 3. Prior to construction, Contractor and Subcontractors shall sign certifications (included in the plan) that they understand requirements of NPDES permit and UPDES General Permit.
 4. Subcontractors shall comply with requirements of NPDES and UPDES General Permit under supervision of Contractor.
 5. Accepted plan shall comply with terms and conditions of NPDES and UPDES permit.

- B. Notice of Intent (NOI): Contractor shall file a Notice of Intent and formal SWPPP as required to the Agency(ies) with Jurisdiction.
- C. Notice of Termination (NOT): After Substantial Completion of Work, file a Notice of Termination (NOT) with the Agency(ies) with Jurisdiction.
- D. CO Notification: Contractor shall notify CO in writing and by telephone of these events:
 - 1. Erosion and sediment control meeting/briefing.
 - 2. Following installation of required sediment control structures.
 - 3. Prior to removal of or modification to sediment control structures.
 - 4. Prior to removal of sediment control structures.

3.3 TEMPORARY STORMWATER POLLUTION PREVENTION PLAN

- A. Review and Acceptance: Contractor and CO will jointly review draft Plan and agree to needed revisions. Contractor shall incorporate revisions, sign, and submit final Plan to CO. Final Plan will be the document enforced on the project.
 - 1. Accepted Plan will describe and ensure implementation of practices to be used to reduce pollutants in stormwater discharges.
 - 2. Contractor shall maintain current copy of Plan and associated records and forms at jobsite throughout duration of project.
 - 3. Plan shall be available for public inspection and inspection and use of CO.
 - 4. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.
- B. Implementation: Implement Plan as required throughout construction period and maintain erosion control elements in proper working order.
 - 1. Do not perform clearing and grubbing or earthwork until Plan has been implemented.
- C. SWPPP (including inspection forms) and data used to complete the NOI shall be provided to CO after Substantial Completion of project.

3.4 SITE INSPECTIONS AND PLAN REVISIONS

- A. Inspections: Contractor and CO will perform a weekly inspection onsite.
 - 1. Inspection shall include disturbed areas not completely stabilized, areas used for storage of materials, locations where vehicles enter or exit site, and other erosion and sediment controls included in the Plan.
 - 2. Inspections shall be documented.
 - 3. Inspection forms shall be retained onsite in Plan notebook throughout construction period.
- B. Plan Revisions: It may be necessary to revise Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.
 - 1. Plan shall specify mechanism whereby revisions may be proposed by Contractor or CO.

2. Contractor and CO will jointly review each revision to Plan before changes incorporated and implemented. Contractor will then provide revised copy of Plan to CO.
 3. Accepted modifications will be implemented within 7 calendar days following date of inspection when deficiencies or necessary corrections are first noted.
- C. Negligence: Provide additional temporary erosion and pollution controls made necessary by Contractor's errors or negligence at no additional cost to Government.

3.5 HOUSEKEEPING AND SITE MANAGEMENT

- A. Store materials onsite in conformance to Federal, state, local, and manufacturer's regulations and specifications. Use Best Management Practices to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.
- B. Manage solid waste in conformance to Federal, state, and local regulations. Best Management Practices should be used to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.
- C. Include a spill prevention and control plan with provisions placed in SWPPP.
- D. Manage hazardous waste (including contaminated soil) in conformance to Federal, state, local and NPS regulations and guidelines.

3.6 EROSION CONTROL MEASURES

- A. All erosion control measures shall be installed in accordance with Utah Department of Environmental Quality criteria.
- B. Erosion control measures shall consist of Best Management Practices for stormwater discharges, including silt fencing, barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms.
- C. Berms and excelsior drainage filters shall be used to form sediment traps and control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and staging areas.
- D. Erosion control measures shall be used to contain only direct precipitation in construction zone. Contained water shall be allowed to percolate into ground or drain slowly through drainage filter sediment traps.
- E. Earthen sediment traps or holding ponds shall not be used unless accepted by CO.
- F. Reduce runoff velocity and direct surface runoff around and away from fuel containment, storage, and borrow areas.
- G. Divert surface runoff around and away from cut and fill slopes.
- H. Place drainage filters around catch basins to create sediment traps to control run-off from construction area.

- I. Excess water used for dust control shall be contained within demolition areas by erosion control measures.
- J. Contractor shall prevent deposition of materials onto paved areas. Contractor shall inspect paved areas for deposited materials weekly and remove materials immediately.
- K. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in approved SWPPP.
- L. Before work begins, sufficient equipment shall be available on site to assure operation and adequacy of erosion control system can be maintained.

3.7 MAINTENANCE OF TEMPORARY FACILITIES

- A. Ensure erosion and sediment control structures remain effective throughout excavation and grading operations. Relocate structures as necessary.
- B. Inspect control structures after each significant rainfall. Promptly repair breaches which occur.
- C. Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

3.8 REPORTING

- A. If a discharge occurs or if project receives written notice or order from regulatory agency, Contractor shall immediately notify CO and shall file written report to Agency(ies) with Jurisdiction within 7 days of discharge event, notice, or order. Corrective measures shall be implemented immediately following discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain:
 - 1. Date, time, location, nature of operation, and type of discharge, including cause or nature of notice or order.
 - 2. Best Management Practices deployed before discharge event, or prior to receiving notice or order.
 - 3. Date of deployment and type of Best Management Practices deployed after discharge event, or after receiving notice or order, including additional Best Management Practices installed or planned to reduce or prevent re-occurrence.
 - 4. An implementation and maintenance schedule for affected Best Management Practices.

3.9 SEDIMENT DISPOSAL

- A. Sediment excavated from temporary sediment control structures shall be disposed on site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.
- B. Contractor shall place sediment removed from traps and other structures where it will not enter a storm drain or watercourse and where it will not immediately reenter the basin.

3.10 REMOVAL OF TEMPORARY STORMWATER POLLUTION CONTROL MEASURES

- A. Temporary control measures shall be removed with permission of CO within 20 working days after final acceptance of project, and/or once grading is complete and slopes have stabilized.

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and environmental requirements.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number and other designation shown or listed in manufacturer's published product literature, current as of date of Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Approved Equals: Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- C. Biobased Materials: As defined in Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.
 - 1. Biobased content: Amount of biobased carbon in material or product as a percentage of weight (mass) of total organic carbon in material or product.
- D. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.
- E. Environmentally preferable products: Products and services with lesser or reduced effect on the environment in comparison to conventional products and services. Refer to Environmental

Protection Agency's (EPA) Final Guidance on [Environmentally Preferable Purchasing](#) for more information.

- F. Stewardship: Responsible use and management of resources in support of sustainability.
- G. Sustainability: Maintenance of ecosystem components and functions for future generations.
 - 1. Recycled Content Materials: Products containing pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with International Organization for Standardization (ISO) 140001 Standard for the Use of Environmental Marketing Claims.
 - 2. Rapidly Renewable Material: Material made from plants typically harvested within a ten-year cycle.
 - 3. Regional Materials: Materials manufactured and extracted, harvested, or recovered within a radius of 500 miles from Project location.

1.3 SUBMITTALS

A. Record Submittals:

- 1. Affirmative Procurement Reporting Form. Submit on form at end of this Section, or similar form as approved by CO.
- 2. Submit environmental data in accordance with Table 1 of ASTM E2129 for these products:
 - a. Joint Sealers
 - b. Paints & Coatings
 - c. Aggregate Base from recycled asphalt concrete pavement
- 3. Material Safety Data Sheets (MSDS): For each product required by OSHA to have an MSDS, submit an MSDS. MSDS shall be prepared within the last 5 years. Include information for MSDS Sections 1 to 16 in accordance with ANSI Z400.1 and as follows:
 - a. Section 1: Chemical Product and Company Identification
 - b. Section 2: Composition/Information on Ingredients
 - c. Section 3: Hazards Identification
 - d. Section 4: First Aid Measures
 - e. Section 5: Fire Fighting Measures
 - f. Section 6: Accidental Release Measures
 - g. Section 7: Handling and Storage
 - h. Section 8: Exposure Controls/Person Protection
 - i. Section 9: Physical and Chemical Properties
 - j. Section 10: Stability and Reactivity Data
 - k. Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects. Provide written description of the process used in evaluating chemical hazards relative to preparation of the MSDS.
 - l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in event of accidental release.
 - m. Section 13: Disposal Considerations. Include data regarding proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or

not product is considered to be "hazardous waste" according to United States EPA Hazardous Waste Regulations 40 CFR 261 (Code of Federal Regulations).

- n. Section 14: Transportation Information. Identify hazard class for shipping.
- o. Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.
- p. Section 16: Other Information. Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts. Identify the date MSDS was prepared.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

- B. Delivery and Handling:

- 1. Schedule delivery to minimize long-term storage at Project site and prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in undamaged condition; in manufacturer's original sealed container or other packaging system; complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with Contract Documents. Ensure products are undamaged and properly protected.
 - 5. Obtain materials in biodegradable or recyclable/reusable packaging which uses minimum amount of packaging possible.

- C. Storage:

- 1. Allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in manner to not endanger Project structure.
 - 3. Store products subject to damage by the elements, under cover in weather tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store cementitious products and materials on elevated platforms.
 - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.
 - 8. Store loose granular materials in well-drained area on solid surfaces to prevent mixing with foreign matter.

1.6 PACKAGING

- A. Where Contractor has option to provide one of listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.
- B. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.

1.7 ENVIRONMENTALLY PREFERABLE PRODUCTS

- A. Provide environmentally preferable products to greatest extent possible.
 - 1. To greatest extent possible, provide products and materials with a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the product.
 - 2. Eliminate use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either Montreal Protocol and Title VI or Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.
 - 3. Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of total value of the materials in project.

1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for product specifically endorsed by manufacturer to Park.
 - 2. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Park.
- B. Special Warranties: Prepare written document containing appropriate terms and identification, ready for execution. Submit draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with Specifications, prepare written document using appropriate form properly executed.
 - 3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products to comply with Contract Documents, undamaged and, unless otherwise indicated, new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types produced and used successfully in similar situations on other projects.
 3. Government reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
 4. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
1. Product: Where Specifications name single product and manufacturer, provide named product that complies with requirements or approved equal.
 2. Manufacturer/Source: Where Specifications name single manufacturer or source, provide product by named manufacturer or source that complies with requirements or approved equal.
 3. Products: Where Specifications include list of names of both products and manufacturers, provide one of the products listed that complies with requirements or approved equal.
 4. Manufacturers: Where Specifications include list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements or approved equal.
 5. Available Products: Where Specifications include list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Products" Articles for consideration of an unnamed product.
 6. Available Manufacturers: Where Specifications include list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Products" Articles for consideration of an unnamed product.
 7. Product Options: Where Specifications indicate sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or approved equal.
 8. Visual Matching Specification: Where Specifications require matching an established Sample, select product that complies with requirements and matches Architect's sample. COs decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

9. Visual Selection Specification: Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include phrase "standard range of colors, patterns, textures" or similar phrase, CO will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, CO will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 APPROVED EQUAL PRODUCTS

- A. Conditions: CO will consider Contractor's request when the following conditions are satisfied. If following conditions are not satisfied, CO will return requests without action, except to record noncompliance with these requirements:
 1. Evidence proposed product does not require revisions to Contract Documents, that it is consistent with Contract Documents and will produce indicated results and is compatible with other portions of Work.
 2. Detailed comparison of significant qualities of proposed product with those named in Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION

3.1 PROTECTION AFTER INSTALLATION

- A. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01 67 00

AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

Project Name: _____ Project Number: _____

Contractor Name: _____ License Number: _____

Contractor Address: _____

Product	Total \$ value provided	Total \$ value with recycled content Pre- consumer	Total \$ value with recycled content Post- consumer	Total \$ value with biobased content	Exempted indicate 1,2,3,4	Comments
Hydraulic Mulch (wood based)						
Compost						
Aggregate base from asphalt concrete pavement						
Other						

CERTIFICATION

I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content.

The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1. The product does not meet appropriate performance standards.
2. The product is not available within a reasonable time frame.
3. The product is not available competitively (from two or more sources).
4. The product is only available at an unreasonable price (compared with a comparable non-recycled content product.)

Signature: _____ Date: _____

END OF
AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes procedural requirements for cutting and patching on roads, parking lots, and sidewalks that do not contain Historic Fabric.

1.2 SUBMITTALS

- A. Cutting and Patching Plan: Submit Plan describing procedures at least 10 days before cutting and patching will be performed, requesting approval to proceed. Include:
 - 1. Extent: Describe cutting and patching, show how performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. CO Approval: Obtain approval of cutting and patching plan before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.3 QUALITY ASSURANCE

- A. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that will match the visual and functional performance of in-place materials when installed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time. Complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction subsequently. Patch as required to restore surfaces to original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer and original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Concrete and asphalt pavement: Cut using an abrasive saw or a diamond-core drill.
 - 3. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 4. Proceed with patching after construction operations cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 73 40 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general procedural requirements governing execution of Work including:

1. Coordination with utility service providers
2. Construction layout
3. Field engineering and surveying
4. General installation of products
5. Progress cleaning
6. Starting and adjusting
7. Protection of installed construction
8. Correction of the Work

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by professional land surveyor certifying location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified As-Built Surveys: Submit two copies signed by professional land surveyor.
- D. Quantity Surveys: Submit two copies showing quantities of work performed and actual construction completed in place.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: Professional land surveyor legally qualified to practice in jurisdiction where Project is located and-is experienced in providing land-surveying services of kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed.

1. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 2. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existence and location of underground utilities and other construction affecting Work.
1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public and Park utilities serving Project site.
 3. Pothole underground water, wastewater, electric, and communication lines located in construction limits to verify location and depth.

3.2 COORDINATION WITH UTILITY SERVICE PROVIDERS

- A. Coordination with Utility Service Providers: Contact following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate Contractor's portion of Work, testing requirements, inspections, etc.
1. Electrical: Service Contact: Garkane Energy Cooperative, Inc. District 6, 800-747-5403 to coordinate Electrical service requirements.
 - a. Contractor Responsibilities: Contractor is responsible for potholing and locating lines in areas with excavation below the existing surface of the ground and where culvert crossings are proposed.
 2. Water Service Contact: Contact Floyd Winder, Project Manager NPS Bryce Canyon N.P., 435-834-4713 to coordinate Water service requirements.
 - a. Contractor Responsibilities: Contractor is responsible for potholing and locating lines in areas with excavation below the existing surface of the ground and where culvert crossings are proposed.
 3. Wastewater Service Contact: Contact Floyd Winder, Project Manager NPS Bryce Canyon N.P., 435-834-4713 to coordinate Wastewater service requirements.
 - a. Contractor Responsibilities: Contractor is responsible for potholing and locating lines in areas with excavation below the existing surface of the ground and where culvert crossings are proposed.
 4. Communication Service Contact: Contact Floyd Winder, Project Manager NPS Bryce Canyon N.P., 435-834-4713 to coordinate Communication service requirements.
 - a. Contractor Responsibilities: You are responsible for potholing and locating lines in areas with excavation below the existing surface of the ground and where culvert crossings are proposed.

3.3 PREPARATION

- A. Field Measurements: Take field measurements as required to fit Work properly. Recheck measurements before installing each product. Where portions of Work are indicated fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of the Contract Documents caused by differing field conditions outside control of Contractor, submit request for information to CO in accordance with Section 01 31 00 "Project Management and Coordination."
- D. All construction equipment shall be cleaned of soil, plant material, and other debris prior to entering park. Inspections of any earth-moving equipment is required prior to entering park and can be performed by Park Ranger or CO. If equipment leaves the park, contractor must communicate use and location to the CO. Park Ranger may deem it necessary to inspect upon re-entry.

3.4 CONSTRUCTION LAYOUT

- A. Verification: Verify layout information shown on Drawings, in relation to the existing benchmarks before proceeding to lay out Work. Notify CO promptly if discrepancies are discovered.
- B. General: Engage a professional land surveyor to lay out Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check location, level and plumb, of every major element as Work progresses.
 - 5. Notify CO when deviations from required lines and levels exceed allowable tolerances.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Record Log: Maintain log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make log available for review by National Park Service (NPS).

3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning Work. Preserve and protect permanent benchmarks and control points

during construction operations. Controls destroyed by Contractor will be replaced by Contractor at their expense.

1. Existing Monuments: All benchmarks, land corners, and triangulation points, established by other surveys, existing within construction area shall be preserved. If existing monuments interfere with Work, secure written permission before removing them.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with NPS requirements for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.6 INSTALLATION

- A. General: Locate Work and components of Work accurately in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions for best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of Work.
 1. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors to be embedded in concrete or masonry. Deliver to Project site in time for installation.

- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials not considered hazardous.
- J. Quantity surveys: Shall be conducted, and data derived from these surveys shall be used in computing quantities of work performed and actual construction completed and in place.
 - 1. Contractor shall conduct original and final surveys and surveys for any periods for which progress payments are requested. These surveys shall be conducted under direction of a representative of the CO, unless CO waives requirement in a specific instance. Government shall make such computations as are necessary to determine quantities of work performed or finally in place. Contractor shall make computations based on surveys for any periods for which progress payments are requested.
 - 2. Promptly upon completing a survey, Contractor shall furnish originals of field notes and other records relating to survey or layout of Work to CO. Contractor shall retain copies of all such material furnished to CO.

3.7 PROGRESS CLEANING

- A. General: Clean Project site, work areas, and common areas daily. Coordinate progress cleaning for joint-use areas where more than one Installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in National Fire Protection Association (NFPA) 241 for removal of combustible waste materials and debris at the end of every work session.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit (27 degrees Celsius).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to level of cleanliness necessary for proper execution of Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of Work, broom-clean or vacuum entire work area, as appropriate.
 - 3. Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials not hazardous to health or property and will not damage exposed surfaces.
 - 1. Utilize non-toxic cleaning materials and methods.
 - a. Comply with Green Seal Standard (GS) 37 for general purpose cleaning.

- b. Use natural cleaning materials where feasible. Natural cleaning materials include:
 - 1) Abrasive cleaners: substitute 1/2 lemon dipped in borax.
 - 2) Ammonia: substitute vinegar, salt and water mixture, or baking soda and water.
 - 3) Disinfectants: substitute 1/2 cup borax in gallon water.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. Clean and protect construction in progress and adjoining materials already in place during handling and installation. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations so that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or deleterious exposure during construction period.
- K. Final Cleaning: At completion of Work, remove remaining waste materials, rubbish, tools, equipment, machinery and surplus materials. Clean exposed surfaces and leave Project clean and ready for occupancy.
 - 1. Provide final cleaning in accordance with ASTM E1971.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 29 "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to specified condition.

- C. Remove and replace damaged surfaces exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 40

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Site improvement materials and other solid waste resulting from construction, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Site improvement materials resulting from demolition or selective demolition operations.
- C. Solid Waste: Garbage, debris, sludge, or other discharged material (except hazardous waste) including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.
- D. Debris: Non-hazardous solid waste generated during construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 millimeter) particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders). A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if mixture is comprised primarily of debris by volume, based on visual inspection.
- E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- F. Environmental Pollution and Damage: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.
- G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- H. Hazardous Materials: Material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have potential to meet the definition of Hazardous Waste in accordance with 40 CFR 261.
- I. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

- J. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- K. Single-use plastic products: Plastic items intended to be disposed of immediately after use, including plastic and polystyrene food and beverage containers, bottles, straws, cups, cutlery, and disposable plastic bags.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Minimize factors contributing to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, single-use plastic products, and contamination. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Minimize waste disposal in landfills.
- B. If waste materials encountered during deconstruction/demolition or construction phase are found to contain lead, asbestos, polychlorinated biphenyls (PCBs), (such as fluorescent lamp ballasts), or other harmful substances, they are to be handled and removed in accordance with local, state, and federal laws and requirements concerning hazardous waste.
- C. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
 - 1. Pulverized and recycle existing asphalt concrete pavement as aggregate base.
 - 2. Salvage existing stone masonry in headwalls for reuse on new headwalls.
 - 3. Salvage existing signs designated to be reset per plans.

1.4 SUBMITTALS

- A. Waste Management Plan: After award of contract and prior to scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to CO for approval. Submit 3 copies of plan. Revise and resubmit Plan as required by CO. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.
- B. Progress Documentation: Supplemental to Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. See Project Waste Management Plan Worksheet Sample, attached to the end of the Division 1 Specifications, and report totals to date for column headings.
- C. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- D. Closeout Submittals
 - 1. With Closeout Submittals, submit a summary of a Project Waste Management Plan worksheet for solid waste disposal and diversion.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Meeting: Conduct separate meeting or cover in Pre-Construction Conference and comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review procedures for reduction of single-use plastic products on site.
 - 6. Review waste management requirements for each trade.

PART 2 - PRODUCTS

2.1 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification and waste reduction work plan. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials salvaged and reused in Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials sold to individuals and organizations, include list of names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials donated to individuals and organizations, include list of names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

7. Reduction of single-use plastic products: Include methods for water distribution to include bottle refilling stations if available for personnel.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include:
1. Landfill tip fees per ton.
 2. If diverted, tip fee savings from landfill diversion.
 3. Costs of recycling, salvage, or reuse.
 4. Revenue from recycling, salvage, or reuse.
 5. Total cost or savings from diversion. (Calculate by using tip fee savings and subtracting costs of recycling or adding revenue from recycling.)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by CO. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during entire duration of Contract.
- B. Waste Management Coordinator: Engage waste management coordinator responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Contractor shall establish contacts with local recycling and reuse companies to set up lines of responsibility. Contractor shall be responsible for coordination in terms of identifying materials, pickup schedules, and standard quality for recycled materials.
- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- F. Separation facilities:
1. Contractor shall designate and CO shall approve specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
 2. Place waste and recycling bins near each other, and close to point of waste generation but out of traffic pattern.
 3. Keep recycling and waste bin areas neat, clean, and clearly marked in order to avoid comingling of materials.

4. Protect bins during non-working hours from off-site contamination.
 5. Check garbage dumpsters periodically for recyclables being thrown away and undocumented materials that could be recycled.
- G. Materials handling procedures: Material to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets requirements set by designated facilities for acceptance. Establish defined area for operations of each trade, especially woodcutting so off-cuts are kept in one area and can be sorted by dimension for future reuse.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Government and Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off ground and protect from weather.
 5. Remove recyclable waste off Government property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2 inch (38 millimeter) size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 32 11 23, Aggregate Base Course.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 1. Remove and dispose of bolts, nuts, washers, and other rough hardware.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose in landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials to accumulate on-site.
 2. Remove and transport debris in manner preventing spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Government property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including:
 - 1. Project Record Drawings
 - 2. Closeout Submittals
 - 3. Substantial Completion and Final Inspection
 - 4. Permit Closure and Transfer
 - 5. Final Acceptance of the Work
 - 6. Warranties

1.2 PROJECT RECORD DRAWINGS

- A. Maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions using National Park Service (NPS) drafting standards to show actual construction conditions. Show additions in red, deletions in green and special instructions in blue.
- B. Keep record drawings current. Make record drawings available to CO for inspection at the time of monthly progress payment requests. If project record drawings are not current, CO may retain an appropriate amount of progress payment.
- C. Submit complete record drawings on completion of total project. Include shop drawings, sketches, and additional drawings to be included in final set, with clear instructions showing the location of these drawings.

1.3 CLOSEOUT SUBMITTALS

- A. A list of closeout requirements has been attached at the end of the Division 1 Specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list. Submit the following before requesting final inspection:
 - 1. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
 - 2. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on USB flash drive with index and descriptions, and similar final record information.
 - 3. Environmental Record Documents: As specified in Divisions 01 and as follows:
 - a. Final Summary of Solid Waste Disposal and Diversion: As specified in Section 01 74 19 "Construction Waste Management".

4. Posted Operating Instructions: As specified in individual sections. Furnish operating instructions attached to or posted adjacent to equipment. Include wiring diagrams, control diagrams, control sequence, start-up, adjustment, operation, lubrication, shut-down, safety precautions, procedures in the event of equipment failure, and other items of instruction recommended by manufacturer.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by CO. Label with manufacturer's name and model number where applicable.
6. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
7. Touch up and repair and restore marred exposed finishes to eliminate visual defects.
8. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems.

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

- A. Request final inspection in writing when project or designated portion of project is substantially complete. CO will proceed with inspection within 10 days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.
- B. If work is determined substantially complete, following final inspection, CO will prepare Punch List and issue a Letter of Substantial Completion.
- C. If work is not determined substantially complete following final inspection, CO will notify Contractor in writing. Contractor shall request new final inspection after completing work. Re-inspection costs may be charged against Contractor in accordance with Inspection of Construction contract clause.
- D. Contractor shall complete Punch List within 30 calendar days, documented weather permitting.
- E. If Contractor completes items of work on Punch List and contractually required items, CO will issue Letter of final acceptance of work.
- F. If Contractor fails to complete work within the timeframe, CO may correct work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

- A. When work covered by the permits is complete, create list of tasks required to close or transfer permits to Park. Submit to CO for approval.
- B. After substantial completion and Punch List completion, permits shall be closed and documented by Agency(ies) with Jurisdiction for the permit.
- C. If responsibility for permits is to be transferred to Park, Park shall be informed of permit provisions completed and responsibilities transferring to Park staff.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of CO for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch (215 by 280 millimeters) paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of Installer.
 - 3. Identify each binder on front and spine with typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF (portable document format) file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. See Division 1 Specification Section "Execution" for information on cleaning agents.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Conduct final cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturer's written instructions.
 - 1. Complete following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to smooth, even-textured surface.

- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Remove labels that are not permanent.
 - g. Touch up, repair, and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - h. Leave Project clean and ready for occupancy.
- C. Waste Disposal: Comply with requirements of Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

Project Waste Management Plan Worksheet Sample

National Park Service (NPS) - Denver Service Center (DSC) | 10-13-21

	A	B	C	D	E	F	G	H	I	J
Material	Quantity Recycled (in tons)	Quantity Salvaged or Reused (in tons)	A + B = Total Quantity Diverted from Landfill	Quantity to Landfill (in tons)	C + D = Total Quantity Generated (in tons)	Tip Fee/Ton at Landfill	C x F = Tip Fee Savings resulting from Landfill Diversion	Cost of Recycling (R), Salvage (S), or Reuse (Re) (Specify R, S, or Re)	Revenue from Recycling (R), Salvage (S), or Reuse (Re) (Specify R, S, or Re)	G - H + I = Total Cost (-) or Savings (+) from Diversion
Asphalt/Concrete										
Brick/Masonry/Tile										
Building Materials (doors, windows, fixtures, shingles, lumber, insulation, sheet goods, etc.)										
Carpet										
Carpet Padding, Foam Only										
Cardboard										
Ceiling Tile										
Drywall										
Glass										
Scrap Metal Aluminum										
Copper										
Steel										
Unpainted Wood & Pallets										
Yard Trimmings, Brush, Trees, Stumps, etc.										
Garbage/Trash										
Other										
Column Totals										
	Total Quantity Recycled	Total Quantity Reused or Salvaged	Total Quantity Diverted from Landfill	Total Quantity to Landfill	Total Quantity Generated		Tip Fee Savings from Diversion	Total Cost of Recycling, Salvage, or Reuse	Revenue from Recycling, Salvage, or Reuse	Total Cost (-) or Savings (+) from Diversion

Percentage Diverted = _____ (C divided by E from Column Totals). Should meet 60% diversion goal.

Closeout and Operation & Maintenance (O&M) Requirements Template

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
Project Record Drawings	01 77 00	Final Record Drawings			
	01 73 40	Certified As-Built Surveys			
	01 73 40	Quantity Surveys			
System Demonstration and Training		Not Applicable			
Tools Spare Parts Equipment		Not Applicable			
Extra Stock	09 91 13	Exterior Painting Maintenance Materials			
Reports	31 10 00	Closeout Report			
	01 74 19	Closeout Submittals			
	01 32 33	Construction Closout Images			
	01 77 00	Closeout Letter and Final Walk-through			
Keys & Keying Schedule		Not Applicable			
O&M Data Warranties Guarantees	01 67 00	Product Warranties			
	07 41 13.16	Maintenance Data for Metal Panels			
	07 41 13.16	Warranties for Metal Panels			
	07 92 00	Warranties for Joint Sealants			
	32 33 00	Maintenance Data and Warranties for Site Furnishings			

SECTION 02 41 00 - DEMOLITION AND SALVAGE

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes removal of pipe culverts and segments, headwalls, multiuse trails, curb and gutter, asphalt and concrete sidewalks, miscellaneous utilities, pavement markings, gravel trail, wooden fence, and sign systems.
- B. This work includes resetting sign systems.
- C. All trees in conflict with the proposed construction have been removed by the NPS. There is a stump remaining that shall be removed by the Contractor as shown on the Drawings and detailed in Section 31 10 00 – Site Clearing.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this Section:
 - 1. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
 - 2. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.
 - 3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
 - a. Part 61 - National Emission Standards for Hazardous Air Pollutants.
 - b. Part 82 - Protection of Stratospheric Ozone.
 - c. Part 273 - Standards for Universal Waste Management.

1.3 DEFINITIONS

- A. ACM: Asbestos-Containing Material
- B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed feature or any part thereof. Demolition also includes removal of culverts, drop inlets, wheel stops, signs, asphalt pavement, concrete curbs & gutters, concrete and asphalt sidewalks, and other underground or above ground facilities, whether as a separate activity or in conjunction with construction of new facilities
- C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.
- D. Relocate: Remove, protect, clean and reinstall features, including signs, and all ancillary components required to make them fully functional, to the new location identified on the Drawings.
- E. Renovation: Altering a facility or one or more facility components in any way.

- F. Salvage/Salvageable: Remove and deliver to the specified location(s), materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of the Park. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

1.4 SUBMITTALS

A. Informational Submittals:

1. Submit proposed Demolition and Salvage Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.

1.5 REGULATORY AND SAFETY REQUIREMENTS

- A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926 - Subpart T.
- B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor's safety requirements shall conform to ANSI A10.6.

1.6 DEMOLITION AND SALVAGE PLAN

- A. Demolition and Salvage Plan shall provide for safe conduct of the Work and shall include:
 1. Detailed description of methods and equipment to be used for each operation;
 2. The Contractor's planned sequence of operations, including coordination with other work in progress;
 3. Procedures for removal and disposition of materials specified to be salvaged.

1.7 SEQUENCING AND SCHEDULING

- A. The Work of this Specification shall not commence until Contractor's Demolition and Salvage Plan has been approved by the CO.
- B. Include the Work of this Specification in the progress schedule, as specified in Section 01 32 16 - Construction Schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 WASTE MANAGEMENT

- A. Contractor shall comply with requirements in Section 01 74 19 - Construction Waste Management and Disposal.

3.2 VERIFICATION OF CONDITIONS

- A. Before beginning Work, Contractor shall verify existing conditions.
 - 1. Verification of existing conditions shall include potholing to locate utilities to perform the Work.
- B. Discrepancies and Questions: Immediately notify CO. Do not proceed with Work in areas of discrepancy or question until fully resolved.

3.3 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

- A. Asphalt Pavement, Concrete Sidewalks, and Concrete Curbs and Gutters
 - 1. Remove concrete sidewalks and curb and gutters at joints or provide neat perpendicular sawcuts at limits of removal if no joints are nearby.
 - 2. Provide neat sawcuts at limits of existing asphalt pavement removal as indicated.
 - 3. Sidewalks and curb and gutters shall be removed as indicated.
 - 4. Remove aggregate base.
 - 5. Aggregate base material may be salvaged and reused provided it meets the criteria for aggregate base material provided in Section 32 11 23 – Aggregate Base Course.
- B. Flagstone Curbs
 - 1. Flagstone curb shall be removed and salvaged as shown on the Drawings.
- C. Storm Sewer Utilities
 - 1. Remove storm drain culverts as indicated.
 - 2. Salvage sandstone blocks from existing headwalls and re-use at new headwall location as shown on Drawings.
- D. Signs
 - 1. Remove signs, posts, and foundations. Salvage signs as directed by the CO.
- E. Fence / Handrail
 - 1. Remove handrails, wood fence beams and posts and foundations as indicated. Salvage wood beams as directed by the CO.
- F. Boulders
 - 1. Landscape boulders shall be removed and salvaged as shown on the Drawings or as directed by the CO.
- G. Miscellaneous Utilities
 - 1. Removal of miscellaneous underground utilities as indicated and as approved by the CO.
- H. Pavement Markings

1. Removal of existing pavement markings, symbols, and words on pavement.
2. Markings shall be removed as much as possible without damaging the pavement's surface, color, or texture.

3.4 PROTECTION

- A. Dust Control: Prevent the spread of dust to the surrounding area. Water shall be sprayed to limit dust.
- B. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal Work, use traffic barricades with flashing lights.
- C. Existing Work:
 1. Survey the site and examine the Drawings and Specifications to determine the extent of the Work before beginning any demolition or salvage.
 2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of the Park; any Contractor-damaged items shall be repaired or replaced as directed by the CO.
 3. Do not overload pavements to remain.
- D. Trees: Protect trees within the Site that might be damaged during demolition and earthwork and are indicated to be left in place, by installing plastic orange construction fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the CO.
- E. Facilities:
 1. Protect electrical and mechanical services and utilities.
 2. Protect all facility elements not scheduled for demolition.
- F. Protection of Personnel:
 1. During demolition, continuously evaluate the condition of features being demolished and take immediate action to protect all personnel working in and around the demolition site.
 2. Provide temporary barricades and other forms of protection to protect Park personnel and the general public from injury due to demolition Work.
 3. Provide protective measures as required to provide free and safe passage of Park personnel and the general public to occupied portions of the structure.
- G. Debris: Construct structurally adequate debris shields to contain debris within the construction limits. Do not allow debris to enter waterways, travel lanes open to public traffic, or areas designated not to be disturbed.

3.5 BURNING

- A. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.6 RELOCATIONS

- A. Perform the removal and reinstallation of reset items as indicated with workers skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of the CO. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the CO.

3.7 BACKFILL

- A. Do not use demolition debris as backfill material.
- B. Except in excavation areas, backfill and compact cavities left by structure removal with backfill material to the lines and grades of the finished ground. Backfill and compact excavated areas according to Section 31 23 00 – Excavation and Fill.

3.8 DISPOSITION OF MATERIAL

- A. Do not remove equipment and materials without approval of Contractor's Demolition/Renovation Plan by the CO.
- B. Salvage equipment and material to the maximum extent possible.
- C. With the exception of the following listed salvaged equipment and materials, all items designated to be removed shall become the property of Contractor:
 - 1. Salvage sign panels and posts if they are in good condition and deliver to a Park storage site as directed.
 - 2. Salvage wood beams from fence if they are in good condition and deliver to a Park storage site as directed.
 - 3. Salvage flagstone curbing and deliver to a park storage site as directed.
 - 4. Salvage stone headwall and reuse a portion of the stone to construct proposed culvert headwall as shown on Drawings.
- D. Remove salvaged items in a manner to prevent damage and protect the items from damage while in storage or during shipment.

3.9 UNSALVAGEABLE MATERIAL

- A. Concrete, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of at an approved waste disposal site.

3.10 CLEANUP

- A. Debris and rubbish shall be removed from the site. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION 02 41 00

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Form accessories.
4. Form stripping

B. Related Sections:

1. Section 03 15 00 – Concrete Joints and Accessories
2. Section 03 21 00 – Steel Reinforcement
3. Section 03 30 00 – Cast In Place Concrete
4. Section 05 50 00 – Metal Fabrications

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

1.3 DESIGN REQUIREMENTS

- ##### A.
- Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 SUBMITTALS

- ##### A.
- The following shall be submitted in accordance with the Contracting Requirements, Drawings and Specifications including Section 01 33 23 - Submittal Procedures.
- ##### B. Shop Drawings:
1. Submit formwork, shoring, and reshoring shop drawings.
 2. Indicate the following:
 - a. Pertinent dimensions, openings, methods of construction, types of connections,

materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347, ACI 301 and ACI 318.
- B. For wood products furnished for work of this section, comply with AF&PA.

1.6 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination
- B. Coordinate this section with other sections of work, requiring attachment of components to formwork

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Project Management and Coordination.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from CO.

3.2 INSTALLATION

- A. Formwork - General:
 - 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
 - 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
 - 4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 - 5. Complete wedging and bracing before placing concrete.
- B. Forms for Smooth Finish Concrete:

1. Use steel, plywood or lined board forms.
 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
 3. Use full size sheets of form lines and plywood wherever possible.
 4. Tape joints to prevent protrusions in concrete.
 5. Use care in forming and stripping wood forms to protect corners and edges.
 6. Level and continue horizontal joints.
 7. Keep wood forms wet until stripped.
- C. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.
- D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- E. Install void forms in accordance with manufacturer's recommendations.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Install form liner on the appropriate wall face as indicated on Drawings.
- D. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- H. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 2. Place ties at least 1 inch (25 mm) away from finished surface of concrete.
 3. Leave inner rods in concrete when forms are stripped.
 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- J. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
 3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 4. Arrange joints in continuous line straight, true and sharp.
- K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
 2. Do not embed wood or uncoated aluminum in concrete.
 3. Obtain installation and setting information for embedded items furnished under other Specification sections.
 4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
 5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.
- L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
 2. Coordinate work to avoid cutting and patching of concrete after placement.
 3. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 2. Slope slabs to drain where required or as shown on Drawings.
 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- N. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by CO.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301

3.8 FIELD QUALITY CONTROL

- A. Notify CO after placement of reinforcing steel in forms, but prior to placing concrete.

END OF SECTION 03 10 00

SECTION 03 15 00 - CONCRETE JOINTS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes concrete joints and accessories for cast-in-place concrete construction.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Concrete Institute (ACI)
 - a. 117, Specification for Tolerances for Concrete Construction Materials.
 - b. 301, Specification for Structural Concrete
 - c. 305, Specification for Hot Weather Concreting
 - d. 306, Standard Specification for Cold Weather Concreting
 2. ASTM International (ASTM):
 - a. A36/A36M, Specification for Carbon Structural Steel.
 - b. A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - c. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - d. A767/A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - e. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - f. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - g. D2240, Standard Test Method for Rubber Property – Durometer Hardness.

1.3 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
 - a. Construction Joints, Expansion Joints, and Control Joints: Layout and location for each type. Include joint locations shown on Drawings, additional required joint locations, and any proposed alternate locations.
 2. Product Data:
 - a. Bond breaker.
 - b. Premolded joint fillers.
 - c. Pourable joint fillers.
 - d. Preformed control joints.
 - e. Epoxy-coated dowels.
 - f. Accessories not specified in other sections.
- B. Informational Submittals:

1. Certification:
 - a. Letter stating compatibility between liquids being contained and materials used for:
 - 1) Joint fillers.
2. Manufacturer's written instructions for product shipment, storage, handling, installation/application, and repair for:
 - a. Bond breaker.
 - b. Bonding agent.
 - c. Premolded joint fillers.
 - d. Pourable joint fillers (sealant proportions not required as products used only as a filler).
 - e. Preformed control joints.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Verify delivered materials are in accordance with Specifications, regulatory agencies, and Manufacturer's product data sheets prior to unloading and storing onsite.
- B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight or as required by Manufacturer.

PART 2 PRODUCTS

2.1 BOND BREAKER

- A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape. Same width as joint that will adhere to premolded joint material or concrete surface.
- B. Use bond prevention material as specified in Section 03 30 00 - Cast-in-Place Concrete, except where bond breaker tape is specifically called for on Drawings.

2.2 PREMOLDED JOINT FILLER

- A. Bituminous Type: ASTM D994 or ASTM D1751.

2.3 PREFORMED CONTROL JOINT

- A. One-Piece, Flexible, Polyvinyl Chloride Joint Former:
- B. One-Piece Galvanized Steel Strip with Preformed Groove:
- C. Furnish in full-length, unspliced pieces.

2.4 POURABLE JOINT FILLERS

- A. General:
 1. Although product is a sealant, it is being specified as a filler to prevent debris accumulation and allow expansion and contraction under shrinkage and thermal loads. It does not need to meet proportional sealant geometry requirements.

2.5 EPOXY-COATED DOWELS

- A. Dowels: ASTM A36/A36M round smooth steel bars.
- B. Bar Coating: Painting and Coating, with factory-applied epoxy coating and factory or field applied lubrication coating conforming to ASTM A775/A775M-19.

2.6 ACCESSORIES

- A. Joint Sealant: Polyurethane.
- B. Steel Reinforcement: As specified in Section 03 21 00 - Steel Reinforcement.
- C. Nails: Galvanized, as required for securing premolded joint filler.
- D. Galvanized Rebar at Control Joints: ASTM A767/A767M and ASTM A615/A615M Grade 60 prior to galvanizing.

PART 3 EXECUTION

3.1 GENERAL

- A. Commence concrete placement after joint preparation is complete.
- B. Time Between Concrete Pours: As specified in Section 03 30 00 - Cast-in-Place Concrete.
- C. Joints, backer material, joint filler and joint sealants shall extend to pavement edges or to each other, as the case may be, and shall be constructed perpendicular to surface of pavement.
- D. Joints shall not vary from specified or indicated line by more than 1/4 inch.
- E. Contractor shall submit jointing plan and details to the CO for approval. Take into consideration placement of joints in curb and gutter, at catch basins, at bollard posts, and position of manholes and other large structures, as well as other limitations herein mentioned.
- F. Place manhole or similar large structure in line of joint, or if impractical, isolate structure from pavement with premolded joint filler, 1/2 inch wide, conforming to AASHTO M213 and ASTM D1751.

3.2 SURFACE PREPARATION

- A. Expansion Joint:
 - 1. Use wire brush or motorized device to mechanically roughen and thoroughly clean concrete surfaces on each side of joint.
 - 2. Use dry, high-pressure air to remove dust and foreign material, and dry joint.
 - 3. Prime surfaces as required before placing joint filler.
- B. Construction Joints: Clean concrete surface prior to placement of abutting concrete.

1. Remove laitance and spillage from steel reinforcement and dowels.
2. Roughen surface to minimum of 1/4-inch amplitude:
 - a. Sandblast after concrete has fully cured.
 - b. Water blast after concrete has partially cured.
 - c. Green cut fresh concrete with high-pressure water and hand tools.

3.3 EXPANSION JOINTS

A. Premolded Joint Filler:

1. Sufficient in width to completely fill joint space where shown.
2. Install per manufacturer's written instructions.
3. Precut premolded joint filler to required depth at locations where joint filler or sealant is to be applied.
4. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material.
5. Vibrate concrete thoroughly along joint form to produce dense, smooth surface.

B. Bituminous Type Premolded Joint Filler:

1. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
2. Secure premolded joint filler in forms before concrete is placed.
3. Install in walkways, at changes in direction, at intersections, and at 45-foot intervals, maximum.

C. Pourable Joint Filler:

1. General:
 - a. Install in accordance with the manufacturer's written instructions, except as specified below:
 - 1) Apply primer prior to pouring joint filler.
 - 2) Use masking tape on top of slabs at sides of joints. Clean spillage. Remove masking tape afterwards.
 - 3) Sealant products used as fillers need not meet sealant geometry parameters. Do not use backing rods.

D. Steel Expansion Joint Dowels:

1. Install coated and lubricated bars parallel to wall or slab surface and in true horizontal position perpendicular to joint in both plan and section view, to permit joint to expand or contract without bending dowels.
2. Secure dowels tightly in forms with rigid ties.
3. Install steel reinforcement in concrete as shown.

3.4 CONTRACTION JOINTS

A. Sawed Type with Poured Filler:

1. Sawing shall be to a depth as shown on Drawings with a maximum width of 1/4 inch and a minimum width of 1/8 inch, in straight lines as shown or as approved by the CO.
 2. Perform saw cuts as soon as Portland cement concrete has set enough to permit sawing without tearing or raveling, before uncontrolled cracking results, and within 24 hours of placing Portland cement concrete.
 3. Saws may be single or tandem, as Contractor may elect, and shall be controlled by guides to true line.
 4. Clean joints thoroughly of foreign matter before pouring approved rubber asphalt filler.
 5. Tops of joint filler shall be true to pavement cross section within 1/8 inch and shall be protected from damage by Portland cement concrete operations.
 6. Areas containing uncontrolled cracks shall be removed and replaced.
 7. Restore curing agents broken or damaged by sawing operations.
- B. Transverse joints shall be as shown on Drawings or as approved by the CO.
- C. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

3.5 CONSTRUCTION JOINTS

- A. Construct when there is an interruption of longer 45 minutes in Portland cement concrete placing operations or where specified.
- B. Place parallel with intended contraction joint.
- C. Tool both free edges of joints with 1/8 inch radius rounder to remove laitance and mortar resulting from finishing operations and to provide clean rounded edge. Tooling shall not form ridges on surface of concrete.
- D. New Portland cement concrete placed contiguous to joint shall conform to proportions and consistency of previously placed concrete.
- E. Transverse Construction Joint:
1. Doweled type using 1" diameter by 18 inch long dowels at 12 inch centers coated with plastic, grease, heavy oil or other approved material that will neither bond with nor be harmful to operation at a depth of 1/2 the pavement thickness parallel to centerline.
 2. If sufficient Portland cement concrete has not been mixed at the time of interruption to place a construction joint at least 3 feet from a planned contraction joint, remove excess Portland cement concrete back to a position to satisfactorily meet these criteria and to satisfaction of the CO.
 3. Fill joint which has opened to a width of 1/8 inch or greater during construction or maintenance periods with poured filler.
 4. Do not construct within 3 feet of a transverse contraction joint.

3.6 SCORED JOINTS

- A. Configuration: 1/4 inch wide by 1/4 inch deep at locations indicated on Drawings formed by tooling of concrete while it is still fresh.
- B. Do not fill or seal.
- C. Layout of joints shall be straight and true and shall not vary from indicated line by more than 1/4 inch.

3.7 CONTROL JOINTS

- A. Locate epoxy-coated steel reinforcement as shown.
- B. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

3.8 PREFORMED CONTROL JOINTS

- A. Use only where specifically shown or as approved by the CO.
- B. Locate slightly below top of slab.
- C. Install in accordance with manufacturer's written instructions in straight, full-length pieces.
- D. Steel Strip Type with Preformed Groove: Brace to withstand pressure of concrete during and after placement using only approved stakes and other secondary installation materials.

3.9 MANUFACTURER'S SERVICES

- A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

3.10 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

- A. Contractor-Furnished Quality Control: Inspection shall be in accordance with ACI 301.

END OF SECTION 03 15 00

SECTION 03 21 00 - STEEL REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes reinforcing steel and coating for reinforcing steel.
- B. Steel reinforcement shall comply with ACI 301 and as modified in the following.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Concrete Institute (ACI):
 - a. 117, Specification for Tolerances for Concrete Construction and Materials.
 - b. 301, Specifications for Structural Concrete.
 - c. SP-66, Detailing Manual.
 - 2. American Welding Society (AWS): D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
 - 3. ASTM International (ASTM):
 - a. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - b. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - c. A767/767M, Standard Specification for Zinc-Coated (Galvanized) Steel bars for Concrete Reinforcement
 - d. A775/A775M, A934 Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - e. A1064/A1064M, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - 4. Concrete Reinforcing Steel Institute (CRSI):
 - a. Placing Reinforcing Bars.
 - b. Manual of Standard Practice.
 - 5. International Code Council (ICC): Evaluation Services Report.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings prepared in accordance with ACI 301 and ACI SP-66:
 - a. Bending limits.
 - b. Placing drawings.
 - 2. Welded, metallic sleeve splice, and mechanical threaded connection.
- B. Informational Submittals:
 - 1. Lab test reports for steel reinforcement showing stress-strain curves and ultimate strengths.

2. Mechanical Threaded Connections:
 - a. Current ICC Evaluation Services Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.
 - b. Verification device threads have been tested and meet requirements for thread quality, in accordance with manufacturer's published methods.
 - c. Manufacturer's instructions.
3. Epoxy-Coated Reinforcing Bars: Written certification in accordance with Paragraph 14.1 of ASTM A775/A775M or ASTM A934 as appropriate.
4. Welding Qualification: Prior to welding, submit welder qualifications and nondestructive testing procedures:
 - a. WPSs: In accordance with AWS D1.1/D1.1M (Annex J Forms) for shop or field welding; or ASME BPVC SEC IX (Forms QW 482 and QW 483) for shop welding only.
 - b. WPQs: In accordance with AWS D1.1/D1.1M (Annex J Forms); or ASME BPVC SEC IX (Form QW 484).
 - c. CWI: Certified in accordance with AWS QC1, and having prior experience with specified welding codes. Alternate welding inspector qualifications require prior approval by Contracting Officer.
 - d. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT TC 1A

1.4 QUALITY ASSURANCE

- A. Welder Qualifications: Certified in accordance with AWS D1.4/D1.4M.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with ACI 301 and recommendations of CRSI Placing Reinforcing Bars.
- B. Epoxy-coated Reinforcing Bars:
 1. Protect contact areas of epoxy-coated bars from handling equipment.
 2. Lift bundles of bars at multiple pickup points to minimize bar-to-bar abrasion from sags in bundles.
 3. Do not drop or drag bars or bundles of bars.
 4. Store bars on protective cribbing.
 5. Color fading of coating is not cause for rejection of epoxy-coated reinforcing bars.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars:
 1. Includes stirrups, ties, and spirals.
 2. ASTM A615/A615M, Grade 60, where welding is not required.
 3. ASTM A775/A775M or ASTM A934 for epoxy-coated bars.

2.2 ACCESSORIES

A. Tie Wire:

1. Black, soft-annealed 16-gauge wire.
2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:

1. Use precast concrete bar supports and side form spacers, unless noted otherwise. Do not use other types of supports or spacers.
2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.
3. Use only precast concrete bar supports where concrete surfaces are exposed to weather, earth, water, chloride intrusion, or corrosive chemicals. Bar supports shall be nonconductive and have geometry and bond characteristics that deter movement of moisture from the surface to the reinforcement.
4. Precast concrete supports shall have same minimum strength and shall be made from same materials as that of the concrete in which they are to be embedded. Precast concrete supports shall be cast and properly cured for at least 7 days before use and shall have a wire or other device cast into each block for the purpose of attaching them securely to steel reinforcement.
5. If epoxy-coated reinforcing is used, furnish epoxy-coated reinforcing bars for spreader bars.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify CO when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.
- B. Repair epoxy coating damaged as a result of handling, shipment, and placing. Repair with patching material in accordance with ASTM A775/A775M, ASTM A934 and manufacturer's recommendations.
- C. Clean reinforcing bars of loose mill scale, oil, earth, and other contaminants.
- D. Coat wire projecting from precast concrete bar supports with dielectric material, epoxy, or plastic.

3.2 INSTALLATION

- A. Bundle or space bars, instead of field bending where construction access through reinforcing is necessary.
- B. Splicing:
 1. Minimum length of lap splices shall be as shown on Drawings.
 2. Use lap splices, unless otherwise shown or permitted in writing by the CO.
 3. Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar.

4. Stagger splices in adjacent bars where indicated.

C. Mechanical Splices and Connections:

1. Use only in areas specifically approved in writing by the CO.
2. Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICC Evaluation Services Report or equivalent code agency report.
3. For metal sleeve splice, follow manufacturer's installation recommendations.
4. Maintain minimum edge distance and concrete cover.

D. Tying Reinforcing Bars:

1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
2. Bend tie wire away from concrete surface to provide clearance of 1 inch from surface of concrete to tie wire.
3. Epoxy-coated Reinforcing Bars:
 - a. Use epoxy-coated or nonmetallic clips.
 - b. Repair coating damage at clipped or welded intersections.

E. Straightening and Re-bending: Field bending of steel reinforcement bars is not permitted.

F. Unless permitted by CO, do not cut reinforcing bars in field. When epoxy-coated reinforcing bars are cut in field, coat ends of bars with same material specified for repair of epoxy coating damage.

3.3 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Notify the CO after placement of reinforcing steel, but prior to placing concrete.

END OF SECTION 03 21 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes cast-in-place concrete construction in concrete structures such as curbs, slabs-on-grade, pavement, sidewalks, ramps, and miscellaneous structures. This work also includes retaining wall structures and shelter foundations. Sidewalk, curb head, median and retaining wall concrete shall be integrally colored as shown on the Drawings.

1.2 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
1. American Concrete Institute (ACI):
 - a. 117, Specification for Tolerances for Concrete Construction Materials.
 - b. 301, Specification for Structural Concrete
 - c. 305, Specification for Hot Weather Concreting
 - d. 306, Standard Specification for Cold Weather Concreting
 2. ASTM International (ASTM):
 - a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - b. C33/C33M, Standard Specification for Concrete Aggregates.
 - c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - d. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - e. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - f. C138/C138M, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - g. C150/C150M, Standard Specification for Portland Cement.
 - h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - i. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - j. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
 - k. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
 - l. C595/C595M, Standard Specification for Blended Hydraulic Cements.
 - m. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - n. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

- o. C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.
- p. C989/C989M, Standard Specification for Slag Cement for Use in Concrete and Mortars.
- q. C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- r. C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- s. C1074, Standard Practice for Estimating Concrete Strength by the Maturity Method.
- t. C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- u. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
- v. C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.
- w. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
- x. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
- y. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
- z. ASTM C1581/C1581M, Standard Test Method for Determining Age at Cracking and Induced Tensile Stress Characteristics of Mortar and Concrete under Restrained Shrinkage.
- aa. C1582/C1582M, Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete.
- bb. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
- cc. C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- dd. C1610/C1610M, Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.
- ee. C1611/C1611M, Standard Test Method for Slump Flow of Self-Consolidating Concrete.
- ff. C1621/C1621M, Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring.
- gg. D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- hh. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.3 DEFINITIONS

A. Defective Area:

1. Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4-inch in diameter, cracks that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections.
 2. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.
 3. Cold joints.
- B. Exposed Concrete: Concrete surface that can be seen inside or outside of structure. Surfaces must be considered exposed concrete, even if covered by paint, sealers, or similar applications.
- C. Flat and Elongated Particles of Aggregates: Those particles having a ratio of length to thickness greater than a 5 to 1.
- D. Hot Weather: As defined in ACI 305.1.
- E. New Concrete: Less than 60 days old.

1.4 SUBMITTALS

A. Action Submittals:

1. Mix Designs:

- a. Contain proportions of materials and admixtures to be used on Project, signed by mix designer.
- b. Documentation of average strength for each proposed mix design in accordance with ACI 301.
- c. Manufacturer's Certificate of Compliance, for the following:

- 1) Portland cement.
- 2) Blended cement.
- 3) Performance-based cement.
- 4) Fly ash.
- 5) Slag cement.

d. Test Reports:

- 1) Aggregates:
 - a) Deleterious substances in fine aggregate per ASTM C33/C33M, Table 2.
 - b) Deleterious substances in coarse aggregate per ASTM C33/C33M, Table 4.
- 2) Water-Soluble Chloride-Ion Content in Hardened Concrete:

- a) One of the following:
 - (1) Test report in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
 - (2) Calculation of water-soluble chloride content based on certified chloride content of each constituent material and proportion of constituent material in concrete mixture.
- 2. Concrete Samples
 - a. Core samples taken from compacted pavement after testing.
 - b. Colored concrete samples.
- 3. Product Data:
 - a. Admixtures:
 - 1) Manufacturer's catalog cut sheets and product data sheets for each admixture used in proposed mix designs.
 - 2) Color Pigment: Product data including application rate and color chart.
 - b. Specified ancillary materials.
- 4. Detailed plan for curing and protection of concrete placed and cured in cold weather. Details must include, but not be limited to, the following:
 - a. Procedures for protecting subgrade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.
 - b. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
 - c. Methods for temperature protection during placement.
 - d. Types of covering, insulation, housing, or heating to be provided.
 - e. Curing methods to be used during and following protection period in accordance with Section 03 39 00 - Concrete Curing.
 - f. Use of strength accelerating admixtures.
 - g. Methods for verification of in-place strength.
 - h. Procedures for measuring and recording concrete temperatures.
 - i. Procedures for preventing drying during dry, windy conditions.
- 5. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F. Plan must include, but not be limited to, the following:
 - a. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
 - b. Use of retarding admixture.
 - c. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.

- d. Types of shading and wind protection to be provided.
 - e. Curing methods, including use of evaporation retardant.
 - f. Procedures for measuring and recording concrete temperatures.
 - g. Procedures for preventing drying during dry, windy conditions.
- 6. Concrete repair techniques.
- B. Informational Submittals:
 - 1. Preinstallation conference minutes.
 - 2. Statement of Qualification:
 - a. Batch Plant: Certification as specified herein.
 - b. Mix designer.
 - c. Installer.
 - d. Testing agency.
 - 3. Field test reports.
 - 4. Concrete Delivery Tickets:
 - a. For each batch of concrete before unloading at Site.
 - b. In accordance with ASTM C94/C94M, including requirements 14.2.1 through 14.2.10.
 - c. Indicate amount of mixing water withheld and maximum amount that is permitted to be added at Site.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Batch Plant: National Ready Mixed Concrete Association (NRMCA) Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
 - 2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or Department of Transportation (DOT)-certified mix designer in jurisdiction of the Work. Requirement may be waived if Mix Designer is a Professional Engineer registered in the state where the Project is located.
 - 3. Flatwork Finisher: Unless otherwise permitted, at least one person on finishing crew must be certified as an ACI Flatwork Finisher, or equivalent.
 - 4. Testing Agency: Unless otherwise permitted, an independent agency, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 - a. Where field testing is required of Contractor, personnel conducting field tests must be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - b. Personnel performing laboratory tests must be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor must be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

5. Surface finish and color shall be uniform in appearance to Samples.
6. Approved panels must establish standards of quality by which Work will be judged.
7. Replace panels if not representative of Work as specified.
8. Panels may be incorporated into Work if approved by the CO.

B. Preinstallation Conference:

1. Required Meeting Attendees:
 - a. The Contractor, including pumping, placing, and finishing, and curing subcontractors.
 - b. Ready-mix producer.
 - c. Admixture representative.
 - d. Steel reinforcement installer.
 - e. Testing and sampling personnel.
 - f. The CO and/or the CO's designee.
2. Schedule and conduct Preinstallation Conference prior to incorporation of respective products into Project. Notify the CO of location and time.
3. Agenda must include:
 - a. Admixture types, dosage, performance, and redosing at Site.
 - b. Mix designs, test of mixes, and Submittals.
 - c. Placement methods, techniques, equipment, consolidation, and form pressures.
 - d. Slump and placement time to maintain slump.
 - e. Finish, curing, and water retention.
 - f. Steel reinforcement details.
 - g. Protection procedures for weather conditions.
 - h. Other specified requirements requiring coordination.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cementitious Materials:

1. Cement:
 - a. Blended Hydraulic Cement Type II:
 - 1) Unless otherwise specified, excluding Type IS (greater than 70), conforming to ASTM C595/C595M.
 - 2) Portland cement used in blended hydraulic cement, conform to requirements of ASTM C150/C150M.
 - b. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:

- 1) When air-entrainment is specified, fly ash shall comply with uniformity requirements of Table 3 of ASTM C618.
- c. Slag Cement: In accordance with ASTM C989/C989M, Grade 100 or Grade 120.
- d. Silica Fume: In accordance with ASTM C1240.
2. Aggregates:
 - a. In accordance with ACI 301, except as modified herein.
 - b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
 - c. Aggregates that are susceptible to alkali-carbonate reactions shall not be used.
 - d. Resistance to Alkali Silica Reaction: See Supplement: Concrete Mix Design.
3. Fine Aggregates:
 - a. In accordance with ACI 301, except as modified herein.
 - b. In the event manufactured sand is included in mix design, material must be from same source as coarse aggregate.
 - c. Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:
 - 1) Limit material finer than 75- μ m (No. 200) sieve to 5 percent mass of total sample.
 - 2) Limit coal and lignite to 0.5 percent.
4. Coarse Aggregate:
 - a. Crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles as determined by ASTM D4791.
 - b. Class designation in accordance with ASTM C33/C33M, Table 4: 4S unless otherwise specified.
 - c. Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for
- B. Admixtures:
 1. Characteristics:
 - a. Compatible with other constituents in mix.
 - b. Contain at most, only trace amount chlorides in solution.
 - c. Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.
 - d. Do not use calcium chloride admixtures.
 2. Air-entraining Admixture: ASTM C260/C260M.

3. Water-reducing Admixture: ASTM C494/C494M, Type A or Type D.
 4. Retarding Admixture: ASTM C494/C494M, Type B.
 5. Accelerating Admixture: ASTM C494/C494M, Type C.
 6. Do not use calcium chloride as an admixture.
 7. High Range Water-reducing Admixture: ASTM C494/C494M, Type F or Type G.
 8. Viscosity Modifying Admixture (VMA): ASTM C494/C494M, Type S.
- C. Water and Ice: Mixing water for concrete and water used to make ice must be potable water unless alternative sources of water are permitted.
1. Water from alternative sources must comply with requirements of ASTM C1602/C1602M, and concentration of chemicals in combined mixing water must be less than:
 - a. Chloride Content: 1,000 ppm.
 - b. Sulfate Content as SO_4 : 3,000 ppm.
 - c. Alkalis as $(\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O})$: 600 ppm.
 - d. Total Solids by Mass: Less than 50,000 ppm.

2.2 ANCILLARY MATERIALS

A. Bonding Agent:

1. Unless otherwise specified, in accordance with the following:
 - a. ASTM C881/C881M, Type V.
 - b. Two-component, moisture insensitive, 100 percent solids epoxy.
 - c. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.

B. Repair Material:

1. One-component or two-component, fast-setting, polymer modified cementitious based repair mortar system.
2. Contain only trace amounts of chlorides and other chemicals that can potentially cause steel to oxidize.
3. Where repairs of exposed concrete are required, prepare mockup using proposed repair materials and methods, for confirmation of appearance compatibility prior to use.
4. Obtain manufacturer's certificate of compliance that products selected are appropriate for specific applications.
5. Repair mortar must be Site mixed.
6. Prepare concrete substrate and mix, place, and cure repair material in accordance with manufacturer's written recommendations.

2.3 CONCRETE MIX DESIGN

A. General:

1. See supplement at end of this section for mix design requirements for each class of concrete used on Project.
2. Unless otherwise specified, prepare design mixtures for each type and strength of concrete, in accordance with requirements of ACI 301.
3. Unless specified otherwise, selection of constituent materials and products in mix design are optional.
4. Use water-reducing admixture or water-reducing admixture and high-range water-reducing admixture for the following:
 - a. Concrete mixtures that will be pumped.
 - b. Concrete mixtures with a water-cementitious materials ratio below 0.50.
 - c. Concrete mixtures used in elements of a liquid-containment structure.
 - d. When needed to achieve fresh properties that facilitate handling, placing, and consolidating of concrete mixtures, and to achieve specified hardened properties.
 - e. When anticipated high temperatures, low humidity, or other adverse placement conditions can adversely affect fresh properties of concrete.
5. Unless otherwise specified, desired fresh properties of concrete must be determined by Contractor and coordinated with concrete producer. Fresh properties of concrete must remain stable to satisfaction of Contractor, for duration of placement and consolidation, and must remain in conformance with requirements of Contract Documents.
6. Concrete producer is encouraged to employ environmentally sustainable concrete mix design technologies such as supplementary cementitious materials and aggregate packing.
7. Color Pigment: Add color pigment to concrete mixtures for the sidewalk, curb head, median and retaining wall as specified on the Drawings. Color pigment shall be added according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup. High purity, chemically inert, unfading, and alkali-fast synthetic pigment coloring material according to ASTM C 979.
 - a. Color additive pigment shall be for integral coloration of the concrete mix. Use additive and sealers as recommended by manufacturer. Test sections will be required for determining the exact amount of additive, as stated in this Specification. Determine coloring agent batch amounts by weight, not volume. Use additional mixing time required as recommended by the manufacturer. The amount of coloring agent to be used will be determined by the CO based on test section results.
 - b. The color of the concrete shall match existing on-site colored concrete and be similar to Interstar Golden Rod (Davis color equivalent 5084 Harvest Gold). Similar colors provided by other manufacturers of concrete dye products are acceptable.

B. Proportions:

1. Concrete mixtures must meet specified aesthetic, durability, and strength requirements.

2. Where fly ash is included in mix, minimum fly ash content shall be 15 percent of weight of total cementitious materials.
3. Where silica fume is included in mix, minimum silica fume content shall be 5 percent of weight of total cementitious materials.

C. Slump:

1. Unless otherwise specified, select a target slump at point of delivery for concrete mixtures used for Work. Selected target slump shall not exceed 9 inches.
2. Concrete shall not show visible signs of segregation.
3. Target slump indicated on submittal shall be used as basis for acceptance during the Project.
4. Determine slump by ASTM C143/C143M.
5. Slump tolerances shall be in accordance with ACI 117.

D. Size of Coarse Aggregate:

1. Unless otherwise specified, nominal maximum size of coarse aggregate shall not exceed:
 - a. Three-fourths of minimum clear spacing between reinforcement.
 - b. One-fifth of narrowest dimension between sides of forms.
 - c. One-third of thickness of slabs or toppings.

E. Combined Gradation Limits: Limits shown are for coarse aggregates and fine aggregates mixed together (combined).

Sieve Sizes	Combined Gradation Percentage Passing
	1-1/2" Max.
2"	100
1-1/2"	95 - 100
1"	65 - 85
3/4"	55 - 75
1/2"	-
3/8"	40 - 55
No. 4	30 - 45
No. 8	23 - 38
No. 16	16 - 30

Sieve Sizes	Combined Gradation Percentage Passing
	1-1/2" Max.
No. 30	10 - 20
No. 50	4 - 10
No. 100	0 - 3
No. 200	0 - 2

2.4 CONCRETE MIXING

- A. General: Unless otherwise specified, in accordance with ACI 301.
- B. Temperature Limits: Minimum concrete temperature of 40° F and maximum concrete temperature of 95° F at the time of discharge in accordance with ACI 301-10.2, ACI 301-20 and ACI 305.1-14

2.5 SOURCE QUALITY CONTROL

- A. Source Quality Control Inspection: CO must have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in this section.

PART 3 EXECUTION

3.1 PREPARATION

- A. Preparation: In accordance with ACI 301.
- B. Inspection: Notify CO and Special Inspector at least 1 full working day in advance before starting to place concrete.

3.2 CONCRETE BONDING

- A. Construction Joints in New Concrete Members: Prepare surface of construction joint as specified in Section 03 15 00 - Concrete Joints and Accessories.
- B. Construction Joints at Existing Concrete:
 - 1. Thoroughly clean and mechanically roughen existing concrete surfaces.
 - 2. Saturate surface with water for 24 hours prior to placing new concrete.

3.3 PLACEMENT OF CONCRETE

- A. Placement into Formwork:

1. Reinforcement: Secure in position before placing concrete.
 2. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
 3. Use placement devices as required to prevent segregation.
- B. Retempering: Not permitted for concrete where cement has partially hydrated.
- C. Pumping of Concrete: Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
- D. Maximum Size of Concrete Placements:
1. Locate expansion, control, and contraction joints where shown on the Drawings.
 2. Construction Joints: Locate additional construction joints as follows:
 - a. Where approved in joint location submittal required in Section 03 15 00 - Concrete Joints and Accessories.
- E. Hot Weather Placement
1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:
 - a. Maintain concrete temperature below 85 degrees F at time of
 - b. placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
 - c. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
- F. Cold Weather Placement
1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:
 - a. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
 - b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of CO.
 - c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.
 - d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
 - e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

- f. Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.

3 .4 CURB CONSTRUCTION

- A. Construct ramps at pedestrian crossings.
- B. Expansion Joints: Place at maximum 45-foot intervals and at the beginning and end of curved portions of curb Install expansion joint filler at each joint.
- C. Curb Facing: Do not allow horizontal joints within 7 inches from top of curb.
- D. Contraction Joints:
 - 1. Maximum 15-foot intervals in curb.
 - 2. Provide open joint type by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.
 - 3. Insert steel sheet to full depth of curb.
 - 4. Remove steel sheet with sawing motion after initial set has occurred in concrete and prior to removing front curb form.
 - 5. Finish top of curb with steel trowel and finish edges with steel edging tool.
- E. Front Face:
 - 1. Remove front form and finish exposed surfaces when concrete has set sufficiently to support its own weight.
 - 2. Finish formed face by rubbing with burlap sack or similar device to produce uniformly textured surface, free of form marks, honeycomb, and other defects.
 - 3. Remove and replace defective concrete.
 - 4. Apply curing compound to exposed surfaces of curb upon completion of finishing.
 - 5. Continue curing for minimum of 7 days.
- F. Backfill curb with earth upon completion of curing period, but not before 7 days has elapsed since placing concrete.
 - 1. Backfill shall be free from rocks 2 inches and larger and other foreign material.
 - 2. Compact backfill firmly.

3 .5 SIDEWALK CONSTRUCTION

- A. Thickness:
 - 1. 4 inches in walk areas.
- B. Connection to Existing Sidewalk:
 - 1. Remove old concrete back to an existing contraction joint.
 - 2. Clean the surface.

3. Apply a neat cement paste immediately prior to placing new sidewalk.
- C. Expansion Joints: Place in adjacent curb, where sidewalk ends at curb, and around posts, poles, or other objects penetrating sidewalk. Install expansion joint filler at each joint.
 - D. Contraction Joints:
 1. Provide transversely to walks at locations opposite contraction joints in curb.
 2. Dimensions: 3/16-inch by 1-inch weakened plane joints.
 3. Construct straight and at right angles to surface of walk.
 - E. Finish:
 1. Broom surface with fine-hair broom at right angles to length of walk and tool at edges, joints, and markings.
 2. Mark walks transversely at 5-foot intervals or in pattern shown on Drawings, with jointing tool; finish edges with rounded steel edging tool.
 3. Apply curing compound to exposed surfaces upon completion of finishing.
 4. Protect sidewalk from damage and allow to cure for at least 7 days.

3.6 CONCRETE PAVEMENT CONSTRUCTION

- A. Concrete shall not be placed:
 1. Until the air temperature in the shade is 35 degrees F and rising and is forecast to remain above 35 degrees F.
 2. On frozen ground.
 3. During periods of rain or snow.
- B. Concrete placement shall not continue when air temperature drops below 40 degrees F.
- C. Protect concrete pavement from inclement weather for 7 days after it has been placed, when rain is imminent, and when air temperature drops or is forecast to drop below 35 degrees F.
- D. Prepare base as specified in Section 32 11 23 - Aggregate Base Course.
- E. Dampen base thoroughly prior to concrete placement; standing water will not be permitted.
- F. Formwork shall be complete prior to placement of concrete. Area in which concrete is to be placed, shall be smooth and free of ruts, projections, debris, spilled concrete, mud, sloughed soil, standing water, organic and other objectionable materials.
- G. Construction Joints: Inspect prior to placement of concrete.
- H. Prior to placing paving equipment in position, full width and length of the area on which the tracks of the paving equipment is to operate shall be brought to density and surface tolerances required.

- I. Protect existing exposed surfaces such as grates, catch basins, air valves, manholes, and cleanout lids from splattered and spilled concrete during concrete placement by use of durable waterproof paper.
- J. Furnish operable backup vibrator onsite prior to concrete placement.
- K. Where width of pavement is narrow, tapering, or of irregular pattern not lending itself to being constructed by prescribed machine methods, Contractor shall be permitted to place concrete as specified and perform strike off, consolidation, final floating, and surface finishing with equipment, tools, means, labor, and methods other than those specified, provided the Work meets approval of the CO and the following requirements:
 - 1. As concrete is being placed, striking off and consolidating Portland cement concrete shall be done without causing segregation of material and shall include thorough uniform vibration throughout the mass until it is uniformly compacted.
 - 2. Floating shall follow vibrating, striking off, and tamping operations and shall include transverse floating or other smoothing and finishing action. This shall provide a surface and evenness within a 12-foot straightedge tolerance of 0.01 foot. Test hardened surface in presence of the CO. Surface shall be free from laitance, soupy mortar, marks, or irregularities.]
- L. Defects:
 - 1. Fill areas of minor honeycomb or other minor defect in composition of Portland cement concrete along exposed edges of Portland cement concrete with a stiff mortar of cement and fine aggregate. Apply to moistened Portland cement concrete to satisfaction of the CO.
 - 2. Area showing serious defects in composition of concrete shall be removed and replaced with pavement of specified quality for full width of strip between longitudinal joints or edges and for a length not less than between the nearest transverse joints.

3.7 JOINTS

- A. Following Section 03 15 00 - Joints and Accessories, unless otherwise specified.

3.8 CURING

- A. Following Section 03 39 00 - Concrete Curing, unless otherwise specified.

3.9 REPAIRING CONCRETE

- A. General:
 - 1. Repair defective areas of concrete.
 - 2. Repair concrete surfaces using specified materials. Select system, submit for review, and obtain approval from the CO prior to use.

3.10 CONCRETE SLAB FINISHES

A. General:

1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
2. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Finish slab in accordance with specified slab finish.
4. Do not dust surfaces with dry materials nor add water to surfaces.

B. Curbs - Steel Troweled Finish:

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
2. Wood float to true, even plane with no coarse aggregate visible.
3. Use enough pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand steel trowel concrete to produce smooth, smooth dense surface, free from trowel marks.
5. Provide light steel-troweled finish (two trowelings) at air-entrained slabs. Provide hard steel-troweled finish (ringing sound from the trowel) for non-air entrained slabs.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.

C. Sidewalk - Broomed Finish:

1. Slope walks down 1/8 inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic or as shown.
4. Lay out sidewalk surfaces in blocks, as shown or as directed by CO, with grooving tool.

D. Paving – Heavy Broom Finish

1. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
2. Broom surface at right angles to direction of traffic or as shown.
3. Lay out paving surfaces in blocks, as shown or as directed by CO, with grooving tool.

3.11 FIELD QUALITY CONTROL

A. General:

1. Unless otherwise specified, concrete field-testing services will be in accordance with ACI 301 and Section 01 40 00 - Quality Requirements.

2. Unless otherwise specified, refer to ACI 301 and Section 01 40 00 - Quality Requirements for additional information regarding requirements related to concrete field quality assurance.
3. Employ one or more agencies to provide tests for concrete work during construction, as specified herein and in Section 01 40 00 - Quality Requirements.
4. Agencies shall be objective, competent, and independent from the Contractor responsible for the Work being inspected.
5. Identify agencies to CO for approval.
6. Agencies shall disclose to CO possible conflicts of interest so that objectivity can be confirmed.
7. Provide electrical and water services to area of site for safe storage and curing of concrete test specimens prior to transport of test specimens to testing lab.
8. Concrete testing agency will provide storage facility for proper curing of concrete test specimens onsite prior to transport of test specimens to testing lab.
9. Unless otherwise specified, concrete will be sampled for making test specimens, from point of delivery.
10. For additional information regarding requirements of the Contractor related to concrete field quality assurance, refer to Section 01 40 00 - Quality Requirements.
11. Unless otherwise specified, sampled concrete used to mold strength test specimens (ASTM C31/C31M) will be tested for slump (ASTM C143/C143M) or slump flow (ASTM C1611/C1611M), air content (ASTM C231/C231M), temperature (ASTM C1064/C1064M), and density (ASTM C138/C138M).
12. Measured Air Content at Point of Delivery:
 - a. When measured air content at point of delivery is greater than specified limit, a check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents.
 - b. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents.
 - c. Concrete that has failed to meet requirements of Contract Documents must be rejected.
13. Test specimens must be stored and cured in accordance with ASTM C31/C31M and tested in accordance with ASTM C39/C39M.
14. Frequency of testing may be changed at discretion of CO.
15. Evaluation and acceptance will be in accordance with ACI 301 and the Contract Documents.

B. Concrete Strength Test:

1. Unless otherwise specified, specimens will be made and tested as follows:
 - a. One standard test specimen at age of 7 days for information.
 - b. Minimum of two standard test specimens at age of 28 days for acceptance.
 - c. A minimum of one spare standard test specimen per sample.
 - d. Spare cylinder will be tested as directed by CO.

C. Tolerances:

1. Concrete tolerances must comply with the more stringent of equipment manufacturers' tolerances and ACI 117.

3 .12 MANUFACTURER'S SERVICES

- A. Provide representative at Site in accordance with Section 01 40 00 - Quality Requirements, for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
1. Concrete Producer Representative:
 - a. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
 - b. Establish control limits on concrete mix designs.
 - c. Provide equipment for control of concrete redosing for air entrainment or high range water reducing admixture, superplasticizers, at Site to maintain proper slump and air content if needed.
 2. Admixture Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.
 3. Bonding Agent Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.

3 .13 PROTECTION OF INSTALLED WORK

- A. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3 .14 SUPPLEMENTS

- A. Requirements of concrete mix designs (CMD) following "End of Section," are a part of this specification and supplement requirements of Part 1 through Part 3 of this section:
1. Concrete Mix Design—CMD-1.

END OF SECTION 03 30 00

CMD-1

- A. Mix Locations: Typical, unless otherwise specified.
- B. Exposure Categories and Classifications: F3S1W2C2 as defined in ACI 318-19.
- C. Mix Properties:
 - 1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.40.
 - 2. Minimum concrete compressive strength (f'c) must be 4,000 psi at 28 days.
 - 3. Concrete mix must be designed to conform to 0.042 maximum shrinkage at 28 days as defined in AASHTO T 160.
 - 4. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in. ‡	Air Content (%)*
3/8	7.5
1/2	7.0
3/4	6.0
1	6.0
1-1/2	5.5
2§	5.0
3§	4.5

‡ See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.
 * Tolerance of air content is $\pm 1\frac{1}{2}$ percent.
 § Air contents apply to total mixture. When testing concretes, however, aggregate particles larger than 1-1/2 inches are to be removed by sieving and air content will be measured on sieved fraction (tolerance on air content as delivered applies to this value). Air content of total mixture is computed from value measured on sieved fraction passing 1-1/2-inch sieve in accordance with ASTM C231/C231M.

- 5. Limit supplementary cementitious materials as follows:

Limits on Cementitious Materials for Concrete Assigned to Exposure Class F3 ^{‡*}	
Supplementary Cementitious Materials	Maximum Percent of Total Cementitious Materials by Mass
Fly ash or natural pozzolans conforming to ASTM C618	25
Slag cement conforming to ASTM C989	50
Silica fume conforming to ASTM C1240	10
Total of fly ash or natural pozzolans and silica fume	35
Total of fly ash or natural pozzolans, slag cement, and silica fume	50
[‡] Supplementary cementitious materials, including fly ash and natural pozzolans, slag cement, and silica fume, used in the manufacture of ASTM C595/C595M and ASTM C1157/C1157M blended cements shall be included in assessing compliance with these limits. [*] Individual limits shall apply regardless of the number of cementitious materials in a concrete mixture.	

6. Provide cementitious materials in accordance with one of the following:
 - a. ASTM C150/C150M Type II or Type V; inclusion of supplementary cementitious materials in design mix is optional.
 - b. ASTM C150/C150M types other than Type II or Type V in accordance with the following:
 - 1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
 - c. ASTM C595/C595M Types excluding Type IS (greater than 70), conforming to ASTM C595/C595M and having (MS) designation.
 - d. ASTM C1157/C1157M having (MS) designation.
 7. Limit water-soluble, chloride ion content in hardened concrete, percent by mass of cementitious materials 0.15.
 - a. Limits are stated in terms of water-soluble chloride ions (Cl⁻) in percent by mass of cementitious materials.
- D. Refer to PART 1 through PART 3 of this section for additional requirements.

SECTION 03 39 00 - CONCRETE CURING

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes curing of curbs, slabs-on-grade, pavement, sidewalks, ramps, retaining wall, foundations and miscellaneous structures.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Concrete Institute (ACI): 308.1, Specification for Curing Concrete.
 - 2. ASTM International (ASTM):
 - a. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - b. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Manufacturers' data indicating compliance with the requirements specified herein for the following products:
 - a. Evaporation retardant.
 - b. Curing compound.
- B. Informational Submittals:
 - 1. Manufacturer's Certificate of Compliance for the following:
 - a. Curing compound showing moisture retention requirements.
 - b. Retardants for exposed aggregate finish.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Curing Compound:
 - 1. Water-based, high-solids content, nonyellowing, curing compound meeting requirements of ASTM C1315, Type I, Class A.
- B. Evaporation Retardant:
 - 1. Optional: Fluorescent fugitive dye color tint that disappears completely upon drying.

2. Physical Characteristics: None.
3. Functional Characteristics: None.
4. Performance Characteristics: Reduces surface moisture evaporation from freshly placed concrete.

C. Water: Clean and potable, containing less than 500 ppm of chlorides.

PART 3 EXECUTION

3.1 CONCRETE CURING

A. General:

1. Immediately after the final floating, surface finishing, and edging has been completed, and while Portland cement concrete surface is still moist, cover and cure entire exposed surface in accordance with one of the methods specified below.
2. Concrete shall be cured by use of curing compound, for minimum of 7 days after concrete placement, in accordance with project specifications and ACI 308. Curing compounds shall be applied in accordance with manufacturer's written instructions.
3. Exposed surfaces shall be sprayed with curing compound immediately after free surface water has disappeared from finished surface.
4. Concrete temperature shall be maintained in accordance with ACI 306R.
5. Curing compounds shall not come in contact with hardened concrete that is to be concreted against.
6. Where surfaces are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures as described below or special methods using moisture shall be agreed upon by CO prior to placing concrete.
7. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified below, by 7 additional days.

B. Use one of the following methods as approved by CO:

1. Method 1: Protect surface by water ponding for 7 days.
2. Method 2: Cover with burlap or cotton mats and keep continuously wet for 7 days.
3. Method 5: Apply curing compound, where allowed, immediately after final finishing when surface will no longer be damaged by traffic.

3.2 EVAPORATION RETARDANT APPLICATION

- A. Use on flatwork when environmental conditions are anticipated to cause rapid drying of the concrete surface. Do not use evaporation retardant on potable water structures, unless product is NSF 61 approved.
- B. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture.
- C. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

END OF SECTION 03 39 00

SECTION 03 63 00 - CONCRETE DOWELING

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes doweling in concrete curbs, slabs-on-grade, pavement, sidewalks, ramps, and miscellaneous structures.

1.2 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
 - 1. American National Standards Institute (ANSI).
 - 2. ASTM International (ASTM):
 - a. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - b. E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Manufacturer's catalog information.
- B. Informational Submittals:
 - 1. Manufacturer's instructions for preparation, placement, drilling of holes, installation of anchors and adhesive, and handling of cartridges, nozzles, and equipment.
 - 2. Manufacturer's written letter of certification identifying installer's qualifications to install products.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: At least three similar projects with same products within last 3 years.
 - 2. Installer: Trained and certified by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Container Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
- B. Store adhesive components in accordance with manufacturer's written instructions.
- C. Dispose of when:

1. Shelf life has expired.
2. Stored other than per manufacturer's instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Adhesive:

1. Physical Characteristics:
 - a. Disposable, Self-Contained Cartridge System:
 - 1) Capable of dispensing both components in proper mixing ratio.
 - 2) Fit into manually or pneumatically operated caulking gun.
2. Functional Characteristics: None.
3. Performance Characteristics:
 - a. Meet requirements of ASTM C881/C881M.
 - b. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.

B. Reinforcing Dowels:

1. Smooth Epoxy-Coated Expansion Joint Dowels: As specified in Section 03 15 00 - Concrete Joints and Accessories.

PART 3 EXECUTION

3.1 INSTALLATION

A. Drilling Equipment:

1. Drilling Hammers for Dowel Holes:
 - a. Electric or pneumatic rotary type with medium or light impact.
 - b. Hollow drills with flushing air systems are preferred.
2. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

B. Hole Diameter: Use drill bit diameter as recommended by manufacturer.

C. Obstructions in Drill Path: When existing steel reinforcement is encountered during drilling, obtain CO approval for proposed fix.

D. Doweling:

1. Install per details shown on Drawings and in accordance with adhesive manufacturer's instructions.
2. When using epoxy anchors, dowels may be pre-bent prior to installation to 15 degrees to align with other bars. Do not heat dowels to bend.
3. Bent Bar Dowels: Where edge distances are critical and intersection with steel reinforcement or other obstruction is likely, slant drill to address edge distance or to clear obstruction. If drill must be slanted more than indicated in the manufacturer's installation instructions to clear obstruction, notify CO for direction on how to proceed.
4. If bars have fused epoxy coating and coating is damaged, recoat damaged area with epoxy.

E. Adhesive:

1. Install in accordance with written manufacturer's instructions.
2. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places mixed adhesive at base of predrilled hole.

3.2 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

- A. Contractor-Furnished Quality Control: Inspection shall be in accordance with ACI 301.

END OF SECTION 03 63 00

SECTION 04 43 00 – STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Stone panels set in mortar with individual anchors as required by installer.
 - 2. Stone will be furnished by the NPS for installation by the Contractor.

1.3 DEFINITIONS

- A. Definitions contained in ASTM C119 apply to this Section.
- B. IBC: International Building Code.

1.4 ACTION SUBMITTALS

- A. Samples for Initial Selection: For joint materials involving color selection
- B. Colored Pointing Mortar Samples for Verification: For each color required. Make samples using same sand and mortar ingredients to be used on Project.
- C. Sealant Samples for Verification: For each type of color of joint sealant required.

1.5 FIELD CONDITIONS

- A. Protect stone cladding during erection by doing the following:
 - 1. Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
 - 2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
 - 3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 - 4. Protect sills, ledges, and projections from mortar and sealant droppings.

- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
- C. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
- D. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F or when joint substrates are wet.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
 - 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
 - 2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
- B. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.7 COORDINATION

- A. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by stone cladding Installer for anchoring, supporting, and flashing of stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.
- B. Time delivery and installation of stone cladding to avoid extended on-site storage and to coordinate with work adjacent to stone cladding.

PART 2 - PRODUCTS

2.1 OTHER STONE

- A. Source Limitations for Stone: NPS will provide stone to Contractor for installation.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
- C. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from single manufacturer for each product.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction, color as required to produce mortar color to match existing.
- B. Hydrated Lime: ASTM C 207.
- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Pigments shall have a record of satisfactory performance in mortar.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime.
- E. Aggregate: ASTM C 144; except for joints narrower than 1/4 inch and pointing mortar, 100 percent shall pass No. 16 sieve.
 - 1. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color to match existing.
- F. Water: Potable

2.3 MORTAR MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
 - 1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride.
 - 2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Discard mortar when it has reached initial set.
- B. Portland Cement-Lime Setting Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
 - 1. Set stone with Type N mortar, unless otherwise recommended by installer.
- C. Pointing Mortar: Comply with ASTM C270, Proportion Specification for types of mortar indicated. Provide pointing mortar mixed to match Contracting Officer approved sample and complying with the following:

1. Point stone with Type N mortar, unless otherwise recommended by installer.

2.4 ANCHORS AND FASTENERS

- A. Provide anchors and fasteners as recommended by installer.
 1. Fabricate anchors from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 316; temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A 276, Type 316.

2.5 STONE ACCESSORIES

- A. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.
- B. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive stone cladding and conditions under which stone cladding will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone cladding.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone cladding.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BACKUP STRUCTURE

- A. Installing Steel: Comply with AISC 303 and install to accommodate construction tolerances specified.
 1. Maintain erection of backup structure within tolerances in AISC 303.
 2. Clean welds, bolted connections, and abraded areas immediately after erection.
 - a. Repair galvanizing to comply with ASTM A780/A780M.
 - b. Apply paint to exposed areas using same material as used for shop painting.

3.3 INSTALLATION OF STONE, GENERAL

- A. Before setting stone, clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- B. Execute stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.
- C. Arrange stone in Informal Range Masonry Pattern, with color and size variations uniformly dispersed for an evenly blended appearance.
- D. Set stone to comply with requirements indicated on drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone cladding in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- E. Provide sealant joints of widths and at locations indicated.
 - 1. Sealing expansion and other joints is specified in Section 07 92 00 "Joint Sealants."
 - 2. Keep sealant joints free of mortar and other rigid materials.
- F. Install concealed flashing at shelf angles, lintels, ledges, and similar obstructions to downward flow of water, and where indicated.

3.4 STONE WITH MORTAR

- A. Set stone with mortar and mechanical anchors as recommended by installer.
- B. Set stone in full bed of mortar with head joints filled unless otherwise indicated.
 - 1. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
 - 2. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
 - 3. Support and brace projecting stones until wall above is in place and mortar has set.
 - 4. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
- C. Fill space between back of stone units and backup wall solidly with mortar or grout.
- D. Rake out joints for pointing with mortar to depths of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

- E. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than 3/8 inch until a uniform depth is formed.
- F. Point stone joints by placing pointing mortar in layers not more than 3/8 inch. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
- G. Tool joints with a round jointer having a diameter 1/8 inch larger than width of joint, when pointing mortar is thumbprint hard.
- H. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

3.5 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where cement-paste bond coat mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Smooth, flat face slightly below edges of stone.

3.6 INSTALLATION OF JOINT-SEALANTS

- A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.7 INSTALLATION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, corners and jambs within 20 feet of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch in 40 feet or more.
- B. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
- C. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 inch.

- E. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/8 inch or a quarter of nominal joint width, whichever is less. For joints within 60 inches of each other, do not vary more than 1/8 inch or a quarter of nominal joint width, whichever is less from one to the other.
- F. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units.

3.8 ADJUSTING AND CLEANING

- A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and stone cladding that does not match approved samples. Damaged stone may be repaired if Contracting Officer approves methods and results.
- B. Replace damaged or defective work in a manner that results in stone cladding's matching approved samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone cladding as work progresses. Remove mortar fins and smears before tooling joints. Remove excess sealant and smears as sealant is installed.
- D. Final Cleaning: Clean stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 04 43 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes metal handrails, bike racks and gray cast iron accessible detectable tactile warning surface panels cast-in-place at sidewalk ramps and other crossing locations.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:

1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
2. American Galvanizers Association (AGA):
 - a. Inspection of Hot-Dip Galvanized Steel Products.
 - b. Quality Assurance Manual.
3. American Iron and Steel Institute (AISI): Stainless Steel Types.
4. American National Standards Institute (ANSI).
5. American Welding Society (AWS):
 - a. D1.1/D1.1M, Structural Welding Code - Steel.
 - b. D1.2/D1.2M, Structural Welding Code - Aluminum.
6. ASTM International (ASTM):
 - a. A36/A36M, Standard Specification for Carbon Structural Steel.
 - b. A48/A48M, Specification for Gray Iron Castings.
 - c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - e. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - f. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - g. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - h. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - i. A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
 - j. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
 - k. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - l. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

- m. A563, Standard Specification for Carbon and Alloy Steel Nuts.
- n. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- o. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- p. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- q. A992/A992M, Standard Specification for Structural Steel Shapes.
- r. A1085, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
- s. F436, Standard Specification for Hardened Steel Washers.
- t. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- u. F594, Standard Specification for Stainless Steel Nuts.
- v. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

1.3 DEFINITIONS

- A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.
- B. Exterior Area: Location not protected from weather by building or other enclosed structure.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings: Provide for all metal fabrications, including welding and fastener information.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Insofar as practical, factory assemble specified items. Package assemblies, which have to be shipped unassembled to protect materials from damage and tag to facilitate identification and field assembly.
- B. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling.
- C. Store fabricated items in dry area, not in direct contact with ground.

PART 2 PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Other Steel Shapes and Plates	A36/A36M or A572/A572M, Grade 50 or A992/A992M for other steel shapes
Steel Pipe	A500, Grade B
Stainless Steel:	
Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs	F593, AISI Type 316, Group 2, Condition SH
Nuts	F594, AISI Type 316, Condition CW
Steel Bolts and Nuts:	
Carbon Steel	A307 bolts, with A563 nuts
High-Strength	A325, Type 1 bolts, with A563 nuts
Anchor Bolts and Rods	F1554, Grade A: 36, with weldability supplement S1.
Eyebolts	A489
Flat Washers (Unhardened)	F844
Flat and Beveled Washers (Hardened)	F436
Welded Anchor Studs	A108, Grades C-1010 through C-1020
Cast Iron	A48/A48M, Class 35
Weathering Steel	ASTM A588

B. Bolts, Washers, and Nuts: Use hot-dip galvanized steel except as noted on the plans.

2.2 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on Drawings.
2. Material type and protective coating use hot-dip galvanized steel except as noted on the Drawings.

2.3 FABRICATED UNITS

A. Bike Racks

1. Install prefabricated bike racks as shown on the Drawings.
2. Racks shall be fabricated from 2 3/8-inch stainless steel.
3. Racks shall be galvanized and permanently affixed in concrete with minimum compression strength of 4,000 psi.

B. Handrail at Northbound Shuttle Stop

1. Posts and rails shall be 1.9 inch outside diameter, high strength heavy industrial steel pipe conforming to ASTM F1043 as shown on the Drawings.
2. The entirety of the railing shall be weathering steel conforming to ASTM A588.
3. Vertical posts shall be evenly spaced.
4. All sharp edges shall be removed.
5. Construct and install the handrails as shown on the Drawings.

C. Handrail at Southbound Shuttle Stop Retaining Wall

1. Posts, rails and vertical slats as shown on the Drawings.
2. The entirety of the railing shall be weathering steel conforming to ASTM A588.
3. Vertical posts shall be evenly spaced with a maximum spacing as shown on the Drawings.
4. All sharp edges shall be removed.
5. Construct and install the handrails as shown on the Drawings.

2.4 CASTINGS

A. Detectable Warning Panels

1. Gray cast iron detectable/tactile warning, 24 inch depth with varying width as shown on the Drawings, designed to be cast-in-place in concrete sidewalks and other walking surfaces
2. Comply with Americans with Disabilities Act Title III Regulations 28 CFR Part 36 ADA Standards for Accessible Design Detectable Warnings on Walking Surfaces
3. Cast iron in accordance with ASTM A 48M, Class 35B

2.5 FABRICATION

A. General:

1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 percent and 0.25 percent.

C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
4. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
5. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer's instructions.

6. Complete welding before applying finish.

D. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653/A653M.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

E. Electrolytic Protection: Coat surfaces of galvanized steel fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals.

F. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

G. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.6 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct deficiencies.

1. Steel: AWS D1.1/D1.1M, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
2. Stainless Steel: AWS D1.6/D1.6M.

PART 3 EXECUTION

3.1 INSTALLATION OF METAL FABRICATIONS

A. General:

1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufactured products in accordance with manufacturer's recommendations.

3.2 CAST-IN-PLACE ANCHOR BOLTS

- A. Locate and hold anchor bolts in place with templates at time concrete is placed.
- B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.
- C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.3 ELECTROLYTIC PROTECTION

A. Galvanized Steel:

- 1. Coat surfaces of galvanized steel fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals.
- 2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
- 3. Allow coating to dry before installation of the material.
- 4. Protect coated surfaces during installation.
- 5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

END OF SECTION 05 50 00

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Applications:
 - 1. Architectural Work: Applications for carpentry work requiring a greater degree of precision, less warp, less bow, fewer knots and other defects which may affect finish tolerances and other performance of the Work.
- B. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- C. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.
- D. Nailers: Wood pieces attached to a surface, used as a base for fastening another material.
- E. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. For Wood-Preservative Treated Materials:

- a. Include data from chemical treatment manufacturer. Indicate type of preservative used and net amount of preservative retained.
 - b. For materials receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- 2. For Fire-Retardant Treated Materials:
 - a. Include data from chemical treatment manufacturer. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - b. Include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - c. For materials receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to CO that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Named Wood Species: Lumber species named in this Section may be known by other names (e.g. Idaho white pine may also be known as Western white pine or White pine). Provide named species or same species as known by another name that can be verified in an authoritative reference such as "The Encyclopedia of Wood", Sterling Publishing Co., Inc.
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

- a. If acceptable with Authorities having Jurisdiction, markings may be omitted if certificates of grade compliance issued by grading agency are submitted.
- 3. Dress lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber:
 - 1. 15 percent for 2 inch nominal thickness or less, 19 percent for more than 2 inch nominal thickness.
- 2.2 WOOD-PRESERVATIVE-TREATED (WPT) MATERIALS
 - A. Preservative Treatment by Pressure Process:
 - 1. AWPAC Use Category:
 - a. UC3B - Above Ground Exposed: For exterior construction above and not in contact with ground, uncoated or poor water run-off service conditions.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - a. Do not use inorganic boron (SBX) for sill plates.
 - 3. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 - B. Lumber: Kiln-dry after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
 - C. Plywood: Kiln-dry after treatment to a maximum moisture content of 15 percent.
 - D. Mark lumber and plywood with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber and plywood indicated to receive a stained or natural finish, mark end or back of each piece.
 - a. If acceptable with CO, markings may be omitted if certificates of treatment compliance issued by inspection agency are submitted.
 - E. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood nailers: Where connecting with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED (FRT) MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to CO, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Lumber: Kiln-dry after treatment to a maximum moisture content of 19 percent.
- D. Plywood: Kiln-dry after treatment to a maximum moisture content of 15 percent.
- E. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber or plywood indicated to receive a stained or natural finish, mark end or back of each piece.
 - a. If acceptable with CO, markings may be omitted if certificates of treatment compliance issued by inspection agency are submitted.
- F. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Mixed southern pine; SPIB.
2. Western woods; WCLIB or WWPA.
3. Northern species; NLGA.
4. Eastern softwoods; NeLMA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, ASTM C 954, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following roofing systems:
 - 1. Standing-Seam Metal Roofing
 - 2. All trim integral with roofing, including the following:
 - a. Fascia
 - b. Eave
 - c. Peak
 - d. Rake
 - 3. Waterproofing Underlayment, sacrificial felts and slip sheet.
 - 4. Roofing Accessories, including closures, clips, and backing plates.
 - 5. Installers Warranty Form
- B. Products Installed But Not Supplied Under This Section: Wood blocking and nailers specified in Division 6 Section "Miscellaneous Rough Carpentry".
- C. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for field-applied sheet metal roofing sealants.
- D. Products Installed But Not Supplied Under This Section:
 - 1. Wood sheathing (exterior application) and decking (interior application) are specified in Division 06 Section "Miscellaneous Rough Carpentry."

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide complete sheet metal roofing system, including, but not limited to, on-site, roll-formed metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.
- B. Wind-Uplift Resistance: Provide portable roll-forming equipment capable of producing sheet metal roofing assemblies that comply with UL 580 for Class 90 wind-uplift resistance.

1. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.
- C. Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal roofing that does not allow water infiltration, with metal flashing and connections of sheet metal roofing lapped to allow moisture to run over and off the material.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 1. Include similar samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Loose Parts
 - c. Wrinkling or Buckling
 - d. Failure to remain weathertight, including uncontrolled water leakage.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
 - f. Galvanic action between sheet metal roofing and dissimilar materials.
2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.
- B. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 32 or initial SRI not less than 39 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
 - 2. Wind Rating: 115.
- D. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A-120.
 - 2. Hail Resistance: SH.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
 2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced 6" between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
1. Subject to compliance with requirements, provide product to match existing.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch.
 - b. Exterior Finish: Three-coat fluoropolymer.
 - c. Color: As selected by Contracting Officer to match existing.
 3. Clips: to accommodate thermal movement.
 - a. Material: thick, stainless-steel sheet.
 4. Panel Coverage: 6 inches.
 5. Panel Height: 1.5 inches.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing, cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 2. Low Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Steel Panels and Accessories:
1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

- a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
 - 2. Apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of 24 inches.
 - b. Rake edges for a distance of 18 inches.
 - c. Hips and ridges for a distance on each side of 12 inches.
- B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.
 - 1. Apply over the entire roof surface.
 - 2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches, in shingle fashion to shed water.
- C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- D. Flashings: Install flashings to cover underlayment.

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 3. Stainless-Steel Panels: Use stainless-steel fasteners.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 ROOFING INSTALLER'S WARRANTY (See next page.)

ROOFING INSTALLER'S WARRANTY

- A. WHEREAS (Insert name) _____ of (Insert address) _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: _____
 2. Address: _____
 3. Building Name/Type: _____
 4. Address: _____
 5. Area of Work: _____
 6. Acceptance Date: _____
 7. Warranty Period: _____
 8. Expiration Date: _____
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 85 mph;
 - c. Fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages
Roofing

Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of (month and year) _____, 20____.

1. Authorized Signature: _____
2. Name: _____
3. Title: _____

END OF SECTION 07 41 13.16

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. The following joint sealant compositions:

- a. Silicone joint sealants.
- b. Nonstaining silicone joint sealants.
- c. Urethane joint sealants.
- d. Silyl-terminated polyether joint sealants.
- e. Butyl joint sealants.
- f. Latex joint sealants.

- 2. Joint sealant backings:

- a. Cylindrical backings.
- b. Bond-breaker tape.

- 3. Miscellaneous materials including:

- a. Primers.
- b. Cleaners.
- c. Masking tape.

- B. Joint Sealant Schedule: Select joint sealant compositions from the following application schedules for each severity of use, substrate, and joint type. Where more than one sealant composition is listed, select the one best suited for the conditions indicated or encountered.

- 1. Exterior joints in horizontal traffic surfaces (not subject to water immersion):

- a. Cast-in-place concrete slabs:

- 1) Contraction control joints
- 2) Expansion joints
- 3) Isolation joints

- b. Joints between different materials listed above:

- 1) Joints not subject to expansion: Sealant selected for use on materials listed above; except where urethane sealant is only option for one of the materials use only urethane sealant.
 - 2) Expansion joints: Expansion joint sealant selected for use on materials listed above; except where urethane sealant is only option for one of the materials use only urethane sealant.
2. Exterior joints in vertical surfaces and horizontal nontraffic surfaces (not subject to water immersion), including ceilings, soffits and other overhead surfaces.
- a. Stone Masonry:
 - 1) Joints between stone units (not expansion joints).
 - b. Metal panels:
 - 1) Joints between panels (not expansion joints): Do not use silicone sealant at joints receiving field applied paint coatings.
 - c. Between different materials listed above:
 - 1) Joints (not expansion joints): Sealant selected for use on materials listed above, except as follows:
 - a) Do not use silicone sealant at joints receiving field applied paint coatings.
 - b) If only nonstaining sealant is prescribed for a material, then use only nonstaining sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by CO.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify CO seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by CO from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- C. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- D. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
- E. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

- B. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
- C. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
- D. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

2.5 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- B. STPE, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 100, Uses T and NT.
- C. STPE, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.

2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance, and type indicated below except where approved otherwise in writing by joint-sealant manufacturer for joint application indicated:

1. Location, Exterior:

a. Exposure, Wet:

1) Position, Vertical:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

2) Position, Horizontal:

- a) Type C (closed cell material with a surface skin).
- b) Type B (bicellular material with a surface skin).

b. Exposure, Dry:

- 1) Position, Vertical: Type B (bicellular material with a surface skin).
- 2) Position, Horizontal: Type B (bicellular material with a surface skin).

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry, including brick and stone.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates.
 - 1. Steel and iron.
 - 2. Galvanized metal.
- B. See EXTERIOR PAINTING SCHEDULE at end of Section.
- C. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.

1.2 DEFINITIONS

- A. MPI Gloss Levels:
 - 1. Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
 - 2. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
 - 3. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
 - 4. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
 - 5. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
 - 6. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products (As Scheduled): Subject to compliance with requirements provide products listed in the Exterior Painting Schedule at end of this Section. Products are listed (with some exceptions) by MPI number and shall be selected from the "MPI Approved Products Lists" (see www.paintinfo.com/mpi/approved/Manufactory_index.shtml). Equivalent products not included in the "MPI Approved Products Lists" shall be submitted as substitution requests.

2.2 PAINT, GENERAL

- A. MPI Standards: Unless indicated otherwise, products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists," except if approved by a substitution request.
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

- C. VOC Content, General: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction.
- D. Colors: Match Existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Bare Steel Substrates: Remove rust, loose mill scale, and residual coatings if any. Clean using methods recommended in writing by paint manufacturer but not less than SSPC-SP 7/NACE No. 4, Brush-Off Blast Cleaning or SSPC-SP 11, Power Tool Cleaning to Bare Metal.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 (Shop, Field, and Maintenance Painting of Steel) for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Contractor shall engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by CO, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates.

1. Water-Based Light Industrial Coating System MPI EXT 5.1B/C/M/N/R:

a. Prime Coat: One of following:

- 1) Primer, zinc rich, inorganic, MPI #19 for 5.1B.
- 2) Primer, alkyd, anti-corrosive for metal, MPI #79 for 5.1C.
- 3) Primer, epoxy, water based, anti-corrosive, for metal, MPI #301 for 5.1M.
- 4) Primer, epoxy, anti-corrosive MPI #101 for 5.1N & 5.1R.
- 5) Shop primer specified in Section where substrate is specified.

b. Intermediate Coat:

- 1) For 5.1B: Light industrial coating, exterior, water based, matching topcoat. Apply where Premium Grade system is indicated.
- 2) For 5.1C/M/N: Light industrial coating, exterior, water based, matching topcoat. Application required.
- 3) For 5.1R: Epoxy, high build, low gloss MPI #108. Application required.

c. Topcoat: One of following matching gloss level indicated.

- 1) Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
- 2) Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.
- 3) Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

B. Galvanized-Metal Substrates.

1. Water-Based Light Industrial Coating System MPI EXT 5.3G/J/K:

a. Prime Coat: One of following:

- 1) Primer, galvanized, cementitious, MPI #26 for 5.3G.
 - 2) Primer, galvanized, water based, MPI #134 for 5.3J.
 - 3) Primer, epoxy, anti-corrosive, MPI #101 for 5.3K.
 - 4) Shop primer specified in Section where substrate is specified.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat. Apply where Premium Grade system is indicated.
- c. Topcoat: One of following matching gloss level indicated.
- 1) Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - 2) Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.
 - 3) Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

END OF SECTION 09 91 13

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
 - 1. Underside of Wood Roof Decking.
 - 2. Exposed Wood

1.3 DEFINITIONS

- A. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of product.
- C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities of jurisdiction and, for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base.
 - 1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 2. Stains: VOC not more than 250 g/L.
- D. Stain Colors: Match Existing, FLD822 Deep Base – Mahogany.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces exposed to view and dust off.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by CO, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION 09 93 00

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes ground mounted roadside traffic signs, including supports, foundations, and panels. Signposts for MUTCD signs shall be steel breakaway posts.
- B. This work includes the installation of flexible delineators.
- C. This work includes mounting salvaged park informational and wayfinding signage, bus loading signs, and installing wood posts and foundations.
- D. This work includes temporary traffic control signs.

1.2 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 2. U.S. Department of Transportation, Federal Highway Administration: Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Drawings showing layouts, actual letter sizes and styles, and Project-specific mounting details.
 - b. Manufacturer's literature showing letter sizes and styles, sign materials, and standard mounting details.
 - 2. Color samples for posts and back of signs.
- B. Informational Submittals:
 - 1. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 SIGN TYPES

- A. Traffic Sign:

1. Aluminum reflectorized signs, standard design meeting requirements of MUTCD.
- B. Salvaged Park Informational Sign:
 1. Aluminum signs for transit bus stops salvaged or provided by the Park for damaged signs as directed by the CO.
- C. Delineators - Flexible Post Testing
 1. Meet Cold Bend Test
 - a. Subject two posts to a temperature of -10°F , $\pm 5^{\circ}\text{F}$ for at least four hours.
 - b. Immediately bend each post four times through a 90-degree angle around a 2-inch mandrel.
 - c. Each post must return to its original straight configuration within a ± 10 -degree angle within five minutes at the end of the four bends.
 - d. Any cracking or significant loss of rigidity are grounds for failure.
 2. Meet Hot Bend Test
 - a. Subject two posts to a temperature of $100^{\circ}\text{F} \pm 5^{\circ}\text{F}$ for at least four hours.
 - b. Satisfy all bending and physical requirements specified in the Cold Bend Test.
 3. Meet Impact Resistance Test
 - a. Subject post to impacts by a typical sedan as follows:
 - 1) Three hits - 0-degree angle at 0°F .
 - 2) Three hits - 0-degree angle at 100°F .
 - 3) Ten hits - 0-degree angle at 35 mph.
 - 4) Five hits - 15-degree angle at 55 mph
 - b. Acceptable Results
 - 1) Installed post remain intact, securely anchored, and within ± 10 -degrees of vertical orientation.
 - 2) Installed post shows minimal signs of cracking or loss of rigidity.
 - 3) Installed post retains at least 50 percent of its reflective sheeting.
 - 4) Impact vehicle suffers little or no damage during the impact test.
 4. Exposure
 - a. Expose the specimens for 500 hours in a carbon arc-type apparatus according to ASTM G 23, Method 1.
 - b. Acceptable results:
 - 1) Exposure does not result in delamination, distress, or discoloration.
 - 2) Sheeting is not removable from the specimens without damage.
 - 3) Post is resistant to ultraviolet light, ozone, hydrocarbons, and other weathering.

2.2 MATERIALS

- A. Fabricate according to the details in the Drawings.
- B. Substrate Aluminum – 0.080 or 0.125 inch thick as follows. Refer to ASTM B 209 alloy 6061-T6, or 5052-H38.
 - 1. Use 0.125 for signs installed on frame.
 - 2. Use 0.080 for all other signs.
- C. Plywood Backing – According to APA product standard PS 1-83, Group One: ½ inch thick.
 - 1. 30/30, high density BB exterior (Douglas Fir) B Grade.
 - 2. Plugged-core (Douglas Fir) with ½ inch maximum gaps
 - 3. Use lumber that is certified wood with certifications through Forest Stewardship Council (FSC) or Sustainable Forestry Initiative (SFI).
- D. Bases – According to the breakaway details in the Drawings. Design and installation requirements for breakaway posts and connections are identified in the Drawings.
- E. Posts, “T” and “U” brackets, extensions, and hardware according to details in the Drawings.
 - 1. Metal Posts
 - a. Refer to ASTM A53
 - b. Galvanize according to ASTM A 653 or ASTM A 123
 - 2. “T” and “U” Extension and 90-degree Post Extension
 - a. Galvanize according to ASTM A 653 or ASTM A 123
 - 3. S Section and W Section steel posts
 - a. Structural Steel: Refer to details in the Drawings.
 - 4. Wood Posts: Preservative treated
 - a. Fir or pine, cut from sound timber with no loose or unsound knots.
- F. Retroreflective and non-reflective sheeting
 - 1. Sheeting – The retroreflective or non-reflective material that comprises the background, legend (word messages and symbols), and border.
 - a. Conform to ASTM D 4956, including supplementary requirements.
 - b. Components – The matched component products required for the manufacture of highway signs consist of the sheeting, cutout letters and borders, adhesives, inks, and overlay films.

- 1) Failure of the sheeting inks or overlay films, provided, sold, or recommended for use, constitute a failure of the entire sign and replacement under manufacturer's warranty replacement obligations.
 - 2) All components and warranties will be compatible with substrates used by the Park, including Aluminum ASTM B 209 5052 - H 38 or 6061-T6.
 - 3) Use only acrylic EC film to achieve color. Do not use vinyl EC film to achieve color.
- c. Permanent Signs – Include sign installations that are in their final configuration and that are expected to have a multi-year life. Examples include regulatory signs, warning signs, barrier markers, crash cushion markers, and delineation.
- d. Work Zone Standard Signs – MUTCD standard application signs including but not limited to Road Work Ahead, Work Zone Speed Limit, Flagger Symbols, Business Access, and Regulatory signing within the work zone.
- 1) Standard signs a. Meet or exceed the minimum requirements of ASTM Type XI.
 - 2) Use fluorescent retroreflective sheeting for orange, yellow, and yellow-green.
- e. Work Zone Project Specific Signs – Signs that have legends specific to the project and that cannot be reused on a future project. Examples include: “Alder Street closed from 1st to 2nd Avenue – use Birch Street” or project notification signs. These are typically used for only one construction season.
- 1) Meet or exceed the minimum requirements of ASTM Type III high intensity prismatic sheeting.
 - 2) Use fluorescent retroreflective sheeting for orange, yellow, and yellow-green.
- f. Flexible Work Zone Devices – Include such devices as roll up signs, cones, tall cones, and flags with retroreflective sheeting.
- 1) Use ASTM Type VI with minimum Coefficient of Retroreflection as shown in Table 2-1.

Table 2-1

Coefficient of Retroreflection (Candelas/Lux/Square Meter)						
Observation Angle	Entrance Angle	White	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent Pink
0.2°	- 4°	500	400	300	200	180
0.2°	+ 30°	200	160	120	80	72
0.5°	- 4°	225	180	135	90	80
0.5°	+ 30°	85	68	51	34	30
1.0°	- 4°	50	40	30	20	18
1.0°	+ 30°	20	16	12	8	7

- g. Work Zone Channelization Devices – Include such devices as drums, vertical panels, barricades, tubular markers, and pavement marking tabs.

- 1) Vertical panels, barricade Types I, II, and III, and directional indicator barricades.
 - a) Meet or exceed the minimum requirements of ASTM Type XI.
 - b) Use of standard orange acceptable.
- 2) Meet or exceed the minimum requirements of ASTM Type IV with the minimum requirements of the Coefficient of Retroreflection as shown in Table 2-2 and the minimum requirements of the Color Specification Limits (daytime) of Table 2-3 for all other channelization devices.

Table 2-2

Coefficient of Retroreflection (Candelas/Lux/Square Meter)			
Observation Angle	Entrance Angle	White	Fluorescent Orange
0.2°	- 4°	500	200
0.2°	+ 30°	200	80
0.5°	- 4°	225	90
0.5°	+ 30°	85	34
1.0°	- 4°	50	20
1.0°	+ 30°	20	8

Table 2-3

Color Specification Limits (daytime)										
Color	Chromaticity Coordinates								Luminance Factor (Y%)	
	1		2		3		4			
	x	y	x	y	x	y	x	y	Min	Max
White	0.303	0.306	0.368	.0366	0.340	0.393	0.274	0.329	27	--
Fluorescent Orange	0.645	0.355	0.562	0.348	0.506	0.404	0.570	0.429	20	

- 3) Use fluorescent retroreflective sheeting for orange and yellow.
- 4) Do not obscure retroreflective sheeting with paint or other materials.

G. Fasteners for ground mounted signs – Refer to applicable details in the drawings.

H. Foundation for ground mounted signs – Refer to applicable details in the drawings.

1. Concrete –Use a commercially available product that exceeds 4,000 psi or a concrete mix meeting Section 03 30 00 - Cast-in-Place Concrete.
2. Reinforcing steel – Refer Specification 03 21 00 - Steel Reinforcement.
3. Anchor bolts – Refer to the details in the drawings.

I. Flexible Delineator Posts

1. Free of burns, discoloration, contamination, and other defects.
2. Remains flexible at temperatures from – 5° F to + 140°F.
3. Capable of being driven into an earth shoulder with or without a pilot hole.
4. Tensile strength of 1,100 psi. Refer to ASTM D 638.

J. Signs and Plaques

1. All sign assemblies shall use provided anti-vandal fasteners and tools to mount components to sign, and sign to fixture.
2. Crossing signs shall be W11-2, S1-1 or W11-15 per MUTCD
3. Crossing plaques W16-7P shall also accompany the crossing signs.
4. STOP signs shall be R1-1 per MUTCD.
5. Pedestrian pushbutton instruction signs shall be furnished, at a minimum size of 5" x 7", to be mounted adjacent to or integral with each pedestrian pushbutton.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. In accordance with manufacturer's recommendations.
- B. Mount securely, plumb, and level.

3.2 SIGNS

- A. Do not reverse screen sign panels larger than 7 ft in any dimension.
- B. Do not remove a sign that is being replaced until the new sign is placed and uncovered if the road is open to traffic during construction.
- C. Establish proper elevation and orientation of all signs and structures and determine proper signpost lengths as dictated by construction slopes. Install facing traffic at locations and in manner shown in MUTCD.
- D. Cover signs that require temporary covering with an opaque material. Secure at the rear of the sign so that the sign is not damaged.
 - 1. Maintain covering until covering or sign is removed.
- E. Construct signpost foundations for metal posts with concrete according to dimensions in the Drawings.
- F. Install backfill material around wood signposts according to dimensions in the Drawings.
- G. Compact backfill to a density equal to surrounding materials.
- H. Paint all exposed steel on signposts with a mat finish exterior rated paint for metal surfaces to match existing on-site brown paint, PPG color equivalent PPG1060-7 Warm Mahogany. Submit color sample to CO for approval prior to painting the posts. Paint the backs of all signs with the same brown paint color. Submit color sample to CO for approval prior to painting the signs.
- I. Affix to each sign a 2-inch x 2-inch impermeable, non-fading weather-resistant, self-adhesive label.
 - 1. Label includes the month and year of manufacture, Contractor's name, and type of sheeting. Attach label where it will not obscure sheeting.

END OF SECTION 10 14 00

SECTION 26 41 13 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide a complete lightning protection system. The system shall comply with the specifications and standards of the following:
 - 1. Underwriters Laboratories Inc., Subject 96A, Ninth Edition.
 - 2. Lightning Protection Institute, LPI 175.
 - 3. National Fire Protection Association, NFPA 780.

1.2 QUALIFICATIONS

- A. The installation shall be accomplished by an experienced installer who shall apply for and deliver to the Owner a Lightning Protection Institute system certification, showing that the system complies with all LPI, UL, and NFPA codes. If the system or its components do not comply with these specifications, such items shall be replaced at no additional cost to the Owner. All work shall be done under the complete supervision of a Certified Master Installer furnished by the equipment manufacturer. This Master Installer shall be locally available at all times during the installation of the lightning protection system. It shall be the responsibility of this Master Installer to supervise all unit locations and connections and he shall completely check the system after completion for strict conformance with UL, NFPA, and LPI code requirements.

1.3 QUALITY CONTROL

- A. The lightning protection system shall be UL Master Labeled.

1.4 MANUFACTURERS

- A. Manufacturers shall be accredited firms listed as a manufacturer of lightning protection systems by Underwriters Laboratories, Inc., and the Lightning Protection Institute, in their latest edition of "Electrical Equipment List."

1.5 SUBMITTALS

- A. Product Data for all materials associated with Lightning Protection System.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall be listed by Underwriters Laboratories Inc., with UL Label “A” affixed to main and secondary cables every 10 feet and UL Label “B” applied to each air terminal point.
- B. The system shall consist of air terminals, interconnecting conductors, down conductors with their groundings and bonding of extended metal objects designed to appear as a part of the building. Conductor runs shall be concealed within the column, wall, and roof construction where possible and practical. Exposed roof circuits cables shall be placed so as to require a minimum of displacement for future repair and maintenance of roofing.
- C. System components shall be of copper complying with the codes of UL, NFPA, and LPI for the type and height of the building. Structures less than 75 feet in height shall utilize Class I materials, while structures over 75 feet in height shall utilize Class II materials.
- D. Air terminals shall have a safety tip and be a minimum of 12 inches tall. Where copper is provided, tips shall be nickel plated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Air terminals shall be mounted to extend a minimum of 10 inches above the object to be protected. Spacing of air terminals on ridges or edges of roofs shall not exceed 20 feet on centers nor be more than 24 inches from ridge ends or roof edges. On flat or gently sloping roofs, additional air terminals shall be located at intervals not exceeding 50 feet on centers.
- B. Conductors of the size required by building Class, I or II, shall interconnect all air terminals and provide a two-way path to ground from each air terminal. Conductors shall maintain a horizontal and/or downward path from the air terminals to ground without forming “U” or “V” pockets.
- C. Each downlead cable from roof circuits shall terminate in a properly made ground connection. Groundings shall consist of an acceptable electrode extended vertically 10 feet into the earth. Where soil conditions will not allow this depth, an alternate method shall be used employing ground plates, a ground field, or encircling counterpoise as required by the codes.
- D. Metal bodies permanently affixed to a structure shall be bonded to the main conductor system in accordance with their size and relative location. Sizeable metal objects, such as ventilators, fans, air handlers, masts, flues, ducts, and cooling towers, shall be bonded to the system, regardless of their locations on the roof. Smaller metal such as flashing, gravel stops, insulation vents, ridge vents, roof drains, and metal soil pipe vents shall be bonded to the system if they are located within 6 feet of the main or secondary conductor runs or within 6 feet of another grounded object.

- E. Fasteners shall be placed on each run of exposed conductor not more than 3 feet apart. Concealed runs of conductor shall be anchored as necessary to maintain position and hold permanently in place.
- F. Splices in main conductor runs and connections to branches shall be made with pressure-type bolted or compression-type connections. Underground connections shall be pressure-type bolted or exothermic welded connectors.

END OF SECTION 26 41 13

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes topsoil removal and stock piling, removal of tree stumps, clearing and grubbing including trees less than 6 inches diameter at breast height (DBH).
- B. The NPS will remove all trees greater than 6 inches DBH prior to construction and outside of the biologically sensitive period (April 1 to July 15). The Contractor will be responsible for removing tree stump(s) as shown on the Drawings.

1.2 DEFINITIONS

- A. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface including but not limited to trees, stumps, bushes, rubbish, refuse, pine needles, and other deleterious materials.
- B. Debris: Broken concrete or asphalt, trash, rubbish, rubble, destroyed ruins or other similar items.
- C. Grubbing: Removal by raking or by excavation of vegetation and other organic matter including stumps, debris, grass, buried logs, and roots greater than 2-inch caliper to depth of 6 inches below subgrade. Remove tree stumps and roots to a depth of 24 inches below subgrade.
- D. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- E. Project Limits: Areas, as shown or specified, within which Work is to be performed.
- F. Stripping: Removal of topsoil remaining after applicable clearing and grubbing is completed.
- G. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by drip line of individual trees or perimeter drip line of groups of trees, unless otherwise indicated.

1.3 SUBMITTALS

- A. Action Submittals: Overall Site Plan along with applicable drawings clearly showing clearing, grubbing, and stripping limits for planned work prior to construction and as part of the Quality Assurance.
- B. Information Submittals: Provide survey information delineating limits of debris disposal location if applicable.

1.4 QUALITY ASSURANCE

- A. Obtain CO's approval of staked clearing, grubbing, and stripping limits, prior to commencing clearing, grubbing, and stripping.

1 .5 SCHEDULING AND SEQUENCING

- A. Prepare Site only after adequate erosion and sediment controls are in place and in accordance with industry standards.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3 .1 GENERAL

- A. Comply with federal, state, and local regulations concerning control of erosion and sediment. Sequence work to reduce erosion as directed in construction sequence. Comply with erosion and sedimentation regulations and permit conditions.
- B. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- C. Clearly mark construction limits and ensure all staff are familiar with construction limits. No construction activity is permitted outside construction limits. Within construction limits, the Contracting Officer (CO) in consultation with the Park will identify trees, shrubs, and other vegetation to remain. Clearly mark these areas with flagging, staking, etc.
- D. Fenced enclosures shall be erected around trees to protect crowns from contact by equipment, to preserve roots and soil conditions, and to identify tree protection zones (TPZ) in which no soil disturbance is permitted and activities are restricted unless otherwise approved by CO.
- E. Clear, grub, and strip areas needed for borrow, or Site improvements within limits shown or specified. The Park may identify DO NOT MOVE areas in which topsoil is not to be moved from its location to another site within the project due to contamination with invasive plant species.
- F. Protect remaining site improvements from damage during construction. Restore damaged improvements to their original condition.
- G. Break down grasses, shrubs, sagebrush, and other minor brush less than 3 feet in height and woody plants and trees less than 2 inches in diameter by chipping, mowing, or shredding. Incorporate this material with the conserved topsoil. Ensure material is reduced to less than 2 inch in any dimension prior to incorporation. Remove and dispose off-site, all brush and trees over 3 feet tall or with a diameter over 2 inches.
- H. Do not injure or deface vegetation that is not designated for removal.

3 .2 TREE PROTECTION

- A. Preserve existing trees including their roots and all plant materials outside the construction limits and within TPZs. Ensure CO approves all field staking and construction within construction limits. Removal of trees greater than 6 inches DBH within construction limits will be completed by the NPS outside of biologically sensitive period (April 1 to July 15). Consult with CO on the removal of any tree parts within construction limits that interfere with construction. Trim and prune only trees agreed upon with CO under consultation with the Park. Trimming and pruning shall follow guidelines in ANSI A300 (Part 1) - 2008 Pruning. Remove all tree protection prior to final acceptance. The following activities are prohibited outside construction limits or within TPZs:
 - 1. Fastening ropes, cables, or guys to trees.
 - 2. Parking vehicles or equipment.
 - 3. Disposing of materials such as concrete or cement residue, washing from cement, concrete mixers, or any other material considered harmful by the CO.
 - 4. Piling or storage of earth material or other construction materials.
- B. Protect roots over 1 inch in diameter which are severed during construction operations. Do not allow the tree roots to dry out while exposed. Immediately cover exposed roots with wet burlap or plastic bags to keep roots moist until roots can be covered with dirt. Rebury the roots as soon as possible.
- C. Any damage to trees, plants, or shrubs outside of the construction limits or within a TPZ will be subject to restitution made to the Park as described in section 3.14, Restitution for Unauthorized Damage to Trees/Vegetation. Ensure all staff are familiar with permitted actions and tree preservation plans prior to construction.
- D. Preserve existing trees including their roots and all plant materials outside the construction limits and within TPZs. Ensure CO approves all field staking and construction within construction limits.
- E. The following activities are prohibited outside construction limits or within TPZs:
 - 1. Fastening ropes, cables, or guys to trees.
 - 2. Parking vehicles or equipment.
 - 3. Disposing of any construction materials such as concrete or cement residue, washing from cement, concrete mixers, or any other material considered harmful by the CO.
 - 4. Piling or storage of earth material or other construction materials.
- F. Review permits and applicable tree preservation plans prior to construction.

3.3 UTILITY LINE PROTECTION

- A. Verify existing utilities had been identified and flagged in field.
- B. Protect existing utility lines that are indicated to remain from damage.
- C. Repair damage to existing utility lines identified to remain.
- D. Coordinate in accordance with Section 01 31 00 - Project Management and Coordination.

3.4 LIMITS

- A. As follows, but not to extend beyond Project limits.
 - 1. Excavation: 5 feet beyond top of cut slopes.
 - 2. Fill:
 - a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
 - b. Stripping 1 foot beyond toe of permanent fill.
- B. Remove rubbish, trash, and junk from entire area within Project limits.

3.5 CLEARING

- A. Clear areas within limits shown or specified.
- B. Timber Removal:
 - 1. The NPS will complete removal for any tree above 6 inch DBH that is in conflict with the work outside of biologically sensitive period (April 1 to July 15).
 - 2. Consult with CO on the removal of any tree parts within construction limits that interfere with construction. Trim and prune only the trees agreed upon with CO under consultation with the Park. Trimming and pruning shall follow guidelines in ANSI A300 (Part 1) - 2008 Pruning.
- C. Clearing materials are not allowed to be placed in wetlands, streams, buffers, or lakes. Cut stumps not designated for grubbing to 24 inches of ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 6 inches of ground surface.

3.6 GRUBBING

- A. Grub areas within limits shown or specified. Break down grasses, shrubs, and other minor brush less than 3 feet in height and woody plants and trees less than 2 inches in diameter by chipping, mowing, or shredding. Incorporate this material with the conserved topsoil. Ensure material is reduced to less than 2 inches in any dimension prior to incorporation and that the material does not exceed an average of 1:10 ratio of mulch to soil. Remove and dispose of excess material off site.
- B. Fully remove stumps designated for removal on the Drawings to a minimum depth of 24 inches below ground level. The removed stumps shall become the property of the Contractor and shall be properly disposed.
- C. Grub Holes:
 - 1. Fill excavated areas with suitable on-site material.
 - 2. Compact fill areas to same density required for embankment.
 - 3. Grade excavations to conform to surrounding surface.

3.7 STRIPPING AND STOCKPILING

- A. Coordinate at least 2 weeks prior to topsoil salvage with the CO to ensure their on-site presence at the initiation of salvage activities.
- B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.
- C. Stockpile and windrow strippings, meeting requirements of Section 32 91 13 - Soil Preparation, for topsoil, separately from other excavated material. Maximum height of stockpiles shall be 3 feet unless otherwise approved by the CO.
- D. Remove topsoil before any excavation work begins. Do not strip or salvage topsoil in frozen, snow covered, or saturated conditions. Only areas with low invasive plant cover (max of 10-15% cover) and less than 2H:1V slopes will have topsoil salvaged, as determined by the CO.
- E. Topsoil shall be removed in one pass. Equipment shall be capable of excavating small, isolated pockets of topsoil. Hand salvage topsoil in areas where topsoil cannot be mechanically removed.
- F. Stockpiles shall be stabilized with excelsior logs and/or silt fence or natural fiber (excluding straw) blankets if determined necessary by the CO and in accordance with the SWPPP.
- G. Flag or install barriers to keep heavy equipment or vehicles from driving on stockpiled topsoil.

3.8 TREE REMOVAL OUTSIDE CLEARING LIMITS

- A. Prior to commencement of construction activities, and outside of biologically sensitive periods (April 1 to October 15) to the greatest extent possible, the NPS will identify and remove trees that may present hazardous conditions to project facilities or staff during construction.

3.9 PRUNING

- A. In accordance with ANSI A300 (Part 1) - 2008 Pruning, remove branches below the following heights:
 - 1. 12 feet above roadways and shoulders.
 - 2. 8 feet above sidewalks.

3.10 MERCHANTABLE TIMBER

- A. Merchantable log timber may be sold to Contractor's benefit. Promptly remove from Project Site.

3.11 DISPOSAL

- A. Stumps: Remove stumps from Site as shown on Drawings.
- B. Noncombustible Clearing and Grubbing Debris:

1. Dispose of debris offsite.
- C. Combustible Clearing and Grubbing Debris:
1. Burning of combustible debris onsite will not be allowed. Dispose of debris offsite.
 2. Woody debris may be chipped. Chips may be mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be 1/4 inch by 2 inches. Dispose of chips that are unused with unchipped debris at location identified by CO.
 3. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.
- D. Strippings:
1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

3.12 EROSION AND DUST CONTROL

- A. Perform clearing and grubbing operations to minimize erosion and dust transport.
- B. Provide additional protective measures to prevent sediment and dust from being removed from Site.
- C. Provide equipment or stabilize areas to prevent dust.

3.13 CLOSEOUT REPORT

- A. Provide survey information delineating limits of debris disposal.

3.14 RESTITUTION FOR UNAUTHORIZED DAMAGE TO TREES/VEGETATION

- A. If the Contractor destroys or injures trees and/or plants designated for protection (i.e. vegetation outside the clearing limits or inside the TPZ), the Contractor will be assessed damages and will be responsible for rehabilitating damaged areas under guidance from the Park. The damage appraisal process will be triggered by any of the following types of damage to vegetation outside the clearing limits or flagged vegetation within the clearing limits:
 1. Removal of any tree or shrub;
 2. Creation of unauthorized roads or vehicle parking areas outside the clearing limits or areas designated for the Contractor's use;
 3. Impacting an area within the TPZ (for example, by equipment or liquids or stockpiled materials or soil disturbance);
 4. Removal or fracturing a limb or trunk that is one of the major structural entities of the tree;
 5. Removal or fracturing any limb over 12 inches in diameter;

6. Damaging or removing bark around more than 30% of the trunk circumference;
7. Any trenching or soil disturbance within the drip line that is deeper than 6 inches; or
8. Creation of unauthorized roads or vehicle parking areas outside the clearing limits or areas designated for the Contractor's use.

If a tree or plant is destroyed, after consultation with the CO, remove the tree or plant and make restitution for the loss. A tree will be considered destroyed if any of the buttress root is debarked or if a wound(s) to the tree trunk measures 10% or more of the total circumference of the tree or is longer than 12 inches vertically. The value of the tree will be determined at \$33.00 per square inch of trunk area (determined by diameter at 4.5 feet above the ground). The value of other plants will be determined at \$46 each for shrubs, and \$2 per square foot for other vegetation.

The Contractor shall be responsible for rehabilitating the damaged area under guidance from the Park. If a tree is damaged, make restitution for the repair of the tree. The cost will be determined at \$33.00 per wound on the trunk below 8 feet level and \$52.00 per wound at and above the 8 feet level. A tree will be considered damaged if it suffers wounds to the trunk of less than 10% of the total circumference of the tree. If any limbs or branches are broken or cut off without prior approval from the CO, prune according to project details and make restitution. The cost will be determined at \$59.00 per limb or branch. Pruning or removal of vegetation when authorized and supervised by the CO is excepted from these damages. Treat minor cuts and damaged areas in accordance with ANSI A300 (Part 1) - 2008 Pruning.

END OF SECTION 31 10 00

SECTION 31 23 00 - EXCAVATION AND FILL

PART 1 GENERAL

1.1 WORK SUMMARY

- A. This section covers the requirements to perform work including but not limited to subgrade preparation, excavation, embankment and grading of earthen materials, and rock excavations as it relates to the following for installation and construction of the project improvements:
1. Roadway, parking areas, trail, and ditch/channel excavation
 2. Grading, sloping, shaping, and finishing subgrades
 3. Embankment and slope construction and finishing
 4. Structure excavation and backfill
 5. Structure pad embankments
 6. Backfill, structural fill, and compaction
 7. Excavating and removing unsuitable material
 8. Rock excavation (as directed or authorized)
 9. Finish grading
- B. Provide all labor, materials, tools, equipment, services, and incidentals as necessary to perform the work as described in this section and in accordance with the Contract Documents and Drawings and to the satisfaction of NPS.

1.2 RELATED WORK

- A. Attention is directed to the General Requirements and related work specified in other sections includes, but is not limited to:
1. Section 01 50 00 - Temporary Facilities and Controls
 2. Section 31 10 00 - Site Clearing
 3. Section 31 37 00 - Riprap
 4. Section 32 11 23 - Aggregate Base Course
 5. Section 32 12 16 - Minor Asphalt Pavement
 6. Section 32 13 13 - Concrete Paving

1.3 DEFINITIONS

- A. Backfill: Soil or other structural material used to fill an excavation.
1. Bedding: material placed over excavated subgrade in bottom of trench or excavation to provide uniform support and grade.
 2. Initial Backfill or Pipe Zone Backfill: Backfill placed beside and over pipe or culverts (up to 1-foot above) in a trench, including haunches to support facility.
 3. Final Backfill: Backfill placed over initial backfill to fill a trench.
 4. Structure Backfill: Backfill placed to bring excavations for structures to subgrade.

- B. Borrow: Satisfactory material generated on-site (local) or obtained from sources (imported) which are outside the planned or authorized grading cross sections on the project site, that comply with the project specifications and are suitable for the purpose intended.
- C. Borrow excavation: Material used for embankment construction that is obtained from outside the roadway prism. Borrow excavation includes unclassified borrow, select borrow, and select topping.
- D. Conserved topsoil: Excavated material conserved from the roadway excavation and embankment foundation areas that is suitable for growth of grass, cover crops, or native vegetation.
- E. Embankment construction. Embankment construction consists of placing and compacting roadway or borrow excavation. This work includes:
 - 1. Preparing foundation for embankment;
 - 2. Constructing roadway embankments;
 - 3. Benching for side-hill embankments;
 - 4. Constructing dikes, ramps, mounds, and berms; and
 - 5. Backfilling subexcavated areas, holes, pits, and other depressions.
- F. Finish Grade: The final surface of the completed facility as noted on the Drawings.
- G. Roadway excavation: All material excavated from within the right-of-way or easement areas, except subexcavation and structure excavation. Roadway excavation includes all material encountered regardless of its nature or characteristics.
- H. Rock: For the purposes of classified excavation, rock shall be defined as material that cannot be dislodged by a heavy duty track-type tractor (*Caterpillar Model D-8 or similar*), rated at not less than 300 hp flywheel power and equipped with a single or multi shank hydraulic ripper, capable of exerting not less than 50,000 lbs breakout force. Rock excavation includes up to 6 inches over-excavation below the required excavation depth. Excavated rock shall be quantified by measuring the volume of removed rock and reducing this amount by 35%. This definition of rock does not include materials such as hardpan, loose rock or boulders, concrete or other materials that can be removed by means other than drilling and blasting or mechanical hammers.
- I. Satisfactory Materials: Materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL are satisfactory as fill for overlot grading and are satisfactory in-situ. Satisfactory material shall be free of any refuse and organic matter. Structural fill shall be as defined elsewhere in the Specifications.
- J. Subexcavation: Material excavated from below subgrade elevation in cut sections or from below the original groundline in embankment sections.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of an embankment fill or backfill immediately below subbase, structural base, topsoil, or other subsequent fill materials.

- L. Trench Rock: For the purposes of classified excavation, trench rock shall be defined as material encountered in trench excavation that cannot be dislodged by a medium duty track-type hydraulic excavator (*Caterpillar Model 320 or similar*), equipped with a heavy duty rock ripping (RR) bucket, rated at not less than 135 hp flywheel power with bucket digging force of not less than 28,000 lbs and stick digging force of not less than 18,000 lbs. Trench rock excavation includes up to 6 inches over-excavation below the required excavation depth. Rock shall be quantified by measuring the extent of rock in the trench, not by measuring the volume of removed rock. This definition of trench rock does not include materials such as hardpan, loose rock or boulders, concrete or other materials that can be removed by means other than drilling and blasting or mechanical hammers.
- M. Unsuitable Material: Earthen material encountered below the natural ground surface in embankment areas or below the grading plane in excavation areas determined to be.
 - 1. Insufficient for structural stability or inappropriate for planned use.
 - 2. Of such unstable nature that it cannot be compacted to the specified density using ordinary methods at optimum moisture content.
 - 3. Too wet to be properly compacted and cannot be dried before incorporation into the work.
- N. Unsatisfactory Materials: Earthen materials classified by ASTM D 2487 as OL, OH, MH, CH, and PT are unsatisfactory in-situ and as fill. Unsatisfactory materials also include those materials containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 6 inches. Fill materials containing stones larger than 3 inches shall not be used in the uppermost 2 feet.
- O. Waste: Excess and unsuitable roadway excavation and subexcavation that cannot be used.

1.4 SUBMITTALS

- A. Submittals shall be in conformance with Contracting Requirements, Specifications, and Division 1 - General Requirements.
- B. Submit a Work Plan based on the Contractor's proposed work schedule and construction sequence of earthwork and grading operations to accommodate construction loads and protection of improvements including underground facilities (e.g. conduits, pipes, culverts), subgrade deterioration and rutting, aggregate base structural section deterioration and rutting, and final pavements.
- C. At least 14 days prior to placement of materials in the work, Contractor shall submit test reports and supporting documentation to indicate the source and material properties for all bedding, backfill, structural fill and other soil materials to be placed in the work as part of the earthwork operations, including:
 - 1. Soil classification test report (ASTM D 2487) on borrow soil material proposed for placement in the work.
 - 2. Laboratory optimum moisture-maximum density curves (AASHTO T 180) for each on-site, borrow, and backfill soil material proposed for placement in the work.

1.5 REFERENCES

- A. The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-24) dated 2024; and published revisions thereto.
<https://flh.fhwa.dot.gov/resources/specs/>
 - 1. Payment descriptions in the FP-24 Standard Specifications shall not apply.
 - 2. In case of conflict with the FP-24 Standard Specifications, the most stringent specification shall apply.
- B. Applicable ASTM and AASHTO standards.

1.6 QUALITY ASSURANCE

- A. Conform to the Contract Documents including but not limited to, Technical Conditions, Drawings, and Standard Specifications.
- B. Sampling and testing requirements shall be in conformance with Table 204-1, 208-1 and 209-1 in the FP-24 Standard Specifications.
- C. Testing Agency: The Contractor shall retain a qualified independent geotechnical engineering and/or material testing agency to perform field quality-control acceptance testing.
- D. Inspection: The Contractor shall coordinate with NPS during all earthwork operations to allow for access to the site as often as necessary for the performance of any special inspections and material testing for verification that the specifications are being met for the installation of materials. Frequency of material testing shall conform to the applicable Utah Test Methods or equivalent ASTM test method.
- E. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.
- F. Drainage: The Contractor shall be responsible for the proper drainage of the site during construction of the Work. Water shall not be allowed to accumulate in any of the excavated areas. Storm or ground water collecting on site during construction shall be removed by pumping, ditching, or other suitable means in conformance with the Specifications and Project Permits.
- G. Inclement Weather: When earthwork operations are ceased due to weather (rain, freezing, snow, etc.), construction shall not be resumed until NPS (who may retain the services of a Geotechnical Engineer) has verified soil strength has not been adversely affected. If soil strength has been decreased, the affected portion of fill shall be rescarified, moistened, or dried as required and recompacted to the specified density.

1.7 PROJECT CONDITIONS AND REQUIREMENTS

- A. Do not commence earthwork operations until temporary fencing, erosion and sedimentation control measures are in place and a Pre-Grade Inspection has been completed by the Contracting Officer and other applicable regulatory agency(s).

- B. Existing utilities shown on the Drawings are approximate. Prior to starting work on the Project, the Contractor shall contact Underground Service Alert (USA) “811” for location at least two working days prior to any excavation. The locations of various utilities shown on the Drawings are solely an accommodation to the Contractor without any representation or guarantee concerning completeness and/or accuracy. The Contractor is responsible for ascertaining the location of, and protection for, all utilities to be encountered in the performance of the required work.
- C. All articles of archaeological interest that may be uncovered by the Contractor during the progress of the work shall be reported immediately to NPS, and work stopped in the immediate vicinity of the find. Further operations of the Contractor with respect to the findings will be decided under the direction of NPS. In no case shall any archaeological findings result in any claim to be made by the Contractor including, but not limited to, project delay.
- D. In the event that the Contractor discovers hazardous materials or physical conditions of any unusual nature while excavating, the Contracting Officer shall be notified immediately and work stopped in the immediate vicinity of the find. NPS shall promptly investigate such conditions and shall issue a contract change order, if required or not covered elsewhere in these Specifications. In the event of a dispute caused by such conditions the Contractor shall not be excused from performance of the contract work.
- E. Protection of Persons and Property:
 - 1. All open excavations shall be backfilled at the end of each day’s work, or properly covered with “traffic rated” trench plating, securely fastened to the ground in accordance with Caltrans requirements, and barricades.
 - 2. The Contractor shall protect structures, utilities, sidewalks, pavements, trees and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
 - 3. The Contractor shall protect, maintain and restore benchmarks, monuments, and other reference points affected by this work. If bench marks, monuments or other permanent reference points are displaced or destroyed, points shall be re-established and markers reset under supervision of a licensed Land Surveyor in the State of California.
- F. Traffic: Minimize interference with adjoining roads, streets, walks, trails and other adjacent occupied or used facilities during earthwork operations.
 - 1. Do not close or obstruct streets, drives, walks, or other adjacent occupied or used facilities without permission from NPS and authorities having jurisdiction.
 - 2. Provide temporary controls and alternate routes around obstructed or closed traffic ways in conformance with authorities having jurisdiction, and Section 01 50 00 - Temporary Facilities and Control.
- G. Blasting activities shall not be allowed as part of the work.
- H. Excavation Safety shall be conducted in accordance with OSHA safety regulations.

1.8 TOLERANCES

- A. Conform to tolerances as specified in the FP-24 Standard Specifications.
- B. All material limits shall be constructed within a minimum tolerance of 0.1 foot for horizontal layout or dimensions and within a minimum tolerance of 0.1 foot for vertical layout with reference to elevation or grade with the following additional requirements:
 - 1. Minimum thicknesses and slopes shall be as shown on the Drawings.
 - 2. All grading shall be performed to maintain slopes and drainage as shown on the Drawings.
 - 3. Completed slopes must be within 0.1 foot from the grade shown on the Drawings.
 - 4. Flowlines must be graded to drain and must be within 0.1 foot from the grade shown on the Drawings.
 - 5. Where aggregate base is to be placed on the grading plane, the grading plane at any point shall not be more than 0.05 foot above the grade shown on the Drawings.
 - 6. Where hot mix asphalt is to be placed, the grading plane at any point shall be within ± 0.05 foot of the grade shown on the Drawings.
 - 7. Where PCC pavement or structures are to be placed, the grading plane at any point shall be within ± 0.05 foot of the grade shown on the Drawings.

PART 2 PRODUCTS

2.1 GENERAL

- A. Conform to the following sections of the FP-24 Standard Specifications, unless otherwise shown on the Drawings:

1. Backfill material	704.01
2. Select borrow	704.02
3. Unclassified borrow	704.01
4. Bedding material	704.01
5. Foundation fill	704.01
6. Water	725.01
- B. All aggregate and earthen soil materials generated on-site, local borrow or import shall be from weed-free sources.
- C. All fill materials shall be free from mud, refuse, construction debris, organic material, rock or stones greater than 6 inches in any dimension, frozen or otherwise unsuitable or unsatisfactory material. Local borrow material for fills shall be secured from excavation after rejection of any unsuitable materials. Materials from other sources may be used upon acceptance by NPS.
- D. All fill materials in the uppermost 2 feet shall not have any rocks larger than 3 inches in diameter.
- E. Material for use in replacing undercut areas or in construction of embankments shall conform to the specifications herein, and shall be accepted by NPS and obtained from approved sources.

- F. Duff and topsoil shall be stripped and salvaged as required in Section 31 10 00 - Site Clearing, without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified by the Contracting Officer.

2.2 SITE BORROW MATERIAL

- A. Site borrow material shall conform to the specifications herein and Section 704.02 of the FP-24 Standard Specifications.
- B. Material shall be well-graded according to table 704-2 of the FP-24 Standard Specifications and shall have a liquid limit (AASHTO T 89, Method A) of 30 max.

2.3 IMPORTED BORROW

- A. Clean, readily compactable soils or soil-aggregate, with all particles passing a 3-inch square opening and not more than 35 percent passing a No. 200 sieve, as determined by AASHTO T88-81. The portion of the material passing a No. 40 sieve shall have a plasticity index of not more than 10, as determined by AASHTO T90-81. Use all suitable existing embankment material available on site before importing borrow.

2.4 BEDDING MATERIAL

- A. Bedding material shall conform to the specifications herein, and Section 704 of the FP-24 Standard Specifications.
- B. Bedding material shall be a sandy, well-graded, free draining material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material with a maximum particle size or 1/2 inch or half the corrugation depth of subject pipe material, whichever is smaller and maximum of 10 percent material passing No. 200 sieve, AASHTO T 27 and T 11.
- C. Bedding material for small diameter or smooth wall plastic piping (e.g. PVC, HDPE) shall be a nonplastic sand material free of clay, organic matter or other deleterious materials, conforming to Section 703.14 of the FP-24 Standard Specifications.

2.5 FOUNDATION FILL

- A. Foundation fill material shall conform to the specifications herein, and Section 704.01 of the FP-24 Standard Specifications.
- B. Foundation fill shall be a suitable material with a maximum particle size of 2 inches and a soil classification, AASHTO M 145, of A-1-a, and maximum of 6.0 percent material passing No. 200 sieve, AASHTO T 27 and AASHTO T 11.

2.6 BACKFILL MATERIAL

- A. Backfill material shall conform to the specifications herein and Section 704.01 of the FP-24 Standard Specifications.
- B. Backfill material shall be a suitable, well-graded, compactable material that, for structures and pipes other than plastic pipe, has a maximum particle size of 3 inches and a

soil classification, AASHTO M 145, of A-1, A-2, or A-3, and for reinforced soil slopes and plastic pipe has a maximum particle size of 1½ inches and a soil classification, AASHTO M 145, of A-1, A-2-4, A-2-5, or A-3.

2.7 STRUCTURE BACKFILL

- A. Structural backfill material shall conform to the specifications herein, and Section 704.01 of the FP-24 Standard Specifications.
- B. Structural backfill shall be suitable, free-draining material with a maximum particle size of 3 inches, a maximum of 5 percent material passing No. 200 sieve, AASHTO T 27 and AASTO T 11, and a plasticity index of a maximum of 6, AASTO T 90.
- C. Native soils for structure backfill may only be placed where shown on the Drawings, and used only as allowed or accepted by the Contracting Officer.

PART 3 EXECUTION

3.1 GENERAL

- A. Prior to starting earthwork operations, all target areas to receive surface improvements shall be striped, cleared and grubbed conforming to Section 31 10 00 - Site Clearing.
- B. Conserve, sort, and stockpile suitable organic matter and topsoil materials.
- C. Temporary slopes and excavations shall be compatible with the soil type, and meet the minimum requirements identified in a project geotechnical report where provided.
- D. Rock Excavation
 - 1. Blasting is not allowed as part of the work.
 - 2. Rock or trench rock excavation/cut may be completed by use of pneumatic or hydraulic hammers, single shank hydraulic ripper, and/or heavy-duty rock ripping bucket.
 - 3. Expansive demolition grout “chinese dynamite” may be used where applicable upon approval of the Contracting Officer.
 - 4. If there is no bid item for rock excavation, rock removal is by change order.

3.2 PROTECTION OF TREES, VEGETATION, AND EXISTING FACILITIES

- A. Prior to commencing earthwork operations, trees and vegetation to remain shall be protected from damage as specified in Sections 01 11 00 - Summary of Work and 01 50 00 - Temporary Facilities and Controls.
- B. Earthwork operations shall only occur in areas showing proposed improvements and where grading work and other significant ground disturbing activities are designated to occur on the Drawings.
- C. All areas disturbed by the Contractor’s operations shall be restored and stabilized prior to soil preparation work specified in Section 32 91 13 - Soil Preparation.

- D. All existing utilities and facilities to remain shall be located and protected from damage during earthwork operations.

3.3 STORAGE OF MATERIALS

- A. Soil materials may only be stockpiled at staging and storage areas identified on the Drawings and in accordance with the SWPPP and Project Permits, and as approved by the Contracting Officer. Soil materials shall not be stockpiled in a manner that destroys or damages existing vegetation in areas not shown on Drawings for excavation or grading.
 - 1. Place, grade, and shape stockpiles to drain surface water.
 - 2. Stockpile materials away from edge of excavations. Do not store within drip line of trees to remain.
 - 3. Cover all stockpiles at the end of each day's work, and when operations are inactive to prevent windblown dust or erosion from precipitation.
- B. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing.
- C. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on site or imported material from approved sources at no additional cost to NPS.
- D. Any areas disturbed by the stockpiling of materials outside of designated staging and storage areas shall be revegetated at the Contractors expense, and no additional compensation will be allowed.

3.4 WATERING

- A. Contractor shall be responsible to obtain any permit, license, agreement, certification, or any combination of these, and pay all associated fees in order to develop a suitable water supply for construction operations.
- B. Contractor must have at least two (2) mobile units available at all times.
- C. No chemical additives, binder, or dust palliative shall be permitted for any watering/dust controls operations without prior written acceptance of NPS.
- D. Each water storage tank and distribution system must be equipped with positive shut-off valves.
- E. Watering for dust control shall also conform to the provisions in Section 01 50 00 - Temporary Facilities and Controls.

3.5 UNSUITABLE MATERIALS

- A. Any unsuitable material encountered during excavation and subgrade preparation work such as organic matter, clay, swampy material or other which cannot provide for a stable trench or be properly compacted, dispose at designated sites or legally off of the project.
- B. Unsuitable material which is encountered below finished subgrade shall be excavated to a depth required by NPS, disposed of and replaced with aggregate base, drain rock, controlled low strength material (CLSM), or other satisfactory material, as so directed and accepted by NPS in writing.
- C. In addition, and at the discretion of the Contracting Officer, a geotextile material may be required to stabilize the bottom of the excavation or trench area.
- D. Over excavation and removal of unsuitable material, and replacement with satisfactory material shall be considered as change order work.

3.6 SURPLUS MATERIAL

- A. Obtain authorization before disposing of surplus material.
- B. Ensure enough material is available to complete the fills and embankments before placing the material at other locations on the job site or disposing of it.
- C. If surplus material is prematurely disposed and it is later discovered there is a material shortage, the Contractor must replace with a satisfactory material accepted by the Contracting Officer.
- D. Dispose of excess material at designated sites or legally off the project.

3.7 DEFICIENCY MATERIAL

- A. If the quantity of acceptable material from excavation is not enough to construct the fill and embankments, the quantity of material needed to complete the work must consist of local or imported borrow.
- B. Local borrow is to be considered as part of the excavation work, and no additional compensation shall be allowed for.
- C. Imported borrow not used in the work shall not be paid for. Disposal of any surplus imported borrow shall not be paid for.

3.8 SUBGRADE PREPARATION

- A. The ground surface in areas to be graded and/or receive overlying improvements, shall be stripped, cleared and grubbed under Section 31 10 00 - Site Clearing.
- B. Any material that is deemed to be organic matter and/or topsoil may not be used as structural fill or placed in sub-grades below proposed improvements.
- C. Exposed ground surfaces shall be kept moist during subgrade preparations. Native soils shall be scarified to a minimum depth of eight (8) inches, moisture conditioned, and compacted per Section 204, Excavation and Embankment of the FP-24 Standard

Specifications, and as shown on the Drawings applicable to the overlying improvements. Subgrade below pavement or in structural areas shall be compacted to no less than 95 percent relative compaction.

3.9 ROADWAY EXCAVATION

- A. Perform roadway excavation, embankment, and compaction according to the applicable provisions of Section 204, Excavation and Embankment of the FP-24 Standard Specifications.
- B. Shape to drain and compact the work area to a uniform cross-section at the end of each day's operations.
- C. Remove unsuitable material from the roadbed and replace it with suitable material.
- D. Finish roadbeds to be smooth and uniform, and shaped to conform to the specified sections. Finish roadbeds to the tolerance listed in Subsection 1.08, Tolerances, herein.
- E. Dispose of unsuitable or excess excavation material according to Section 02 41 00 - Demolition and Salvage. Replace shortage of suitable material caused by premature disposal of roadway excavation.
- F. Place roadway structural base sections and aggregate courses under Section 32 11 23 - Aggregate Base Course.

3.10 ROAD SHOULDER RECONDITIONING

- A. Conform to Section 303, Road Reconditioning of the FP-24 Standard Specifications.
- B. Clear vegetation, repair soft and unstable areas, and reshape to slopes as shown on the Drawings.
- C. Road shoulder backing material shall be aggregate base as shown on the Drawings and conforming to Section 32 11 23 - Aggregate Base Course.

3.11 TRENCH EXCAVATION AND BACKFILL

- A. Perform trench excavation according to the applicable provisions of Section 209, Structure Excavation and Backfill of the FP-24 Standard Specifications.
- B. For pipelines or culverts, excavate to widths as specified or as needed to effectively achieve compaction requirements.
- C. Remove safety features when no longer necessary.

3.12 EXCAVATION FOR FORMWORK AND STRUCTURES

- A. Perform structure excavation according to the applicable provisions of Section 208, Structure Excavation and Backfill for Selected Major Structures of the FP-24 Standard Specifications.

- B. Excavate to foundation grade without disturbing the trench or foundation surface. Foundation grade is the elevation at the bottom of the bedding for installing the structure.

3.13 EMBANKMENT CONSTRUCTION

- A. Construct embankments according to the applicable provisions of Section 204, Excavation and Embankment of the FP-24 Standard Specifications, unless otherwise specified on the Drawings.
- B. Incorporate only suitable excavation or specified fill material into the embankment.
- C. At the end of each day's operations, shape to drain and compact the embankment surface to a uniform cross-section. Eliminate ruts and low spots that could hold water.
- D. In structural areas and within the roadway prism, place embankment material in horizontal layers not exceeding 8 inches in compacted thickness.
- E. For embankment outside of structural areas or roadway prism, place material in horizontal layers not exceeding 12 inches in compacted thickness.
- F. Incorporate rock or large boulders in embankment only where allowed or authorized by the NPS Representative, by reducing in size or placing them individually. Reduce rock to less than 12 inches in the largest dimension, or as authorized by the Contracting Officer for specified location. Distribute any rock within the embankment to prevent nesting, and fill all voids between rocks.
- G. Compact embankment according to subsection 204.11 of the FP-24 Standard Specifications, unless otherwise specified on the Drawings.

3.14 NATIVE SOIL DITCH

- A. Excavate, shape, and slope ditches to the lines and grades shown on the Drawings.
- B. Construct ditches in accordance with applicable provisions of subsection 204.12 in the FP-14 Standard Specifications.
- C. Remove projecting roots, stumps, rock, or similar matter. Any areas excavated below grade are to be backfilled according to the specifications herein.
- D. Compact each layer according to subsection 204.11 of the FP-24 Standard Specifications, unless otherwise specified on the Drawings.
- E. Maintain ditches in an open condition and without sticks, and other debris.

3.15 BACKFILL AND COMPACTION FOR STRUCTURES

- A. Complete structure backfill and compaction according to the applicable provisions of Section 209, Structure Excavation and Backfill of the FP-24 Standard Specifications.

- B. Place backfill layers evenly on all sides of the structure. Extend each layer to the limits of the excavation, natural ground or proposed improvement. Place backfill material in compacted layers not exceeding 6 inches in depth.
- C. Do not place backfill material against fresh concrete until 80 percent of the design strength is achieved.
- D. Compact according to subsection 209.10 of the FP-24 Standard Specifications:
 - 1. Determine optimum moisture content and maximum dry density of backfill material according to AASHTO T 99, Method C. Adjust the moisture content of the backfill material to a moisture content suitable for compaction.
 - 2. Compact material placed in all layers to at least 95 percent of the maximum density. Determine the in place density and moisture content according to AASHTO T 310 or other approved test procedures.
 - 3. Do not apply density requirements as measured by AASHTO T 310 to material incapable of being tested or compacted to maximum values determined by AASHTO T 99. For these material, fill the voids around the rock in each layer with earth or other fine material. Compact each layer until there is no visible evidence of further consolidation.

3.16 SLOPING, SHAPING AND GRADING

- A. Complete sloping, shaping and grading according to the applicable provisions of Section 204, Excavation and Embankment of the FP-24 Standard Specifications.
- B. Complete slopes, waterbars, drainage channels, ditches, culverts, riprap, and other underground structures and facilities before placing aggregate courses.
- C. 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 on the Drawings.
 - 1. Cut out soft spots, fill low spots, and trim high spots to achieve required grading and comply with required surface tolerances.
 - 2. Provide a smooth transition between adjacent existing grades and new grades.
 - 3. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded.
 - 4. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes.
- D. If a slide or slipout occurs on a cut or embankment slope, remove or replace the material and repair or restore damage to the work. Bench or key the slope to stabilize the slide. Reshape the cut or embankment slope to an acceptable condition.
- E. Slope grades to direct water away from facilities and to prevent ponding.
- F. Low areas resulting from removal of unsuitable material or from excavation of rock shall be brought up to required grade with satisfactory materials or proposed fill material as shown on the Drawings.

- G. Construct slopes to the lines and grades shown on the Drawings, but in no case shall slopes be steeper than 3:1, unless shown otherwise on the Drawings. Slope tolerances are measured perpendicular to the planned slope.
- H. Round the tops of excavation slopes and ends of excavations to gently blend with adjacent grades and facilities.
- I. The Contractor may be directed in the field to vary the angle of slopes to achieve a natural appearance. No additional compensation for this varying sloping will be considered.
- J. No portion of a slope may encroach on a roadway, walkway, or trail.
- K. Maintain completed slopes and graded areas true and smooth for the duration of project work, until overlying materials are placed, and/or final revegetation activities are complete and the project work is accepted. Repair slope damage caused by traffic, disturbance, tracking, or erosion regardless of amount or extent.

3.17 FINISHED GRADES

- A. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified.
- B. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes and noticeable breaks. At the ends of cuts and at intersections of cuts and embankments, adjust slopes in the horizontal and vertical planes to blend into each other or into the natural ground.
- C. Drainage ways shall be finished to permit adequate drainage and avoid ponding.
- D. Areas to receive topsoil or revegetation treatments shall be set to the proper grade to allow for placement of topsoil and/or incorporation of amendments, and application of mulches as part of the finish work.

3.18 TOPSOIL PLACEMENT

- A. Topsoil placement shall be done in accordance with Section 32 91 13 – Soil Preparation.

3.19 PROTECTION

- A. The Contractor shall protect newly graded areas from traffic, erosion and any settlement or washing away that may occur due to subsequent construction, disturbance and weather conditions.
- B. Repair and reestablish grades to required elevations, slopes and specified tolerances where completed or partially completed surfaces become disturbed. Scarify or remove and replace soil material to depth as directed by the Contracting Officer; reshape and recompact.

END OF SECTION 31 23 00

SECTION 31 37 00 - RIPRAP

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes riprap at culvert inlets and outlets.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

- a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
- b. C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- c. C150/C150M, Standard Specification for Portland Cement.
- d. C535, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- e. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- f. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus
- g. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- i. D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile
- j. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
- k. D6241, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50 mm Probe

- B. The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-24), dated 2024; and published revisions thereto.

<https://flh.fhwa.dot.gov/resources/specs/>

1. Payment descriptions in the FP-24 Standard Specifications shall not apply. Please refer to Section 01 27 00 – Definition of Contract Line Items.
2. In case of conflict with the FP-24 Standard Specification, the more stringent specification shall apply.

1.3 DEFINITIONS

- A. Refer to applicable definitions in Section 31 23 00 - Excavation and Fill.

1.4 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

- a. Description and location of proposed sources of riprap bedding and riprap.

2. Samples:

- a. A sample of proposed type of riprap material (approximately 1/3 cubic foot) shall be submitted to NPS no less than 15 days prior to placement in the work for review and acceptance.
- b. A 12 by 12 inch sample of the filter fabric shall be provided for verification.

B. Informational Submittals:

- 1. Quarry Certificate of Conformance and supporting documentation showing proposed riprap bedding or riprap meet Standard Specification gradation and materials requirements for the Class or Type specified.
- 2. Trip tickets showing source, type, and weight of each load of material delivered to Site.
- 3. Filter fabric and securing pins product data.

1.5 QUALITY ASSURANCE

- A. Riprap Source: Quarry that has produced riprap and has performed satisfactorily on other projects for at least 5 years.
- B. Site Visit: Arrange for CO to visit quarry site to observe materials proposed for riprap and riprap bedding.

1.6 SCHEDULING AND SEQUENCING

- A. Complete subgrade preparation as specified in Section 31 23 00 – Excavation and Fill and geotextile installation prior to placing riprap.

PART 2 PRODUCTS

2.1 RIPRAP

- A. Rock riprap shall conform to the specifications herein, unless shown otherwise on the Drawings.
- B. Substitution of locally sourced or local borrow rock/riprap material generated onsite (i.e. not imported from offsite commercial quarry) shall be reviewed for acceptance by NPS prior to placement in the work. Locally sourced rock/riprap material is preferred, where generally conforming to the material specification for quality and size/gradation requirements.

- C. Rock shall be of the size and gradation for each improvement type and area as shown on the Drawings. Gradation by class shall conform to Section 705.02, Riprap of the FP-24 Standard Specifications.
1. An equivalent gradation class of material, per Utah Department of Transportation Standards, may be substituted based on available supply, review and acceptance of submittals.
- D. The Contractor shall use stone that is free of weak cleavages and is hard, sound and durable against disintegration under conditions to be met in handling and placing; and is hard and tenacious and otherwise of a suitable quality resistant to abrasion, weathering, and water action to ensure permanency in the specified kind of work. Material properties shall conform to:

Rock Material Properties

Property	Value	Test Method
Apparent Specific Gravity, min.	2.40	AASHTO T 85
Absorption, max (%)	4.0	AASHTO T 85
Durability Index, min	52	AASHTO T 210
Los Angeles Abrasion, max (%)	50	AASHTO T 96
Soundness of Aggregate (using sodium sulfate), max (%) loss	12	AASHTO T 104 (5 cycles)

- E. Stone shall be angular and of such shape to form a stable protection structure for the required section or feature. Flat or elongated shapes will not be accepted unless the thickness of the individual pieces is at least 1/3 of the length.
- F. Shale, rock with shale seams, or other fissile or fissured rock will not be accepted.
- G. Stones shall be uniform in color indigenous to the area. All stone material shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings. Stones shall be free of machine-made scratches, mars, or other damage to the visible surface.

2.2 FILTER FABRIC OR UNDERLAYMENT

- A. Geotextile filter fabric for separation and/or stabilization shall conform to Section 714, Geosynthetic Material of the FP-24 Standard Specifications.
- B. Identify, store, and handle geosynthetics according to ASTM D4873 and the manufacturer's recommendations. Elevate and protect geosynthetic rolls with a waterproof cover if stored outdoors. Limit geosynthetics exposure to less than 10 days of ultraviolet radiation.

PART 3 EXECUTION

3.1 EARTHWORK, EXCAVATION AND EMBANKMENT

- A. Applicable construction operations for earthwork, excavation and embankment shall conform to Section 31 23 00 - Excavation and Fill.
- B. Excavation width shall be as shown on the Drawings, but should be no wider than what is required to safely place and compact the stone and adjacent backfill material.
- C. The bottom of the excavation shall be graded, compacted and prepared as shown on the Drawings to provide a firm and uniform bearing for the rock. Unsuitable materials shall be addressed as specified in Section 31 23 00 - Excavation and Fill.
- D. Geosynthetics shall be as shown on the Drawings, in conformance with the Specifications, and as otherwise directed by the CO.
- E. Any associated backfill, bedding material, or accepted native soils, shall be placed as shown on the Drawings, conforming to the Specifications, and as otherwise directed by the CO.
- F. Fill adjacent to rock sections shall meet the top of rock and blend with existing grades for a natural appearance. Finish grading and any topsoil placement shall meet the lines and grades as shown on the Drawings, and be prepared to receive any revegetation treatments as specified.
- G. Dewatering may be required to properly complete the work. The excavation and general work area shall be sufficiently dry to allow for the proper construction and inspection of the excavation, subgrade, bedding and backfill materials, and installation of facilities for a complete job in place.

3.2 PLACING RIPRAP

- A. Placement of riprap for bank protection, slope protection and erosion control shall be in accordance with the applicable requirements of Section 251, Riprap of the FP-24 Standard Specifications. All materials shall be placed to the lines, grades, and dimensions as shown on the Drawings, and directed by the CO.
- B. Placement of geotextile shall be in accordance with the applicable requirements of Section 207, Earthwork Geosynthetics of the FP-24 Standard Specifications. All materials shall be placed to the lines, grades, and dimensions as shown on the Drawings, and directed by the CO.
- C. Prepare subgrade within limits indicated in accordance with section 31 23 00 – Excavation and Fill. Bring areas that are below allowable minus tolerance limit to grade by filling with material and compacting the subgrade to the density as specified in section 31 23 00 – Excavation and Fill.
- D. For rock lined ditch in natural areas, the subgrade shall be undisturbed native soils (or compaction of 95% of the Modified Proctor Maximum Dry Density if in fill condition) unless otherwise shown on the Drawings.

- E. Obtain approvals of subgrade prior to placing riprap.
- F. Place geotextile filter fabric, bedding material, and riprap on prepared subgrade to required thickness and grades as shown on the Drawings; and to produce a well-graded mass of stone with minimum percentage of voids. Place to full thickness in a single operation to avoid displacing the underlying material.
- G. Place riprap in a method in which gradation of material is maintained and stone sizes are evenly distributed; avoid segregation. Hand placement and manipulation of rock should be expected, as directed by the CO, to achieve the required configuration of the improvement and to achieve a natural appearance.
- H. All rock is to be placed to minimize the potential for movement when flow is induced, which shall be accomplished by interlocking the angular nature of the rock with itself.
- I. Backfill, trim and dress all areas to required cross sections, and finish grades.
- J. Prevent mixture of earthen embankment and stone/riprap revetment materials.
- K. The Contractor shall take all necessary measures to protect any fabric, underlayment, or blanket from damage (if such material is damaged the product shall be repaired per the manufactures recommendations, and as directed by the CO).

3.3 PROTECTION

- A. The Contractor shall protect newly installed facilities for the duration of the work.
- B. Protect finished product from damage and avoid operating construction equipment or vehicles directly over a rock riprap structure.
- C. Repair and replace any displaced or damaged parts with new materials to the required lines and grades.

END OF SECTION 31 37 00

SECTION 32 11 23 - AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes production, construction, and compaction of an aggregate base course used for pavements, shoulders, trails, and incidental construction.
- B. Existing aggregate base material from the project site may be salvaged and reused provided it meets the criteria provided in this section.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. C29, Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate.
 - b. C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - c. C117, Standard Method of Test for Materials Finer Than 75 μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - d. C131, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - e. C183, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
 - f. D75, Standard Practice for Sampling Aggregates.
 - g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m<sup>3 - h. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2700 kN-m/m<sup>3 - i. D1883, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - j. D2216, Standard Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 - k. D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - l. D2844, Standard Specification for Resistance R-Value and Expansion Pressure of Compacted Soils.
 - m. D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - n. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - o. D5195, Standard Test Methods for Density of Soil and Rock In-Place Below Surface by Nuclear Methods.</sup></sup>

- p. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T 11, Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
 - b. T 27, Sieve Analysis of Fine and Coarse Aggregates
 - c. T 89, Determining the Liquid Limit of Soils
 - d. T 90, Determining the Plastic Limit and Plasticity Index of Soils
 - e. T 96, Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - f. T 180, Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop.
 - g. T 210, Standard Method of Test for Aggregate Durability Index (ASTM D3744/D3744-11a)
 - h. T 335. Determining the Percent of Fracture in Coarse Aggregate
- 3. The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-24), dated 2024; and published revisions thereto.
<https://flh.fhwa.dot.gov/resources/specs/>
 - a. Payment descriptions in the FP-24 Standard Specifications shall not apply. Refer to Section 01 27 00 – Definition of Contract Line Items.
 - b. In case of conflict with the FP-24 Standard Specifications, the most stringent specification shall apply.

1.3 DEFINITIONS

- A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.
- B. Completed Lift: Compacted with uniform cross-section thickness.
- C. Base Course: Crushed aggregate or similar as specified placed and compacted on prepared subgrade or subbase course.
- D. Gravel Surfacing: Aggregate used for construction of multi-use paths and trails that can be easily graded and compacted.

1.4 SUBMITTALS

- A. Informational Submittals:
 - 1. Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 30 days prior to delivery of materials to Project showing materials meeting the physical qualities specified.
 - 2. Certified results of in-place density tests from independent testing agency.

3. Provide copies of certifications for material testing personnel and laboratories to be used for Contractor Quality Control.
4. Provide required documentation for all Contractor Quality Control material testing as noted in the specifications.

1.5 QUALITY ASSURANCE

- A. Conform to the Contract Documents including but not limited to, Technical Conditions, Drawings, and Standard Specifications.
- B. Conform to the sampling, testing and acceptance requirements of Sections 301.08 of the FP-24 Standard Specifications.
- C. Testing Agency: The Contractor shall retain a qualified independent geotechnical engineering and/or material testing agency/consultant to perform field quality-control acceptance testing.
- D. Inspection: The Contractor shall coordinate with the CO during all earthwork and base course operations to allow for access to the site as often as necessary for the performance of any special inspections and material testing for verification that the specifications are being met for the installation of materials. Frequency of material testing shall conform to the applicable Specifications, Standards and Test Methods.
- E. All Contractor required 'Quality Control' materials testing shall be based upon applicable ASTM and AASHTO Test Methods referenced herein for the materials specified. All equipment, material, and labor necessary for Quality Control testing shall be supplied by and all costs borne by the Contractor.
 1. Provide copies of all applicable testing procedures and standards (per ASTM and/or AASHTO).
 2. Provide certifications for calibration of all field testing equipment.
 3. A report of any field test results and laboratory testing shall be furnished.
 4. All deficiencies, which become present from testing shall be rectified, and the materials retested until passed, or materials replaced where non-conforming.
 5. All tests shall be performed in the presence of the CO.

1.6 PROJECT CONDITIONS AND REQUIREMENTS

- A. All imported base courses and aggregate materials shall be sourced from an accepted supplier, meeting the contract compliance requirements, and certified weed free. Do not change suppliers during course of work unless authorized by NPS.

1.7 TOLERANCES

- A. Conform to surface tolerance requirement of Section 301.06 of the FP-24 Standard Specifications
- B. Minimum thicknesses and slopes shall be as shown on the Drawings.
- C. The surface of the finished AB material at any point shall not vary more than 0.05 feet above or below the grade established by the Engineer and as shown on the Drawings.

- D. Where HMA is to be placed, the grading plane at any point shall not be more than 0.05 foot above the grade shown on the Drawings.
- E. Where PCC pavement or structures are to be placed, the grading plane at any point shall not be more than 0.05 foot above the grade shown on the Drawings.

PART 2 PRODUCTS

2.1 BASE COURSE

- A. Clean, hard durable, pit run gravel or crushed stone graded from coarse to fine containing enough fines to bind material when compacted.
- B. Conform to Section 703.05, Subbase, Base, and Surface Course Aggregate of the FP-24 Standard Specifications.
- C. In addition to the aggregate quality characteristics specified in the FP-24 Standard Specifications, conform to the following:
 - 1. Aggregate Base (AB)

a.	Plastic limit, AASHTO T 90	nonplastic
b.	Sand equivalent (min), AASHTO T176	25
c.	Resistance (R-value, min), AASHTO T 190	78
- D. Aggregate Base "Grading Designation" shall be Grade D as shown on Table 703-1, Target Value Ranges for Subbase and Base Gradation of Section 703.05(b) of the FP-24 Standard Specifications.
 - 1. An equivalent gradation class of material, per Utah Department of Transportation Standards, may be substituted based on available supply, review, and acceptance of submittals.

2.2 SOURCE QUALITY CONTROL

- A. Sample the material and perform tests necessary to locate acceptable source of materials meeting specified requirements.
- B. Final approval of aggregate material will be based on test results of installed materials.
- C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 EXECUTION

3.1 GENERAL

- A. Subgrade shall be completed as specified in Section 31 23 00 – Excavation and Fill. Preparation of the subgrade and/or surface on which aggregate courses are placed shall conform to Section 301.03 of the FP-24 Standard Specifications.

- B. Obtain CO's acceptance of subgrade before placing base course or surfacing material.
- C. Do not place base course or surfacing materials in snow or on soft, muddy or frozen subgrade.
- D. Conform to Section 301, Untreated Aggregate Courses of the FP-24 Standard Specifications.
- E. Maintain base courses with sufficient moisture, and avoid rutting from excess travel impacts. Correct any irregularities or depressions by adding additional base course materials, smooth, and compact to maintain a uniform finish to the required tolerances.

3.2 EQUIPMENT

- A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

3.3 HAULING AND SPREADING

- A. Hauling Materials:
 - 1. Do not haul over surfacing in process of construction.
 - 2. Loads: Of uniform capacity.
 - 3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.
- B. Spreading Materials:
 - 1. Mixing and spreading of aggregate courses shall comply with Section 301.04 of the FP-24 Standard Specifications.
 - 2. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
 - 3. Produce even distribution of material upon roadway or prepared surface without segregation.
 - 4. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.4 CONSTRUCTION OF COURSES

- A. Base Course and Gravel Surfacing:
 - 1. Maximum Completed Lift Thickness: 6 inches.
 - 2. Completed Course Total Thickness: As shown.
 - 3. Spread on roadway or preceding course to depth, grade, and cross-section shown.
 - 4. Maintain moisture levels to prevent loss of fines during processing.
 - 5. Lightly blade surface of each lift and roll until thoroughly compacted to line and grade shown.
 - 6. Blade or broom surface to maintain true line, grade, and cross-section.

3.5 ROLLING AND COMPACTION

- A. Compaction of aggregate courses shall conform to Section 301.05 of the FP-24 Standard Specifications.
- B. Commence compaction of each layer of base and gravel surfacing after spreading operations and continue until density of 95 percent of maximum density has been achieved as determined by AASHTO T 180.
- C. Roll each layer of material until material does not creep under roller before succeeding layer is applied.
- D. Commence rolling at outer edges and continue toward center; do not roll center of road first.
- E. Apply water as needed to maintain optimum moisture content.
- F. Place and compact each lift to the required density before succeeding lift is placed.
- G. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.
- H. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.6 CLEANING

- A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate.

END OF SECTION 32 11 23

SECTION 32 12 13.13 - ASPHALT PRIME/TACK COAT

PART 1 GENERAL

1.1 DESCRIPTION

- A. This work consists of applying an emulsified asphalt tack coat and prime coat.

1.2 SUBMITTALS

- A. Material invoice or bill for lading.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Emulsified Asphalt: A group of asphalt products using water and soap (emulsifier) to reduce viscosity. These products consist of approximately 60 percent asphalt and 40 percent emulsifier. When specified for tack coat, an equivalent anionic grade emulsion may be substituted for a cationic grade and vice versa. The sieve test in AASHTO M 208 is not required.
1. Anionic emulsions shall conform to AASHTO M 140. For RS-1h and RS-2h, conform to AASHTO M 140 for RS-1 and RS-2, except conform the following for the penetration on the residue.
 - a. Ductility, 77 °F, 2 inches/min, AASHTO T 51 40 mm min.
- B. Prime Coat: Liquid asphalt applied to a prepared subgrade or untreated base course.
1. Design according to MC-70 or MC-250.
 2. Blotter Material – Granular materials, Table 2-1, when tested according to AASHTO T 27.

Table 2-1
Granular Materials

Sieve Size	Percent Passing
No. 4	90 to 100
No. 10	25 to 80
No. 200	0 to 15

- C. Tack Coat: Emulsified asphalt to the existing surface or new pavement surface and intermediate lifts.
 - 1. Design according to AASHTO M 208.
 - a. Select emulsion according to the time constraints required for Maintenance of Traffic (MOT) and the ability to fully cure before allowing traffic on the roadway.
 - 1) Residual asphalt content to be approximately 60 percent.
 - a) Dilute at terminal only.
 - b) Do not change dilution before obtaining approval from the Contracting Officer.
- D. Water – Conform to the following:
 - 1. Water for mixing or curing cement concrete, mortar, or grout shall conform to AASHTO M 157. Potable water of known quality may be used without testing according to AASHTO T 26. Potable water is safe for human consumption as defined by the public health authority having jurisdiction.
 - 2. Furnish water for planting or care of vegetation that is free of substances injurious to plant life such as oils, acids, alkalis, or salts.
 - 3. Furnish water for earthwork, pavement courses, dust control, and incidental construction free of substances detrimental to the work.

PART 3 EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

- A. Equipment
 - 1. Asphalt distributor:
 - a. Capable of heating asphalt evenly;
 - b. Adjustable full circulation spray bar to 15-foot width;
 - c. Positive controls including tachometer, pressure gauge, volume measuring device, or calibrated tank to uniformly deposit asphalt over the full width within 0.02 gallons per square yard of the required rate; and
 - d. Thermometer for measuring the asphalt temperature in the tank.
 - 2. Rotary power broom.
 - a. Self-propelled; and
 - b. Capable of controlling the vertical broom pressure.
 - 3. Pneumatic-tire rollers. Furnish a minimum of two pneumatic-tire rollers both with the following capabilities:
 - a. Self-propelled;

- b. Minimum compacting width – 5 feet; and
 - c. Gross weight adjustable within the range of 200 to 360 pounds per inch of compaction width.
- B. Surface Preparation. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods. When the surface is concrete, remove excess joint and crack filler.
 - 1. Prime Coat
 - a. Shape the surface to the required grade and section.
 - b. Keep the surface free from ruts, corrugations, or other irregularities.
 - c. Compact the surface to the level approved by the CO.
 - 2. Tack Coat
 - a. Clean the surface of all materials that prevent the tack coat from bonding to the existing surface such as mud, dirt, leaves, and water.
 - b. Cover all tacked surface areas with surfacing materials the same day the tack coat is applied.
- C. Weather Limitations. Apply asphalt tack coat on a dry, unfrozen surface when the air temperature in the shade is above 35 °F and rising.
- D. Prime Coat and Tack Coat Application
 - 1. Protect the surfaces of nearby objects to prevent spattering or marring.
 - 2. The CO will approve the exact application rate, temperature, and area to be treated before application and may make adjustments for variations in field conditions. Apply the prime and tack coat uniformly with an asphalt distributor. Move distributor forward at the proper application speed at the time the spray bar is opened. Use care not to apply excess asphalt at the junction of spreads. Correct skipped areas or deficiencies. Remove and dispose of paper or other material used.
 - 3. Apply at the following rates:
 - a. Prime Coat: 0.5 gal/yd²
 - b. Tack Coat: Refer to Table 3-1.

Table 3-1
Application Rate (gal/yd²)

Existing Pavement Condition	Residual	Undiluted	1:1 Dilute	2:1 Dilute
New Hot Mix Asphalt	0.03	0.05	0.10	0.08
Milled Hot Mix Asphalt	0.07	0.12	0.24	0.18

4. When a tack coat cannot be applied with an asphalt distributor spray bar, apply the tack coat uniformly and completely by fogging with a hand spray attachment or by another approved method. If excess asphalt material is applied, squeegee the excess from the surface. Allow the tacked surfaces to completely cure before placing the covering course. Place the covering course within 4 hours of placing the tack coat.
5. Do not apply prime coat or tack coat:
 - a. On a wet surface or where surface conditions prevent proper adhesion.
 - b. When the surface temperature is below 50 degrees F.
 - c. When weather conditions prevent proper adhesion.
6. Keep the viscosity between 50 and 100 centistokes. Refer to AASHTO T 201.
7. Immediately apply another application to under primed surface.
8. Apply tack coat between all lifts of Hot Mix Asphalt and to all surfaces, including vertical that will come in contact with Hot Mix Asphalt.
 - a. Apply prime coat to protect the grade from damage.
9. Spread blotter material if the prime coat does not penetrate.
 - a. Use the quantities required to absorb the excess asphalt.
 - b. Blotter material cost will be incidental to the tack coat pay item cost.
10. Allow prime or tack coat to fully cure before allowing traffic on paving.

END OF SECTION 32 12 13.13

SECTION 32 12 16 - MINOR ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Work under this Section shall consist of constructing minor Asphalt Concrete Pavement (ACP). Furnish all labor, material and equipment necessary to complete the work according to the contract.
- B. Furnish ACP mixture (pavement) composed of mineral aggregate, recycled asphalt, mineral filler, and antistrip additives. 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.
- C. Related Sections.
 - 1. 02 41 00 – Demolition and Salvage
 - 2. 31 23 00 – Excavation and Fill
 - 3. 32 11 23 – Aggregate Base Course
 - 4. 32 17 23 – Pavement Markings
 - 5. 32 12 13.13 – Asphalt Prime/Tack Coat

1.2 REFERENCES

- A. AASHTO - American Association of State Highway and Transportation Officials
 - 1. M 156 – Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
 - 2. M 320 – Standard Specification for Performance-Graded Asphalt Binder
 - 3. AASHTO R 26 – Standard Practice for Certifying Suppliers of Performance-Graded Asphalt Binders
 - 4. R 35 – Standard Practice for Superpave Volumetric Design for Asphalt Mixtures
 - 5. T 11 – Standard Method of Test for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
 - 6. T 27 – Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
 - 7. T 84 – Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate
 - 8. T 85 – Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
 - 9. T 166 – Standard Method of Test for Bulk Specific Gravity (G_{mb}) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens
 - 10. T 209 – Standard Method of Test for Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures
 - 11. T 245 – Standard Method of Test for Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus

12. T 246 – Standard Specification for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
 13. T 247 – Standard Method of Test for Preparation of Test Specimens of Hot Mix Asphalt (HMA) by Means of California Kneading Compactor
 14. T 255 – Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying
 15. T 283 – Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
 16. T 308 – Standard Method of Test for Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
 17. 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
1. D2950 – Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
 2. D7227 – Standard Practice for Rapid Drying of Compacted Asphalt Mixture Specimens Using Vacuum Drying Apparatus

1.3 SUBMITTALS

- A. Mix Design Submittal: The job mix formula (JMF) shall be submitted in writing by the Contractor at least 21 days prior to the start of paving operations. The JMF shall have been approved by the local state department of transportation within the past 12 months. For each proposed JMF, the Contractor shall submit a production certification conforming to the state department of transportation specifications and conforming to design parameter (a), (b), or (c) for the type of mix submitted and conforming to design parameter (d) in Table 1-1. The Design ESAL for this project is stated in the Geotechnical Report which is attached as Appendix A.

Table 1-1 ACP Mix Requirements

Design Parameters	Specification
(a) Volumetric hot ACP (AASHTO M 323, AASHTO R 35, and AASHTO T 312) Gyratory compaction level	75
Volumetric properties at 0.3 to 3 million ESAL's (AASHTO M 323)	See Table 1-2
(b) Hveem (AASHTO T 246 and AASHTO T 247) Stabilometer, minimum	35
Percent air voids ⁽¹⁾	3.5
(c) Marshall (AASHTO T 245) Stability, pounds, minimum	2000
Flow, 0.01 inches	8 – 14
Percent air voids ⁽¹⁾	3.5

Compaction, number of blows each end of test specimen	75
(d) Moisture susceptibility (AASHTO T 283) Tensile strength ratio, minimum	0.80

(1) The percent of air voids are based on AASHTO T 166, AASHTO T 209 and AASHTO T 269.

Table 1-2 ACP Design Requirements (if design parameter “a” is used in Table 1-1)

Design ESAL (Million)	Gyratory Compaction Level (% Theoretical Maximum Specific Gravity, G _{mm}) AASHTO T 312 ⁽⁴⁾			Minimum Voids-in-the Mineral Aggregate (VMA), % ⁽¹⁾		Voids Filled with Asphalt (VFA), %	Dust- to- Binder Ratio ⁽³⁾	Minimum Tensile Strength Ratio, AASHTO T 283 ⁽⁴⁾
				Nominal Maximum Size Aggregate ⁽²⁾				
	N _{initial}	N _{design}	N _{max}	½ inch (12.5 mm)	⅜ inch (9.5 mm)			
< 0.3	6 (≤91.5%)	50 (96.5%)	75 (≤98.0%)	14.0- 15.0	15.0- 16.0	70.0 - 80.0	0.6 -1.4	0.80
0.3 to < 3	7 (≤90.5%)	75 (96.5%)	115 (≤98.0%)			70.0 - 80.0		

1.4 QUALITY ASSURANCE & CONTROL

- A. Contractor Quality Control (CQC): Plan Comply with the requirements specified in Section 01 40 00 - Quality Requirements.
- B. Sampling/Testing – The Contractor shall retain an independent agency to facilitate all sampling and testing. The minimum frequency for sampling and testing shall be as shown in Table 1-3 and included in the approved CQC Plan. The results and findings of QC inspections shall be documented in Inspector Daily Reports (IDRs).
- C. 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.

Table 1-3 Sampling, Testing, and Acceptance Requirements

Material or Product	Type of Acceptance	Characteristic	Test Methods Spec	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
ACP	Measured and tested for conformance	Density ⁽¹⁾	AASHTO T 166	1 per 700 tons	In-place after compacting	Yes	24 hours	Deliver cores to CO after testing is completed
		Surface tolerance	Straight-edge measurement	Continuously after compaction	Finished pavement surface	No	24 hours	—
		Placement temperature	—	First load and as determined by CO thereafter	Hauling vehicle before dumping, in hopper or windrow before pickup, or behind laydown	No	Upon completion of measurement	—
	Process control	Gradation at the plant	AASHTO T 27 & T 11	Contractor determined	Cold feed or hot bins as applicable	No	24 hours	—
		Moisture content of aggregates	AASHTO T255	Contractor determined	Stockpile	No	24 hours	—
		Density	ASTM D2950	1 per 500 feet	In-place after compacting	No	24 hours	—

(1) Cut two 6-inch diameter side-by-side cores. Remove them with a core retriever and fill and compact the core holes with asphalt concrete mixture. Label the cores and protect them from damage due to handling and temperature. Submit one core for verification testing. Dry the other core to constant mass at 125±5 °F or vacuum dry it according to ASTM D7227 before performing the core density and measuring the thickness. Use 62.245 pounds per cubic foot to convert specific gravity to density.

1.5 DELIVERY & 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.
- D. The temperature range of the asphalt mixture when delivered to the project site will be established in the CQC Plan utilizing the approved JMF. Monitor the temperature of the mixture, 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 CQC Plan.

1.6 PROJECT SITE CONDITIONS

- A. Place HMA on a prepared dry, unfrozen surface when the air temperature in the shade is above 35°F and rising, and the temperature of the road surface in the shade conforms to Table 1-4.

Table 1-4 HMA Placement Temperatures

HMA Placement Temperature Compacted Lift Thickness Road Surface Temperature °F	<2 Inches Minimum Lay-Down Temperature ⁽¹⁾ °F	2.1-3 Inches	>3.1 Inches
< 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.

B. 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. Asphalt mix shall be as shown on the Drawings.
- B. All other manufactured, non-project produced materials shall require Commercial Certification such as mineral filler, antistrip and WMA additives.
- C. Recycled Asphalt Pavement (RAP) material may be used as a component of the asphalt mixture as allowed by local state DOT.

2.2 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. 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.

2.3 MIXES

A. Asphalt Mixture Production

- 1. Do not heat asphalt binder above 350°F 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 is uniformly coated with asphalt binder and thoroughly distributed throughout the mixture.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify the CO at least 14 days prior to beginning paving work. A pre-paving conference will be scheduled at least 7 days prior to starting pavement placement. All submittals listed herein are required to be approved prior to scheduling said pre-paving conference. 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 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. If the plans call for pre-paving repair work, such as milling, patching of failed/damaged areas, crack sealing, etc., this work shall be done in accordance with the plans, details and applicable section(s) of these specifications.
 - 3. 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.
 - 4. Apply an asphalt tack coat to contact surfaces of pavements, curbs, gutters, manholes, and other structures in accordance with Section 32 12 13.13 - Asphalt Price/Tack Coat. When ACP will be placed on subgrade or aggregate base, apply an asphalt prime coat in accordance with Section 32 12 13.13 - Asphalt Price/Tack Coat.

3.2 CONSTRUCTION

- A. Placement of Asphalt - Place all courses of pavement mixture with an asphalt paver or device approved by the CO.
- 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. 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, or at lane lines if more than two lanes.

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 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 (hand raking) shall be performed in such a manner as to prevent segregation.

D. Asphalt Compaction; Furnish rollers of sufficient size, number and type, to support the production rate and meet compaction requirements. Thoroughly and uniformly compact the asphalt surface by rolling. In places inaccessible to rollers, use alternate equipment approved by the CO. Do not cause cracking, shoving or undue displacement.

E. 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 inch, measured between any two contacts of the straightedge, or deviations in excess of 0.25 inches measured at the end of the straightedge.

3.3 FIELD QUALITY CONTROL

- A. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may perform inspection, sampling and testing to verify conformance with contract requirements.
- B. The Contractor shall retain an independent testing agency to sample and test the asphalt pavement per Table 1-3.
- C. 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 described herein. At the sole discretion of the CO the Contractor's QC tests may be used for the purposes of acceptance.
- D. Monitor the compaction process with nuclear density gauges calibrated according to the ASTM D2950 calibration section within 6 months before use. Check the standard and reference on each day of use according to the ASTM D2950 standardization and reference check sections. The minimum density shall be 93.5% of AASHTO T 209 density.

3.4 ADJUSTING

- A. Defective Area Correction: 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 13 - CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Place Portland cement concrete in a base course, surface course, overlay course, or an inlay course.
- B. This specification does not apply to concrete flat work.

1.2 REFERENCES

A. ACI Standards

- 1. 305 – Hot Weather Concreting
- 2. 306 – Cold Weather Concreting
- 3. 318 – Building Code Requirements for Reinforced Concrete

B. ASTM Standards

- 1. A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- 2. C39 – Compressive Strength of Cylindrical Concrete Specimens
- 3. C78 – Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- 4. C94 – Ready-Mixed Concrete
- 5. C174 – Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
- 6. C231 – Air Content of Freshly Mixed Concrete by the Pressure Method
- 7. C1315 – Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
- 8. D3665 – Random Sampling of Construction Materials
- 9. D5249 – Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints
- 10. E950 – Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

C. DOT Standards

- 1. Publication No. FHWA HIF-07-004: Integrated Materials and Construction Practices for Concrete Pavement

1.3 SUBMITTALS

- A. Before delivery: Submit 48 hours before delivery:
 - 1. Concrete pavement placement plan. Identify items such as but not limited to grade control system, placement start and stop timing, hydration control during cold conditions (ACI 306), hot and windy conditions (ACI 305), timing for

evaporation retarder application, timing for curing agent application, floating restrictions, concrete saw-cut timing, header joints.

2. Proof of finisher's ACI certification.
3. Make and model name of paving machine, grade trimmer, and gang drill mechanism.

B. Submittal requirements in related sections:

1. Traffic control plan, Section 01 50 00 – Temporary Facilities and Controls.
2. Joint layout plan per Section 03 15 00 – Concrete Joints and Accessories.
3. Curing and protection plans per 03 30 00 – Cast in Place Concrete. Describe method to prevent excessive concrete temperatures and water evaporation that could impair strength or serviceability of concrete. Refer to ACI 305 and ACI 306.
4. Evaporation Retarder Data Sheet – per Section 03 39 00 – Concrete Curing. Identify product components, application and manufacturer's recommendations.
5. Pre-approved concrete mix design or supplier's mix number per Section 03 30 00 – Cast In Place Concrete.
6. Manufacturer's recommended installation procedures for joint sealing material per Section 03 15 00. When accepted by CO, will become the basis for accepting or rejecting actual installation procedures used in the Work.
7. Batch tickets (to be submitted at delivery) per Section 03 30 00 – Cast In Place Concrete.

1.4 QUALITY ASSURANCE

- A. Do not change concrete supplier until CO accepts new source and new mix design.
- B. Reject product that does not meet requirements of Section 03 30 00 – Cast In Place Concrete.
- C. Remove product found defective after installation and install acceptable product at no additional cost to CO.
- D. The foreman of paving crew shall have completed at least three (3) projects of similar size and nature.
- E. The lead finishing mechanic shall be ACI certified.
- F. Follow state of practice for quality assurance as published in FHWA Publication No. HIF-07-004.
- G. If requested, submit a quality control and testing report describing source and field quality assurance activities performed by the Contractor and its Suppliers.

1.5 WEATHER

- A. Hot weather, ACI 305. Set retarding admixture may be used if allowed in mix design. Discontinue placement if ambient air temperature exceeds 100 deg F in the shade.

- B. Cold weather, ACI 306. Accelerating admixtures may be used if allowed in mix design. Provide weather protection until 90 percent of design compressive strength is achieved. When removing heat, limit temperature changes next to concrete surface to 20 deg F per 12 hours until the concrete surface temperature reaches ambient:
 - 1. Use of admixtures or curing agent will not relax cold weather placement and cure requirements.
 - 2. Do not use chemical additives to prevent freezing.
 - 3. Prevent loss of moisture during protection.

1.6 NOTICE

- A. Follow Laws and Regulations concerning when and to whom notices are to be given. Send written notice at least three (3) days before start of paving.
- B. Indicate paving time and when new surface can be used.

1.7 ACCEPTANCE

- A. General:
 - 1. Acceptance is by Lot. Lot size is one day production.
 - 2. Opening a paved surface to traffic does not constitute acceptance.
 - 3. Observation of Contractor's field quality control testing does not constitute acceptance. Such testing; however, may be used by CO for acceptance if requirements are met.
- B. Temperature, Slump, Air:
 - 1. Lot size is one (1) random batch.
 - 2. Testing Frequency: Section 03 30 00 – Cast In Place Concrete.
 - 3. Reject non-complying batches until two (2) consecutive batches are compliant then continue in random batch testing for acceptance.
- C. Strength Dispute Resolution:
 - 1. CONTRACTOR:
 - a. Hire an Independent Testing Agency,
 - b. Follow Section 03 30 00 – Cast In Place Concrete requirements.
 - c. Conduct testing at no additional cost to CO. Retesting must be completed within 40 calendar days after placement.
 - 2. Contracting Officer:
 - a. Accept lot at full pay if average strength of three (3) cores from the defective lot is greater than or equal to 85 percent of compressive strength (f_c'), and if no single strength retest is less than 75 percent of f_c' .
 - b. Use original cylinder compressive strengths for pay factor determination if any of above criteria are not met.

D. Placement: Section 03 30 00 – Cast In Place Concrete.

1. Verify grade, cross slope, finish, and dimensions.
2. No standing water in curb and gutter.
3. Curing membrane applied at twice coverage rate recommended by curing membrane Supplier.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Mixing plant: ASTM C94, Option C:

1. Use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.
2. Mixing time must exceed 80 seconds after adding air entrainment admixture.

B. Cylinder Storage Device: A container at the work site that maintains an interior temperature of 60 to 80 deg F. equipped with an automatic 7-days temperature recorder, accurate within 2-degrees and having a permanent recording feature. A 24 hours test run may be required. Cease concrete operation when storage capacity of storage device is reached.

C. Concrete Hauling Vehicle:

1. Truck mixer: Not allowed if ready mix product can be provided. If allowed:
 - a. Fill drum no more than 63 percent of the gross drum volume and no less than 2-cubic yards is occupied.
 - b. Use drum manufacturer's recommended mixing speed (between 12 and 18 rpm)
 - c. Driver of vehicle has and follows Supplier's manual of standard operational procedures.
2. Truck Agitator: Do not fill drum greater than 80 percent of the gross drum volume. Use drum manufacturer's recommended agitating speed (between 2 – 6 rpm).
3. Dump truck. End dump or side dump is acceptable. Air content must be controlled at the mixing plant.

D. Trimmer: A self-propelled unit to strike off and shape surface of road base material so future placement of concrete pavement meets specified thickness. The trimmer uses the same line and grade control assembly or system that the paving machine uses.

E. Slip Form Paving Machine:

1. Capable of providing one pass between crown line and back of curb unless specified otherwise.
2. Self Propelled with two or four tracks
3. Steering and elevation controlled from reference string lines.

4. Paving width up to 50 feet (depending upon model and attachments).
5. Weight 2,000 pounds per foot of paving lane width.
6. Continuous auger, hydraulic plow-pans, or conveyor system to distribute concrete in front of the screed.
7. Variable speed internal vibrators.
8. Capable of consolidating mats up to 15 inches thick.
9. Various finishing attachments.

F. Fixed Form Paving Machine:

1. Capable of providing one pass between crown line and lip of gutter.
2. Ride on forms or on self-propelled wheels.
3. Steering and elevation controlled by fixed forms.
4. Various paving width.
5. Weight about 1,000 pounds per foot of paving width.
6. Suspended screw auger to spread concrete in front of screed or roller.
7. Has one or two vibrators that move transversely in front of the screed. May also use fixed vibrators near the form edges.
8. Capable of consolidating mats up to 10 inches thick.

G. Vibrating Screed:

1. Capable of providing one pass between crown line and lip of gutter.
2. Various paving width.
3. Elevation controlled by fixed forms or string-line.

H. Finishing and Texturing Equipment.

1. Machine float may be attached to paver.
2. Texturing equipment acceptable to CO.
3. Curing compound application device with a fully atomizing type power spray and a wind protection hood.

I. Straight Edge: 10 to 20 feet long hand-operated. Successive straightedge checks should overlap by one-half the length of the straightedge.

3.2 PREPARATION

A. General:

1. Locate and preserve utilities. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over fixtures.
3. Coat surface of Street Fixtures with oil to prevent bond with concrete pavement.
4. Remove sand, leaves and other objectionable materials before placing paving course.
5. Notify CO at least 24 hours before commencement of concreting operations.

B. Traffic Control:

1. Implement notification and traffic control plan requirements. Do not proceed without certified flaggers.
2. Apply temporary lane marking tape or paint after layout has been verified with CO.

C. Aggregate Base Course:

1. Verify base course is placed to grade, compacted, and dampened. Refer to Section 32 11 23 – Aggregate Base Course.

3.3 PROTECTION

A. Protect placed concrete in accordance with Section 03 30 00 – Cast in Place Concrete and as follows:

1. Do not allow steel wheel rollers or steel wheel vehicles on the concrete pavement. Keep traffic and construction equipment off at least 10 days after concrete placement or until 100 percent of the design strength has been achieved and verified by either:
 - a. Maturity meter.
 - b. Concrete cylinders.
2. If construction traffic is permitted, keep pavement clean. Remove surface stains and spillage of materials as they occur.
3. Remove saw-cut dust immediately. Protect neighborhood, storm drains and down-stream fish habitat.

B. Trees, Plants, Ground Cover:

1. Protect trees, plants, and other ground cover from damage.

3.4 LAYOUT OF WORK

1. Construction survey requirements. Section 01 73 40 - Execution.

3.5 LINE AND GRADE CONTROL

A. General:

1. Furnish, place, and maintain forms, supports, wire devices, and materials as required for providing continuous line and grade control.
2. Use survey staking. Distances between line and grade control points are as follows:
 - a. 25 feet maximum on tangent sections.
 - b. 10 feet maximum on vertical curve high points and low points, and on horizontal curves from PC to PT points.
3. Provide additional grade control at high points, low points,
4. Check line and grade control immediately before paving operation.
5. Use the same grade control system to control the paver and the grade trimmer.

- B. Slip Form Paving. Equip machinery with a control system that automatically controls concrete placement to the specified longitudinal grades and transverse cross slopes.
- C. Formed Paving. Section 03 10 00 – Concrete Forming and Accessories. Keep forms free from warps, bends, kinks, and equal in depth to the specified pavement edge. Tightly join formed sections and stop paving operation if the side forms do not meet or hold the following line and grade:
 - 1. Top of forms not more than 1/4 inch from true grade.
 - 2. Vertical face on longitudinal axis not more than 1/4 inch from true line.

3.6 REINFORCEMENT PLACEMENT

- A. Section 03 21 00 – Steel Reinforcement.
- B. Use smooth dowel in expansion joints.
- C. Interrupt reinforcement placement at expansion joints.
- D. Keep load transfer bars and dowels in vertical center of concrete and perpendicular to the joint during concrete placement.
- E. Position mats on bar chair supports and properly tie before concrete is poured. Keep mats clean, free from rust, flat, and free of distortions. Straighten bends, kinks, and other irregularities or replace units before concrete placement. Provide at least two (2) inch overlap to adjacent mats.
- F. DO NOT place the end of a dowel or tie bar within 18 inches of any joint

3.7 JOINTS

- A. Refer to Section 03 15 00 – Concrete Joints and Accessories.

3.8 PLACEMENT

- A. Section 03 30 00 – Cast In Place Concrete.
- B. Do not place concrete until concrete subbase and surface course forms have been checked for line and grade. Moisten subbase or base if required to provide a uniform dampened condition at time of concrete placement. Do not place concrete around manholes or other structures until they are at required finish elevation and cross slope.
- C. At the beginning of concrete placement:
 - 1. Test slump and air. If corrections are necessary, placement may proceed after 2-subsequent and consecutive batches pass testing.
 - 2. Tempering, not allowed unless Section 03 30 00 requirements are followed or mix design makes allowance for water addition.
 - 3. Admixtures (such as for air entrainment) not allowed unless specified elsewhere.

- D. Any delay more than 15 minutes from placing to start of finishing operations is cause for stopping placement work.
- E. Prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
- F. Do not place concrete in a longitudinal section until test specimens from the adjacent lane have attained a compressive strength of 2,500 psi as determined by maturity meter or cast cylinders.
- G. Deposit and spread concrete in a continuous operation between transverse joints. If interrupted for more than ½-hour, place a construction joint.
- H. Place the concrete to the full width of the pavement in a single construction operation unless indicated otherwise.

3.9 SCREEDING AND FLOATING

- A. Strike-off, consolidate, and provide a smooth surface by screeding
- B. After screeding, test slab for trueness with a straight edge. Distribute concrete as required to remove surface irregularities.
- C. Apply an evaporation retarder immediately after screeding (or after floating if floating is required). Apply retarder BEFORE bleed water has vanished. Do not use the retarder as a finishing aid.
- D. Use floating hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture. Refloat repaired areas to provide a continuous smooth finish.

3.10 FINISHING

- A. Section 03 30 00 – Cast In Place Concrete.
- B. Any delay more than 30 minutes for completing the finishing operation is cause for stopping concrete placing to correct difficulties.
- C. Round edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool. Eliminate tool marks.
- D. Surface Texture: After floating when excess moisture or surface sheen has disappeared:
 - 1. For speed less than 45 mph: Apply 1/16-inch-deep burlap drag, turf drag, or broom.
 - 2. For speeds 45 mph and greater: Apply 1/8-inch-deep groove placed 80 degrees to center line and randomly spaced between 3/8 and 1-1/2-inches.

- E. Do not remove forms for at least 24 hours after concrete has been placed. After form removal, clean ends of joints and patch any minor honeycombed areas. Remove and replace areas or sections with major defects.

3.11 CURE

- A. Section 03 39 00 – Concrete Curing.
- B. Immediately after floating and texturing as the water sheen of the surface is disappearing, apply curing agent in 2- directions for total white coverage on all exposed surfaces.
- C. Apply agent at 2-times the rate recommended by the compound manufacturer. Applying curing agent too late (after concrete dampness has disappeared) may cause work rejection by CO.
- D. Eliminate thermal shock of concrete by keeping cure temperature close to ground and air temperature.

3.12 TOLERANCES

- A. Slab Thickness: Not more than 1/4-inch deficient.
- B. Dowel Bar:
 - 1. Maximum allowable skew is 0.375 inches per 12 inches (3 percent) in the horizontal and vertical planes.
 - 2. Embedment is 6-inches minimum.
 - 3. Position in slab is center plus or minus 1/2 inch.

3.13 REPAIR

- A. General: Section 03 30 00. All expenses are at no additional cost to CO.
- B. Corrective Action for Cracks: Consider repair options published in guidelines by the American Concrete Pavement Association (ACPA). Do not begin corrective work until CO agrees with repair option. Drill test cores when necessary to determine magnitude. Fill holes with Portland cement concrete bonded to pavement with epoxy adhesive.

3.14 OPENING TO TRAFFIC

- A. Not less than 3,000 psi compressive or 400 psi flexure strength.

END OF SECTION 32 13 13

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes applying permanent pavement markings on the completed pavement as shown in the Drawings.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M237, Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete.
 - b. M247, Standard Specification for Glass Beads Used in Traffic Paint.
 - c. M248, Standard Specification for Ready-Mixed White and Yellow Traffic Paints.
 - d. M249, Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form).
 - 2. ASTM International (ASTM):
 - a. D522, Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - b. D713, Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
 - c. D1475, Standard Test Method for Density of Liquid Coatings, Inks, and Related Products.
 - d. D1729, Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials.
 - e. D2243, Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.
 - f. D2805, Standard Test Method for Hiding Power of Paints by Reflectometry.
 - g. D3335, Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.
 - h. D3718, Standard Test Method for Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy.
 - i. D3723, Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing.
 - j. D4280, Standard Specification Extended Life Type, Non-plowable, Prismatic, Raised, Retroreflective Pavement Markers.
 - k. E1347, Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry.

3. The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-24) dated 2024; and published revisions thereto.
<https://flh.fhwa.dot.gov/resources/specs/>
 - a. Payment descriptions in the FP-24 Standard Specifications shall not apply.
 - b. In case of conflict with the FP-24 Standard Specifications, the most stringent specification shall apply.
4. U.S. Department of Transportation, Federal Highway Administration: Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

1.3 DEFINITIONS (NOT USED)

1.4 SUBMITTALS

A. Action Submittals:

1. Shop Drawings
2. Product Data:
 - a. Paint.
 - b. Thermoplastic material.
 - c. Reflective markers.
 - d. Epoxies, resins, and primers to be used.
 - e. Glass Beads: Proposed gradation.

B. Informational Submittals:

1. Description of proposed methods for removal of drips, overspray, improper markings, paint and thermoplastic material tracked by traffic, and existing markings.
2. Manufacturer's Certificate of Compliance for products specified in this section.
3. Equipment List: Proposed equipment to be used, including descriptive data.
4. Manufacturer's Instructions:
 - a. Application of waterborne traffic paint.
 - b. Application of glass beads.

PART 2 PRODUCTS

2.1 PAINT

- A. Color: ASTM D1729, white or yellow.
- B. Waterborne traffic paint in accordance with AASHTO M248, Type F or N.
- C. Acrylic water-based, ready-mixed paint composed of resin solids of 100% acrylic polymer.

1. Pigment, ASTM D3723, 45 to 55 percent by mass.
 2. Lead, chromium, cadmium, or cobalt, ASTM D3335 & ASTM D3718, 0 percent by mass.
 3. Volatile organic compounds, EPA Method 24, 20.0 oz/gallon maximum.
 4. Density of paint, ASTM D1475, 12.0 lb/gallon minimum.
 5. Viscosity, ASTM D562, 75-90 Krebs units.
 6. Drying time to no track, ASTM D713, 90 seconds maximum.
 7. Flexibility, ASTM D522, using the 1/4-inch cylindrical method, no cracking or flaking.
 8. Dry opacity, ASTM D2805, contrast ratio at 319 ft²/gallon spreading rate, 0.96 minimum.
 9. Daylight reflectance (without glass beads), ASTM E1347, white 84 percent and yellow 55 percent relative to magnesium oxide standard.
 10. Freeze-thaw stability, ASTM D2243, ± 5 Krebs units maximum.
- D. Homogeneous, easily stirred to smooth consistency, with no hard settlement or other objectionable characteristics during storage period of 6 months.

2.2 GLASS BEADS

- A. In accordance with AASHTO M247, Type I.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

- A. Cleaning:
1. Thoroughly clean surfaces to be marked before application of pavement marking material.
 2. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water or a combination of these methods.
 3. Completely remove rubber deposits, surface laitance, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion.
 4. Scrub areas of old pavement affected with oil or grease with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application.
 5. Surfaces shall be completely free of dirt and ice, and dry of water at the time of application of materials specified herein.
 6. Oil-Soaked Areas: After cleaning, seal with cut shellac to prevent bleeding through the new paint.
 7. Reclean surfaces when the Work has been stopped due to rain.
 8. Existing Pavement Markings:
 - a. Remove existing pavement markings that may interfere or conflict with newly applied marking patterns, or that may result in a misleading or confusing traffic pattern.
 - b. Perform grinding, scraping, sandblasting or other operations so finished pavement surface is not damaged.

- B. Pretreatment for Early Painting: Where painting is required prior to 30 days after paving rigid pavements, pretreat with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride.
- C. New Concrete Pavement:
 - 1. Allow a minimum cure time of 30 days before cleaning and marking.
 - 2. Clean by either sandblasting or water blasting to the following results:
 - a. No visible evidence of curing compound on peaks of textured concrete surface.
 - b. No heavy puddled deposits of curing compound in valleys of textured concrete surface.
 - c. Remaining curing compound is intact, with loose and flaking material completely removed.
 - d. Peaks of textured pavement surface are rounded in profile and free of sharp edges and irregularities.
 - 3. Allow a minimum drying time of 24 hours after water blasting before applying thermoplastic markings.
- D. New Asphalt Pavement: Allow a minimum pavement cure time of 30 days before applying paint.

3.2 PAINT APPLICATION

- A. General:
 - 1. Apply in accordance with Section 634, Permanent Pavement Markings of the FP-24 Standard Specifications.
 - 2. Thoroughly mix pigment and vehicle together prior to application and keep thoroughly agitated during application.
 - 3. Do not add thinner.
 - 4. Apply only when air and pavement temperatures are above 50 degrees F and less than 95 degrees F. Maintain paint temperature within these same limits.
 - 5. Apply only when surface is dry.
 - 6. Do not apply when conditions are windy to the point of causing overspray or fuzzy line edges.
 - 7. Provide guidelines and templates to control paint application.
 - 8. Establish control points at 100 ft intervals on tangent and at 50 ft intervals on curves.
 - 9. Maintain the line within 2 inches of the established control points and mark the roadway between control points as needed.
 - 10. Maintain the line dimension within 10 percent of the width and length dimensions defined in Standard Drawings
 - 11. Take special precautions in marking numbers, letters, and symbols.
 - 12. Sharply outline edges of markings and apply without running or spattering.
- B. Rate of Application:

1. Glass Bead Application:
 - a. Apply immediately following application of paint.
 - b. Use evenly distributed drop-on application method.
 - c. Rate: 8 pounds per gallon of paint.
 - d. Glass beads are not required on parking lot markings or symbols.
 2. On new pavement or new asphalt surface treatments, apply two coats of paint at a uniform rate of 210 square feet per gallon.
- C. Drying:
1. Provide maximum drying time to prevent undue softening of bitumen and pickup, displacement, or discoloration by traffic.
 2. If drying is abnormally slow, discontinue painting operations until cause is determined and corrected.
- D. Protection:
1. Protect markings from traffic until paint is thoroughly dry.
 2. Protect surfaces from disfiguration by paint spatters, splashes, spills, or drips.
- E. Cleanup: Remove paint spatters, splashes, spills, or drips from the Work and staging areas including areas outside the immediate Work area where spills occur.

END OF SECTION 32 17 23

SECTION 32 31 26 - WOOD FENCE

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes constructing wooden fences including foundations.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Wood-Preservers' Association (AWPA):
 - a. C1, All Timber Products - Preservative Treatment by Pressure Processes, All.
 - b. C5, Fence Posts - Preservative Treatment by Pressure Processes.
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M 168, Standard Specification for Wood Products
 - b. M 111, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 3. ASTM International (ASTM):
 - a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - b. C150, Standard Specification for Portland Cement.
 - c. F537, Standard Specification for Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials.
 - d. F1222, Standard Classification for Hardware for Wood Fencing.

1.3 DEFINITIONS

- A. Posts: As defined in ASTM F537.
- B. Rails: As defined in ASTM F537.
- C. Sweep: Maximum deviation of center of post or brace from line drawn between centers of butt and tip of post or brace.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings: Include construction details, material descriptions, dimensions of individual components, and finishes for fence and gates.
 - 2. Samples:

- a. Posts and Rails: Minimum 6-inch length.
- b. Ties, Fasteners, Fittings: One each.
- c. Approved Sample fittings may be incorporated in the Work when no longer needed by CO.
- d. Color samples of paint for wood posts and rails.

1.5 QUALITY ASSURANCE

- A. Erect fencing using skilled laborers experienced in wood fence construction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.7 SCHEDULING AND SEQUENCING

- A. Complete necessary Site preparation and grading before installing wood fences.

PART 2 PRODUCTS

2.1 GENERAL

- A. Fencing materials shall carry a tag identifying manufacturer.
- B. Manufactured Materials: Same kind and color for each type of fence on Project.

2.2 WOOD POSTS AND RAILS

- A. General: Conform to ASTM F537.
 - 1. Peel bark, except for red cedar posts and bracing, which do not require peeling. Trim knots flush with the surface and season the wood.
 - 2. For dimension lumber for fences, use timber that is sound, straight, and reasonably without knots, splits, and shakes. Provide surfaced on four sides finish.
 - 3. All posts shall have a minimum diameter of 8-inches and be a minimum of 5-foot long.
 - 4. All rails shall have a minimum diameter of 6-inches and be 8-foot, 6 inches long.
 - 5. Paint all wood on posts and rails with FLB82X Mahogany Brown paint. Submit color sample to CO for approval prior to painting the posts and rails.
- B. Treated Wood Posts and Rails:
 - 1. Species: Pine as addressed by AWPAC5; round posts only.
 - 2. Treatment: In conformance with AWPAC1 and AWPAC5.
 - 3. Creosote treatment of wood is not allowed.

2.3 BOLTS FOR WOOD POST/RAIL HARDWARE

- A. Conform to ASTM F1222.

- B. Furnish with Class A coating.
- C. Paint bolt heads and all exposed surfaces with FLB82X Mahogany Brown paint. Submit color sample to CO for approval prior to painting the metal hardware.
- D. Lag bolts shall be minimum 3/8 inch by 6 inches.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clear area to extent specified in Section 31 10 00 - Site Clearing, on both sides of fence. Eliminate ground surface irregularities along fence line to extent necessary to maintain clearance between bottom rail and finish grade.
- B. Stake locations of fence lines and terminal posts.

3.2 INSTALLATION - GENERAL

- A. Erect fencing in straight lines between angle points.
- B. Provide necessary hardware for a complete fence installation.
- C. Countersink lag bolts to be flush with rail.

3.3 WOOD POST INSTALLATION

- A. General:
 - 1. Do not cut off bottoms to avoid rock removal or additional excavation.
 - 2. Cut butt end of post square.
 - 3. Set posts with large end down, plumb, and in good line on side on which rails are to be fastened.
 - 4. Notch post similar to a "T-slot" or "Dove Tail" about 5 inches below the top of post, and 2 inches deep by 3 inches wide, use existing posts and rails as examples as directed by the CO.
 - 5. The top of post will be "crowned" with 6 rounded sides, use existing posts and rails as examples as directed by the CO.
- B. Postholes:
 - 1. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil.
 - 2. Clear of loose materials.
 - 3. Remove waste materials from postholes from Site or regrade into slopes on Site.
 - 4. Depth: 6 inches deeper than post embedment depth below finish grade, minimum 24 inches below finished grade.
 - 5. Place aggregate base bottom 6 inches of hole per Section 32 11 23 - Aggregate Base Course.
- C. Posts:

1. Set with minimum embedment below finished grade of 18 inches.
2. Verify set plumb, aligned, and at correct height and spacing.

D. Backfill:

1. After posts are placed and aligned, backfill holes with excavated native material or suitable earth material and compact with hand tampers or other approved method.
2. Backfill shall be placed in layers of 9 inches or less.
3. Mound excess earth around post to provide natural drainage.

3.4 REPAIR

- A. Repair damage to painted surfaces.

3.5 CLEANUP

- A. Remove excess fencing materials and other debris from Site.

END OF SECTION 32 31 26

SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Benches.
- B. Related Requirements:
 - 1. Section 31 23 00 "Excavation and Fill" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance and Warranty Information: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Flat Bench
 - 1. Material: 100% recycled HDPE.
 - 2. Length: 72 inches.
 - 3. Style: Flat bench, no back or arms.
 - 4. Top Finish/Color: Brown Lumber or equal.
 - 5. Base Material: Aluminum
 - 6. Base Finish/Color: Black.
 - 7. Attachment: Attached to concrete slab with bracket anchors provided by manufacturer. All fasteners shall be stainless steel.
 - 8. Bench shall be UV protected.

9. Bench shall have load-bearing capacity to exceed standard seating loads in public spaces and in accordance with local, state and federal codes.
- B. Backed Bench
1. Material: 100% recycled HDPE.
 2. Length: 72 inches.
 3. Style: Backed bench, one arm in center of bench.
 4. Top Finish/Color: Brown Lumber or equal.
 5. Base Material: Aluminum.
 6. Base Finish/Color: Black.
 7. Attachment: Attached to concrete slab with bracket anchors provided by manufacturer. All fasteners shall be stainless steel.
 8. Bench shall be UV protected.
 9. Bench shall have load-bearing capacity to exceed standard seating loads in public spaces and in accordance with local, state and federal codes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored or positioned at locations indicated on Drawings.

END OF SECTION 32 33 00

SECTION 32 91 13 - SOIL PREPARATION

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes preparing finish grades and topsoil.
- B. No fertilizer or soil amendments shall be allowed. Wood chips may be used as a soil additive as detailed in this section.
- C. All areas used as construction staging, parking or subjected to heavy use will require decompaction to a depth of 12 inches to prepare the soil for seeding and/or revegetation. The extent of areas to be decompacted shall be approved by the CO.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. C33/C33M, Standard Specification for Concrete Aggregates.
 - b. C602, Standard Specification for Agricultural Liming Materials.
 - c. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
 - d. D5268, Standard Specification for Topsoil Used for Landscaping Purposes.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Samples:
 - a. Representative of stockpiled topsoil.

PART 2 PRODUCTS

2.1 CONSERVED TOPSOIL

- A. General: Natural, friable, sandy loam, obtained from clearing and grubbing areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.
- B. Source: Windrow and stockpile material onsite, in accordance with Section 31 10 00 - Site Clearing.

- C. Native Topsoil Previously Stripped and Stockpiled Under This Contract: Contractor shall be responsible for estimating quantity of stockpiled topsoil available onsite for reclamation Work.
 - 1. Topsoil shall not be moved from the Job Site unless authorized by the CO.
 - 2. Topsoil shall not be moved from designated DO NOT MOVE zones identified by the CO with Park consultation.

2.2 SOIL ADDITIVES

- A. Wood chips produced as part of clearing or tree removal can be added to topsoil as described in 31 10 00 - Site Clearing.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

- A. Existing Conditions: Inspect and verify that rough subgrade preparation and elevations conform to grading plans before proceeding with Work of this section.
- B. Scarify subgrade to minimum depth of 12 inches where topsoil is to be placed.
- C. Remove stones over 2-1/2 inches in any dimension, sticks, roots, rubbish, and other extraneous material.
- D. Limit preparation to areas which will receive topsoil within 2 days after preparation.

3.2 TOPSOIL PLACEMENT

- A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.
- B. Mix soil amendments (wood chips only, as described above) before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before seeding. Do not use fertilizer.
- C. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade. A minimum depth of 4 inches of topsoil must be placed in areas to be reseeded.
- D. Remove stones exceeding 1-1/2-inch diameter, roots, sticks, debris, and foreign matter during and after topsoil placement.
- E. Do not place topsoil on surfaces without prior approval from the CO.
- F. Adjust placement of conserved topsoil as directed by the CO in the field.
- G. Topsoil placement shall be coordinated with seeding timeframe.

END OF SECTION 32 91 13

SECTION 32 92 00 - TURF AND GRASSES

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes groundcover vegetation. The NPS will complete all seeding and planting activities. The Contractor shall be responsible for soil preparation per Section 32 91 13 – Soil Preparation and all erosion control installation and maintenance.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product labels/data sheets for all materials including erosion control blanket.
- B. Informational Submittals:
 - 1. Submit manufacturer's installation recommendations for erosion control blanket.

1.3 DELIVERY, STORAGE, AND PROTECTION

- A. Store all erosion control materials and products in accordance with the manufacturer's directions.

1.4 SEQUENCING AND SCHEDULING

- A. Complete Work specified in Section 32 91 13 - Soil Preparation, before starting Work of this section.
- B. Notify CO at least 5 days in advance of material delivery:
- C. Contractor shall notify CO a minimum of 2 weeks prior to soil preparation so NPS can prepare for seeding activities.

1.5 MAINTENANCE SERVICE

- A. The Park will maintain plantings beyond contract period.

PART 2 PRODUCTS

2.1 FERTILIZER

- A. No fertilizer will be used in any revegetation work unless requested by the CO. If requested, the CO will specify the composition of the fertilizer.

2.2 SEED

- A. Government will mix and provide all seed for this project and perform all seeding.

2.3 EROSION CONTROL BLANKET

- A. Furnish an erosion control blanket composed of certified weed free processed all-natural fibers (straw is not acceptable) mechanically bound between two all-natural fiber nettings to form a continuous matrix with a minimum dry weight of 0.4 pounds per square yard according to ASTM D 6475. Netting must be a loose weave, non-welded, with movable, floating, jointed netting. Utilize U-shaped wire staples with a minimum of 12-inch-long legs and 8-gauge thickness to facilitate installation without bending. Ensure materials are protected from weather and/or handling damage.
- B. Erosion control blanket shall be installed as shown on the Drawings.

PART 3 EXECUTION

3.1 PREPARATION

- A. All seeding shall be completed by the NPS between October 1st and November 30th.
- B. Prior to seeding, the Contractor shall grade areas to smooth, even surface with loose, uniformly fine texture.
 - 1. Roll and rake, remove ridges, fill depressions to meet finish grades.
 - 2. Limit such Work to areas to be planted within immediate future.
 - 3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.
- C. Remove weeds and weed debris.
- D. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.2 FERTILIZER

- A. No fertilizer will be used in any revegetation work unless requested by the CO. If requested, the CO will specify the composition of the fertilizer.

3.3 SEEDING

- A. Seeding and planting will be completed by NPS. Contractor is responsible for topsoil preparation in accordance with Section 32 91 13 – Soil Preparation.
- B. Contractor shall notify the Contracting Officer a minimum of 2 weeks prior to topsoil preparation so NPS can procure seed and coordinate seeding activities. Within 48 hours of completion of seeding by NPS, the Contractor shall install appropriate erosion control products at the locations shown on the Drawings.

3.4 FIELD QUALITY CONTROL

- A. The Park will assume responsibility of field quality control at the conclusion of the contract scope of work.

END OF SECTION 32 92 00

SECTION 33 41 01 - STORM DRAIN PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. This work includes pipe, end sections, and fittings used to convey surface water and stormwater by gravity flow. Corrugated Steel Pipe and flared Steel End Sections shall have a bituminous coated finish for corrosion protection as per the manufacturer's instructions.
- B. Existing culverts may be salvaged and reused provided they meet the requirements of the Drawings and Specifications. All culverts salvaged for reuse shall be approved by the CO prior to placement.
- C. Provide a minimum of 14 days' notice to the CO prior to any culvert work to allow for an archeological monitor provided by the Park to be present. The CO will provide locations where the monitor is required to be present during work.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section and supplemental Data Sheets:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M 36, Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
 - b. M 111, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products (ASTM Designation: A123/A123M-17)
 - c. M 170, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
 - d. M 196, Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
 - e. M 207, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
 - f. M 218, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized), for Corrugated Steel Pipe
 - g. M 245, Standard Specification for Corrugated Steel Pipe, Polymer-Precoated, for Sewers and Drains
 - h. M 274, Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe
 - i. M 289, Standard Specification for Aluminum-Zinc Alloy Coated Sheet Steel for Corrugated Steel Pipe
 - j. M 294, Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60- in.) Diameter
 - k. M 304, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter

- l. M 330, Standard Specification for Polypropylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
 - m. MP 20, Standard Specification for Steel-Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
 - n. PP 63, Standard Practice for Pipe Joint Selection for Highway Culvert and Storm Drains
2. ASTM International (ASTM):
- a. A 500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - b. C 443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - c. D 1056, Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

1.3 SUBMITTALS

A. Informational Submittals:

- 1. Manufacturer's Certification of Compliance.
- 2. Manufacturer's data sheets and installation instructions.

PART 2 PRODUCTS

2.1 MATERIAL

A. Pipe

1. General

- a. Provide pipe according to the size, material or interior roughness, and joint type specified.
 - 1) Meet the material requirements in Table 2-1.
 - 2) Meet the joint requirements of AASHTO PP 63 for silt-tight and leak-resistant joints.
 - 3) Determine the strength and thickness of the pipe required based on the cover over the pipe. Refer to the Drawings.
 - 4) Maintain the same type of pipe material, joint, strength, and thickness throughout the entire length of pipe.
- b. Internally label each section of pipe with the manufacturer's name or trademark, nominal diameter, and manufacture date. Include the pipe class, gauge, and coating according to the pipe material type.
 - 1) Place the pipe so that the location of the label is above the spring line of the pipe.

Table 2-1

Pipe Material Specifications	
Interior Roughness and Material Type	
Corrugated	
Polymer Coated Corrugated Steel Pipe and Pipe Arch	AASHTO M 245

2. Metal Pipe – Steel and Aluminum

- a. Do not allow pipes of different types of metal to contact each other.
- b. Use rubber gaskets on all connecting bands. Refer to ASTM D 1056 for flat gaskets and ASTM C 443 for O-ring gaskets.
- c. Use bands with projections (dimple bands) only in extension of existing pipes or a field cut where annular corrugations do not exist.

B. Steel end section

1. End Section: Galvanized steel sheeting according to AASHTO M 218.
2. Smooth Tapered Sleeve, when required: Galvanized steel sheeting according to AASHTO M 218.
3. Refer to Drawings.

C. Corrugated-steel pipe and fittings

1. Furnish pipe, special sections (such as elbows, branch connections, and prefabricated flared end sections) and coupling bands conforming to AASHTO M 36 and either AASHTO M 218, AASHTO M 274, or AASHTO M 289 for the dimensions and thicknesses specified. Refer to Drawings for coupling and end section details.
2. Fabricate underdrain pipe from steel sheets with a minimum thickness of 0.052 inches (1.32 millimeters). Use any class of perforation specified in AASHTO M 36.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE, FITTINGS, AND APPURTENANCES

A. General:

1. Pipe invert may deviate from line or grade up to 1/2 inch for line and 1/4 inch for grade, provided that finished pipe line will present a uniform bore, and such variation does not result in a level or reverse sloping invert, or less than minimum slope shown.
2. Bed pipe to form continuous and uniform bearing and support for pipe barrel between joints. Do not rest pipe directly on bell or pipe joint.
3. Prevent entry of foreign material into gasketed joints.
4. Plug or close off pipes that are stubbed off for manhole, concrete structure, or for connection by others, with temporary watertight plugs, unless indicated otherwise.

- B. Excavation and backfill
 - 1. Perform the work described under Section 31 23 00 – Excavation and Fill.
 - 2. Keep trenches free from water.
 - 3. Grade and prepare the bottom of the trench to provide a firm and uniform bearing throughout the entire length of the pipe.
 - a. Do not use blocking to bring the pipe to grade.
 - b. Shape the pipe foundation and bedding to have recesses to fit any projecting hubs or bells.
 - 4. Remove and relay or replace pipe that is out of alignment, not joined properly or damaged before placing backfill.
- C. Furnish prefabricated steel end sections compatible with the adjoining pipe.
- D. Prepare a smooth foundation free of rock and debris, capable of uniformly supporting the end section.
- E. Follow manufacturer's recommendations for connecting pipes and for connecting pipe to end sections, concrete headwalls, catch basins, and similar structures.
 - 1. Do not allow pipes of different types of metal to contact each other.
- F. Place the end section at the same alignment and slope as the adjoining pipe.
- G. Embed the toe plate for steel end sections.
- H. Connect the end section to the adjoining pipe according to the Drawings.
 - 1. Use a 3 /8 inch neoprene flat gasket when connecting to a dissimilar metal. Refer to ASTM D 1056.
- I. Backfill and grade slopes to match the end section.

3.2 POST INSTALLATION PIPE INSPECTION

- A. Inspect pipes after installation of pipe, placement of backfill and before placing pavement or finished grade for deflection.
- B. Notify the Contracting Officer at least 24 hours before performing an inspection. Clean and flush the pipe with water immediately before the inspection.
 - 1. Remove and dispose material and debris from pipes.
- C. Manual Inspection
 - 1. Perform manual inspection for pipes in the presence of the Contracting Officer.
 - a. Follow OSHA requirements for inspecting confined entry spaces.

2. Observe and document the following:
 - a. Deflection - Take the following measurements every 10 ft along the length of the pipe to the nearest ¼ inch:
 - 1) Vertically from the crown to invert.
 - 2) Horizontally at the spring line.
 - 3) Two measurements, each diagonally at 45 degrees to the pipe springline.
 - b. Cracks – Measure cracks using a device capable of measuring 0.01 inch.
 - c. Joint Gaps – Measure the widest separation at each joint to the nearest ¼ inch.
 - d. Damage.

3.3 FIELD QUALITY CONTROL

A. General

1. Each pipe shall be inspected to verify that the following criteria have been met:
 - a. Alignment
 - b. Deflection
 - c. Joint gap
 - d. Damage
2. Proposed resolutions for nonconforming pipes require the seal of a licensed Professional Engineer competent in the structural design of the pipe material being evaluated.

B. Alignment

1. Do not exceed the installation horizontal and vertical alignment tolerances in Table 3-1.

Table 3-1

Installation Alignment Tolerances		
Design Grade	Horizontal	Vertical* Inch/100 ft
>1%	Not to exceed the pipe manufacturer's requirements	1 ½
0.5% - 1%		1
<0.5%		½

* Increase tolerance by 50 percent for pipes with silt tight joints.

C. Deflection

1. Do not exceed a 5 percent shape change from the nominal diameter.

- a. Proposals for acceptance of pipes with a deflection greater than 7.5 percent will be rejected.

D. Joint Gap

- 1. Do not exceed the joint separation, measured along length of pipe, in Table 3-2.
 - a. Repair or replace joints with visible signs of soil or water infiltration.

Table 3-2

Joint Gap Tolerances	
Nominal Diameter (inches)	Separation (inches)
12 to 36	0.75
42 to 48	1.00
54 to 90	1.25
96 to 144	1.75

E. Damage

- 1. Pipes are to be free from:
 - a. Cuts, cracks, spalls, chips, or punctures.
 - 1) Cracks are allowable up to 0.01 inch in width for reinforced concrete pipe
 - b. Loss or delamination of coatings.
 - c. Exposed reinforcing steel.
 - d. Imperfect concrete mixing and casting such as honeycomb or open texture.

END OF SECTION 33 41 01

APPENDIX A

**Bryce Canyon National Park Visitor Center Shuttle Stops
Final Geotechnical Engineering and Pavement Recommendation Report**

Bryce Canyon National Park, Utah

Yeh Project No. 224-307

January 28, 2025

Prepared for:

Stantec Consulting Services
Denver Office
410 17th Street, Suite 400
Denver, Colorado 80202-4427
Attn: Tracy Lawless, PE, SE

Prepared by:

Yeh and Associates, Inc.
2000 Clay Street, Suite 200
Denver, Colorado 80211
Phone: 303-781-9590

**Bryce Canyon National Park Visitor Center Shuttle Stops
Final Geotechnical Engineering and Pavement Recommendation Report**

Bryce Canyon National Park, Utah

Yeh Project No. 224-307

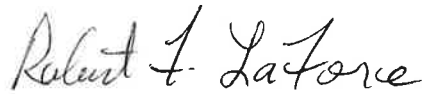
January 28, 2025

Prepared by:



Matt Kelly, E.I.T.
Staff Engineer

Prepared by



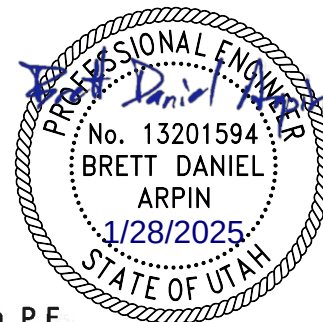
Robert F. LaForce, P.E.
Senior Project Manger

Reviewed by:



Masoud Ghaeli, P.E.
Senior Project Manager

Reviewed by:



Brett D. Arpin, P.E.
Project Manager

Table of Contents

1. PURPOSE AND SCOPE OF STUDY	1
2. PROPOSED CONSTRUCTION	2
3. PROJECT AREA GEOLOGY	2
4. SITE INVESTIGATION	3
4.1 SUBSURFACE EXPLORATION	3
4.2 SUBSURFACE CONDITIONS	4
4.3 LABORATORY TESTING	5
4.3.1 Results	5
4.3.2 Sulfate Resistance and Corrosion Potential	6
5. CONSTRUCTION RECOMMENDATIONS	6
5.1 SITE GRADING CONDITIONS	7
5.2 FILL MATERIALS AND PLACEMENT	7
5.3 DRAINAGE CONSIDERATIONS	8
6. PAVEMENT DESIGN	8
6.1 TRAFFIC LOADING	8
6.2 DESIGN PARAMETERS	9
6.3 RECOMMENDED PAVEMENT THICKNESS	9
6.4 RECOMMENDED ASPHALT MIXES	10
7. SUBGRADE PREPARATION	10
8. LIMITATIONS	10
9. REFERENCES	11

List of Figures

Figure 1 – Project and Boring Location Map	1
Figure 2 – Project Area Geology Map	3

List of Tables

Table 5-1 – Analytical Test Results	6
Table 6-1 – Pavement Design Parameters for Shuttle Stops.....	9
Table 6-2 – Recommended ACP Pavement Thickness	9
Table 6-3 – Recommended ACP Lift Thickness	10

List of Appendices

Appendix A – Legend, and Boring Logs
Appendix B – Drilling and Pavement Condition Photos
Appendix C – Soil Test Data
Appendix D – Traffic Loading Information
Appendix E – Pavement Design and Binder Recommendations

1. PURPOSE AND SCOPE OF STUDY

This report presents the results of Yeh and Associates, Inc.'s (Yeh) geotechnical engineering investigation and pavement recommendations for the construction of new shuttle stops at the Visitor Center of Bryce Canyon National Park. The project and boring locations are shown in Figure 1. The purpose of this report is to provide geotechnical investigation and pavement recommendations for use by Park Personnel and Stantec Consulting in the design of hot mix asphalt (HMA) pavement for new and extended shuttle stops in Bryce Canyon National Park.



Figure 1 – Project and Boring Location Map

Our scope of work includes:

- Drilling borings to obtain soil samples to provide subsurface information at the proposed shuttle locations.

- Performing laboratory tests on select soil samples collected during subsurface investigation to evaluate the engineering characteristics of the on-site soils and bedrock.
- Preparing a report that:
 - Summarizes field and laboratory data.
 - Presents the results of geotechnical engineering analysis.
 - Describe the existing pavement conditions.
 - Provides pavement design recommendations for the proposed shuttle stops.

2. PROPOSED CONSTRUCTION

The project location is along Bryce Canyon National Park Road south of the Park Visitor Center. The project will construct new shuttle stops on the west side of the road and extend the existing shuttle stop on the east side.

3. PROJECT AREA GEOLOGY

The site is overlain by Holocene age alluvium, colluvium and slope wash (Bowers, 1991, USGS). This consists of poorly sorted and inconsistent beds of mixed clay, silt, sand and gravel. This layer is between 0 and 40 feet thick. Adjacent to the roadway are the Pink Limestone member and Boat Mesa conglomerate. The Pink Limestone member, which is responsible for the hoodoos and spires found to the south and east, underlies the alluvium. The Pink Limestone consists of alternating beds of limestone and calcareous mudstones. The basal layer of this unit is a conglomerate that has varying amounts of sand, gravel and limestone which may be up to 40 feet thick in some areas. Nearby to the northeast and the south is the Boat Mesa conglomerate which consists of alternating layers of calcareous sandstone, conglomeratic sandstone and limestone. Figure 2 presents a project area geology map.

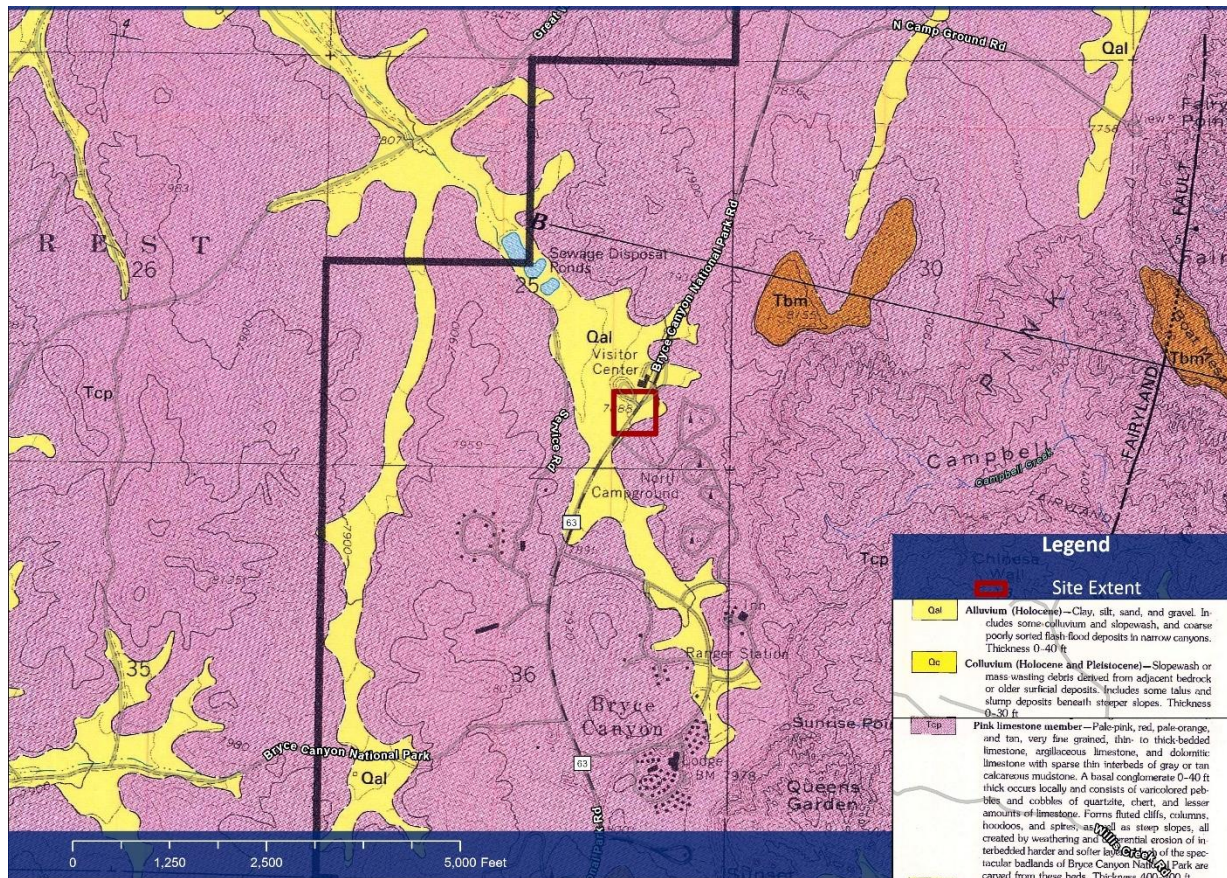


Figure 2 – Project Area Geology Map

4. SITE INVESTIGATION

4.1 Subsurface Exploration

The subsurface explorations were conducted on November 1, 2024 by completing 5 borings both through the existing pavement and at unpaved areas at the future shuttle stop locations.

The borings were advanced by a truck-mounted CME 75 drill rig equipped with an automatic (i.e., hydraulic) hammer, using solid-stem drilling methods, operated by ConeTec of Salt Lake City, Utah. Traffic control was provided by the Utah Barricade Company of West Valley City, Utah.

The boring locations were originally marked in the field by Park and Stantec personnel and all borings were drilled within a few feet of the original locations following minor adjustments for utility clearances.

Modified California (MC) tube, standard penetration test (SPT) split spoon, and bulk samples were obtained by Yeh during the site investigation using a drill rig with a calibrated automatic hammer. Bulk samples of the subsurface material were collected between two and five feet below the ground surface. The SPT split spoon sampler has an outside diameter of 2.0 inches, an interior diameter of 1.375 inches, and is 18 inches in length. The MC sampler has an outside diameter of 2.5 inches, and an interior diameter of 2.0 inches, is 12 inches in length, and uses 4-inch long brass liners to collect samples. The samplers were seated at the bottom of the test hole, then advanced by a 140-pound hammer falling a distance of 30 inches. The penetration resistance shown on the boring logs is the total number of blows required to advance the sampler for the final two 6-inch intervals or a fraction thereof and constitutes the penetration resistance value. If 50 blows could not advance the sampler in a 6-inch interval, driving was terminated. The penetration resistance value is a useful index to evaluate the consistency and relative density, or hardness of the materials encountered.

Modified California or SPT samples were taken at depths of 2 feet, 5 feet and 10 feet in most borings along with bulk soil samples at depths from 2 to 5 feet. Boring logs are presented in Appendix A.

4.2 Subsurface Conditions

Samples YA-B1 and YA-B2 were taken through the existing pavement and the HMA thicknesses were 4.0 inches and 4.5 inches, respectively. YA-B1 was taken in the existing northbound Shuttle Stop pavement and YA-B2 was taken through the existing northbound mainline pavement. A review of photographs taken during drilling show the existing pavement is in excellent condition.

Drilling photographs are presented in Appendix B. The photographs also help document the pavement conditions. The mainline boring YA-B2 appears to have a layer of sand immediately below the pavement and both the shuttle stop and mainline pavement are underlain with fill material consisting of clayey sand, SC.

Borings YA-B3, YA-B4 and YA-B5 were taken in the area to be developed for the new construction and contain similar subgrade soils. After removing the topsoil, most of this area will receive fill material.

At the time of drilling, groundwater was not encountered below the existing surface in any of the boring locations. Year-round groundwater observations were not performed as part of the field investigation. Groundwater conditions in the study area may vary throughout the year. Groundwater variations can occur during different seasons, following precipitation events, after site grading

changes, and due to changes in surface and subsurface drainage characteristics of the surrounding area.

4.3 Laboratory Testing

Testing was performed in the laboratory on selected soil samples to evaluate their engineering characteristics. Laboratory test results are presented in Appendix C and summarized on the boring logs in Appendix A. The following tests were performed in general accordance with locally recognized standards:

- Sieve analysis (ASTM D6913)
- Soil classification (ASTM D2487, D3282, AASHTO M145)
- Natural moisture content determination (ASTM D2216)
- Atterberg Limits (ASTM D4318, AASHTO T89, AASHTO T90)
- Water-soluble sulfate content (ASTM D4327, AASHTO T290)
- Water-soluble chloride content (ASTM D4327, AASHTO T291)
- Resistivity (AASHTO T288)
- pH (AASHTO T289)
- R-value (AASHTO T190)
- One-dimensional swell or collapse of soils (ASTM D4546, AASHTO T 258)

4.3.1 Results

The sieve analysis and Atterberg limits test results were used to classify soils and bedrock according to Unified Soil Classification System (USCS) and AASHTO standards. In general, the tested soils classified as clayey sand (SC), clayey Gravel (GC), sandy lean clay (CL), and lean clay with sand and silt (SC-SM) according to the USCS. These samples have AASHTO classifications of A-1-b, A-2-6, A-4, and A-6 according to AASHTO standards. The bedrock sample was encountered a depth of 10.5 feet in Boring YA-B5 and was identified as clayey sandstone.

R-values of 18 and 24 were obtained from lab testing on bulk samples of YA-B2 and YA-B4, respectively. All the samples tested had plastic indices (PI) below 20. Two (2) swell/consolidation tests were performed on samples from YA-B3 and YA-B4. Swell/consolidation values ranged from -0.1 percent to 0.1 percent, when wetted under an applied pressure using 1000 pounds per square foot

(psf). These swell/consolidation measurements represent a low probability of swell/consolidation problems.

Using equations from Report NCHRP 128, also in the AASHTO 1993 Pavement Design Guide, a resilient modulus of 4,627 psi was calculated using the R-value of 18 for input to the pavement design program.

4.3.2 Sulfate Resistance and Corrosion Potential

Two representative soil samples were selected for chemical testing including water-soluble sulfate, water soluble chloride content, pH, and electrical resistivity. The test results are presented in Appendix B and summarized in Table 5-1. This concentration of water-soluble sulfates represents a Class 0 degree of sulfate attack on concrete exposed to these geologic materials. The degree of attack is based on a range of Class 0 (negligible) to Class 3 (very severe) as described in the American Concrete Institute (ACI) Standard 201.2R, "Guide to Durable Concrete".

A qualified corrosion engineer should review the laboratory data and boring logs to determine the appropriate level of corrosion protection for materials in contact with these soils.

Table 5-1. Analytical Test Results

Boring No.	Sample Depth (ft)	Soil Classification	Water-Soluble Sulfates (%)	Water-Soluble Chlorides (%)	pH	Resistivity (ohm-cm)
YA-B2	2-5	A-4(2) – SC	0.003	0.0390	7.7	7,950
YA-B4	2 - 5	A-2-6(0) - GC	0.003	0.0390	7.2	7,650

5. CONSTRUCTION RECOMMENDATIONS

The following sections present recommendations for site preparation, excavation, subgrade preparation, fill placement, and surface drainage on the project. Site preparation and earthwork operations should be performed in accordance with the requirements presented in Section 204 of FP-24. Earthwork should be observed and evaluated by a qualified representative of the engineer or project manager. The evaluation of earthwork should include observation and testing of engineered fills, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

5.1 Site Grading Conditions

Initial site work should consist of stripping vegetation, organics, debris, and other deleterious materials from the proposed structure and pavement areas and any other areas to receive fill. All exposed surfaces should be free of mounds and depressions, which could prevent uniform compaction. Stripped materials consisting of vegetation and organic materials should be wasted from the site or used to revegetate landscaped areas after completion of grading operations. Once properly cleared, all exposed areas which will receive fill should be scarified and compacted in accordance with Section 204 of FP-24.

Based upon the subsurface conditions encountered, subgrade soils exposed during construction are anticipated to be relatively stable. However, the stability of the subgrade may be affected by precipitation, repetitive construction traffic, and other factors. If unstable conditions are encountered or develop during construction, stability may be improved by scarifying and drying the subgrade soils. In general, permanent cut slope angles in on-site overburden materials should not exceed 3H:1V, however, flatter slope angles may be necessary for revegetation.

5.2 Fill Materials and Placement

Prior to receiving fill, the exposed subgrade materials should be scarified to a minimum depth of 12 inches and the scarified materials appropriately processed and compacted. Any imported embankment placed under the future pavement section (ABC) should have a minimum R-value of 18 to match or exceed the R-value of the on-site materials.

Visual inspection and proof rolling at the surface of the compacted fill and the subgrade is required to identify potential areas where the subgrade contains soft/loose soils. Areas which deform non-uniformly under heavy wheel loads should either be moisture conditioned and recompact or excavated and replaced with select material such as Select Borrow conforming to Section 704.02 of FP-24 and recompact. The depth of over-excavation, if required, should be determined during construction.

Fill placed on existing slopes that are steeper than 3H:1V should be properly benched in accordance with Section 204.09 of FP-24. Compaction should be performed in horizontal lifts that are 12 inches or

less in loose thickness, using equipment and procedures that will produce a uniform fill with the required moisture contents and densities throughout the lift.

We recommend that the subgrade preparation process including soil excavation, the placement and compaction of materials, proof rolling, and visual inspection of foundation soils be observed and evaluated by the geotechnical engineer of record or the project manager's representative.

5.3 Drainage Considerations

Moisture conditions in the subgrade soils influence the performance of pavements, foundations, and other improvements. The risk of wetting these subgrade soils can be reduced by proper planning and maintenance of surface grades and drainage. Excessive wetting of the subsurface before, during, and after construction can cause movement of pavements and foundations. Precautions should be taken to avoid wetting or drying of open excavations for foundations and other earthwork.

Positive drainage away from the pavement structures should be provided. Proper design of drainage should include preventing the ponding of water on or immediately adjacent to structures and pavements. Surface features that could retain water in areas adjacent to the roadway or structures should be graded to drain. Backfill against structures should be moisture-conditioned, well-compacted, and free of all construction debris to reduce the possibility of moisture infiltration and migration.

6. PAVEMENT DESIGN

6.1 Traffic Loading

Last year the Shuttle Service for Bryce Canyon National Park ran from April 6, 2024 to October 31, 2024 and averaged 70 shuttle buses per day resulting in a total of 12,132 shuttle buses stopping at the southbound shuttle stop. The park anticipates continuing the same level of shuttle bus service with a change to battery powered buses which are heavier than the current vehicles.

In the Federal Lands Highway's Project Development and Design Manual (PDDM), buses are classified as Class 4 vehicles. The Truck Factor, equivalent single axle load (ESAL) value, for Class 4 vehicles ranges from 0.75 to 1.75. To address the battery powered buses, we recommend a Truck Factor of 1.5

ESAL per vehicle to address the loading on the shuttle stops. That loading will result in a 20-Year Design equivalent single axle loads (ESAL) loading of 420,000. Appendix D presents the traffic loading data calculations and data supplied by Park personnel.

6.2 Design Parameters

Table 6-1 presents the hot mix asphalt (HMA) design parameters for addressing the new Shuttle Bus Stop pavement. This design was completed through the Win Pas program which follows the AASHTO 1993 Pavement Design Guide. HMA design parameters we obtained from Section 11.2.1.4 of the current version of the PDDM.

Table 6-1. Pavement Design Parameters for Shuttle Stops

Design Parameter	Parameter Value
Traffic Loading, 20-Year ESAL	420,000
Reliability (%)	80
Initial Serviceability	4.2
Terminal Serviceability	2.0
Overall Deviation	0.49
Subgrade R-value	18
Subgrade Resilient Modulus M_R (psi)	4,627
HMA Structural Layer Coefficient (/in.)	0.44
ABC Layer Coefficient (/in.)	0.12
Minimum Structural Number	3.26
Design Structural Number	3.36

6.3 Recommended Pavement Thickness

Table 6-2 presents the recommended asphalt pavement and aggregate base course (ABC) thickness for the shuttle stops. The Win Pas Pavement design program output is presented in Appendix D. The recommended HMA and ABC layer thicknesses are greater than the existing pavement.

Table 6-2. Recommended HMA Pavement Thickness

Roadway Section	Number of Lanes	Minimum HMA Thickness, in.	Minimum ABC Thickness, in
New Shuttle Stop Pavement	1	6.0	6.0

6.4 Recommended Asphalt Mixes

The asphalt mixes for the shuttle stops should be 75 gyrations mixes meeting the requirements for either nominal ½ or ¾ inch mix and conforming to the requirements in Section 703 of FP-24. The gradations should conform to Table 703-3 of FP-24.

Using the Long Term Pavement Performance Binder Program (LTTPBind) the recommended asphalt binder based on Bryce Canyon Weather Station data is PG 52-28. Because of the stopping and standing movements of traffic at the shuttle stops, we recommend that performance graded binder meeting the requirements for PG 64-28 be used to help control rutting. The PG 64-28 meets the low temperature requirements for this area and exceeds the high temperature requirements for the project area. PG 64-28 is readily available in Utah. A printout from the LTTPBind Binder Selection program is presented in Appendix D following the pavement design program output.

Table 6-3 presents the recommended asphalt pavement lift thicknesses and asphalt binder performance grade for the shuttle stops.

Table 6-3. Recommended HMA Lift Thicknesses

Roadway Section	HMA Lift Thicknesses, in.	Performance Grade Asphalt Grade
Shuttle Stops	Top Mat – 2.0 in. Middle Lift – 2.0 in. Bottom Lift – 2.0 in.	PG 64-28

7. SUBGRADE PREPARATION

Since the new shuttle stop pavement will need to be constructed on fill, we recommend that following removal of existing vegetation and top soil, the in-place subgrade be sub-excavated and recompact (moisture treated) at optimum to 2 percent above optimum moisture to a depth of 6 inches below the ABC. We also recommend that any imported soil placed below the new pavement have a minimum R-value of 18.

8. LIMITATIONS

This study was conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design and construction purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from exploratory borings

and field review and the proposed type of construction. Subsurface variations across the site are likely and may not become evident until excavation is performed. If during construction, fill, soil, rock, or water conditions appear to be different from those described herein, this office should be advised at once so reevaluation of the recommendations may be made. We recommend on-site observation of excavations and pavement subgrade conditions by a representative of the geotechnical engineer.

9. REFERENCES

Standard Specification for Roads and Bridges on Federal Projects, FP-24, Federal Highway Administration, 2024.

Federal Lands Highway, Project Development and Design Manual, PDDM, 2018

Geologic Map of Bryce Canyon National Park and Vicinity, Southwestern Utah, Bowers, 1991, USGS. Miscellaneous Investigations Series Map I-2108. Scale 1:24,000.

AASHTO 1993 Pavement Design Guide, American Association of State Highway and Transportation Organization (AASHTO) 1993

Evaluation of AASHTO Interim Guides for Design of Pavement Structures, Report NCHRP 128, Highway Research Board, 1972.

Appendix A

BORING LEGEND AND LOGS



Legend for Symbols Used on Borehole Logs

Sample Types



Bulk Sample of
auger/odex cuttings



Modified California
Sampler
(2.5 inch OD, 2.0
inch ID)



Standard
Penetration Test
(ASTM D1586)

Drilling Methods



HOLLOW-STEM
AUGER

Lithology Symbols

(see Boring Logs for complete descriptions)



Fill



Asphalt



Poorly Graded
Gravel with Clay
(GP-GC)



Sandstone



Clayey Gravel (GC)



Silty, Clayey Sand
(SC-SM)



Clayey Sand (SC)



Well-Graded Sand
with Gravel (SW)



Lean Clay (CL)

Lab Test Standards

Moisture Content	ASTM D2216
Dry Density	ASTM D7263
Sand/Fines Content	ASTM D421, ASTM C136, ASTM D1140
Atterberg Limits	ASTM D4318
AASHTO Class.	AASHTO M145, ASTM D3282
USCS Class.	ASTM D2487
(Fines = % Passing #200 Sieve Sand = % Passing #4 Sieve, and retained on the #200 Sieve)	

Other Lab Test Abbreviations

pH	Soil pH (AASHTO T289-91)
S	Water-Soluble Sulfate Content (AASHTO T290-91, ASTM D4327)
Chl	Water-Soluble Chloride Content (AASHTO T291-91, ASTM D4327)
S/C	Swell/Collapse (ASTM D4546)
UCCS	Unconfined Compressive Strength (Soil - ASTM D2166, Rock - ASTM D7012)
R-Value	Resistance R-Value (ASTM D2844)
DS (C)	Direct Shear cohesion (ASTM D3080)
DS (phi)	Direct Shear friction angle (ASTM D3080)
Re	Electrical Resistivity (AASHTO T288-91)
PtL	Point Load Strength Index (ASTM D5731)

Notes

1. Visual classifications are in general accordance with ASTM D2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)".
2. "Penetration Resistance" on the Boring Logs refers to the uncorrected N value for SPT samples only, as per ASTM D1586. For samples obtained with a Modified California (MC) sampler, drive depth is 12 inches, and "Penetration Resistance" refers to the sum of all blows. Where blow counts were > 50 for the 3rd increment (SPT) or 2nd increment (MC), "Penetration Resistance" combines the last and 2nd-to-last blows and lengths; for other increments with > 50 blows, the blows for the last increment are reported.
3. The Modified California sampler used to obtain samples is a 2.5-inch OD, 2.0-inch ID (1.95-inch ID with liners), split-barrel sampler with internal liners, as per ASTM D3550. Sampler is driven with a 140-pound hammer, dropped 30 inches per blow.
4. "ER" for the hammer is the Reported Calibrated Energy Transfer Ratio for that specific hammer, as provided by the drilling company.
5. Rock strength grade (R0 to R6) based on Brown (1981).



Boring Began: 11/1/2024
Boring Completed: 11/1/2024
Drilling Method(s): Hollow-Stem Auger

Total Depth: 11.5 ft
Ground Elevation: 7900
Coordinates: Lat: 37.639245 Long: -112.169848 (Not Surveyed) Inclination from Horiz.: Vertical
Location: Southern end of the visitor center shuttle stop. Night Work: ☐

Weather Notes: 35° F Partly
Cloudy

Driller: ConeTec

Drill Rig: CME 75 Truck

Hammer: Automatic (hydraulic), ER: %

Logged By: M. Kelly

Final By: M. Kelly

Groundwater Levels: Not Observed

Symbol	-	-	-
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/Depth	Drilling Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
				Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
							0.0 - 0.3 ft. ASPHALT (4 inches).									
				5-5-6	11		0.3 - 6.0 ft. Clayey SAND (SC) (Fill), brown and tan, low plasticity, dry to moist, loose to medium dense, angular to subangular, lensed with gravel.	8.9		17.5	34.2	48.3	26	11	A-6 (2) SC	
				3-4-4	8		6.0 - 10.0 ft. Clayey SAND (SC), brown and tan, low plasticity, dry to moist, loose, subrounded, lensed with gravel.									
				5-5-4	9		10.0 - 11.0 ft. Poorly graded GRAVEL with clay and sand (GP-GC), tan, white and red, low plasticity, dry to moist, loose, subangular to subangular.									
							11.0 - 11.5 ft. Clayey SAND (SC), tan, low plasticity, moist, loose.									
							Bottom of Hole at 11.5 ft.									



Boring Began: 11/1/2024
Boring Completed: 11/1/2024
Drilling Method(s): Hollow-Stem Auger

Total Depth: 12.0 ft
Ground Elevation: 7900
Coordinates: Lat: 37.639467 Long: -112.1697 (Not Surveyed)
Location: North bound travel lane next to the north end of the visitor center shuttle stop.
Weather Notes: 44° F Mostly Sunny
Inclination from Horiz.: Vertical
Night Work: ☐

Driller: ConeTec
Drill Rig: CME 75 Truck
Hammer: Automatic (hydraulic), ER: %

Logged By: M. Kelly
Final By: M. Kelly

Groundwater Levels: Not Observed			
Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/Depth	Drilling Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
				Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
							0.0 - 0.4 ft. ASPHALT (4.5 inches).									
				3-5-5	10		0.4 - 1.5 ft. Well-graded SAND with silty clay and gravel (SW-SC) (Fill), black, dry, subangular.	12.8		13.8	37.2	49.0	23	10	A-4 (2) SC	pH=7.7 S=0.003% Chl=0.0390% R-Value=18 Re=7950ohm-cm
	5			2-2-3	5		1.5 - 3.0 ft. Clayey SAND (SC) with gravel (Fill), black, brown and tan, low plasticity, moist, medium dense, subangular sand and gravel.									
							3.0 - 5.0 ft. Clayey SAND (SC) with gravel, brown, low plasticity, moist.	20.0		4.7	10.3	85.0	34	16	A-6 (13) CL	
	10			2-2-5	7		5.0 - 12.0 ft. Lean CLAY (CL) with silt and trace sand, tan and brown, medium plasticity, moist, medium stiff.									

Bottom of Hole at 12.0 ft.



Boring Began: 11/1/2024
Boring Completed: 11/1/2024
Drilling Method(s): Hollow-Stem Auger

Total Depth: 11.0 ft
Ground Elevation: 7900
Coordinates: Lat: 37.639373 Long: -112.169953 (Not Surveyed) Inclination from Horiz.: Vertical
Location: 70 Feet south west of visitor center intersection in gravel shoulder of south bound lane. Night Work: ☐

Weather Notes: 20° F Partly Cloudy

Driller: ConeTec
Drill Rig: CME 75 Truck
Hammer: Automatic (hydraulic), ER: %

Logged By: M. Kelly
Final By: M. Kelly

Groundwater Levels: Not Observed

Symbol	-	-	-
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/Depth	Drilling Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
				Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
	5						0.0 - 5.0 ft. Gravelly SAND with Silt and trace clay (Fill), brown, low plasticity, frozen to dry, angular to subrounded.	7.3		34.4	46.7	18.9	19	5	A-1-b (0) SC-SM	
				3-4-5	9		5.0 - 10.0 ft. Clayey SAND (SC), brown, moist, loose.									roots, organics @5.5'
	10			4-7	11		10.0 - 11.0 ft. Silty Lean CLAY, tan, moist, stiff.	17.6	112.4		8.0	91.0				S/C=-0.1% @ 1000 psf

Bottom of Hole at 11.0 ft.



Boring Began: 11/1/2024
Boring Completed: 11/1/2024
Drilling Method(s): Hollow-Stem Auger

Total Depth: 11.0 ft
Ground Elevation: 7900
Coordinates: Lat: 37.639176 Long: -112.170092 (Not Surveyed) Inclination from Horiz.: Vertical
Location: 150 Feet south west of visitor center intersection in gravel shoulder of south bound lane. Night Work: ☐

Driller: ConeTec
Drill Rig: CME 75 Truck
Hammer: Automatic (hydraulic), ER: %

Logged By: M. Kelly
Final By: M. Kelly

Groundwater Levels: Not Observed			
Symbol	-	-	-
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/Depth	Drilling Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
				Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
				8-17-14	31		0.0 - 3.5 ft. Clayey GRAVEL with sand (GC) and silt (Fill), brown and purple, low plasticity, dry to moist, dense, subangular to angular.	7.3		35.1	31.8	33.1	25	12	A-2-6 (0) GC	pH=7.2 S=0.003% Chl=0.0390% R-Value=24 Re=7650ohm-cm
	5			7-10	17		3.5 - 6.0 ft. Clayey SAND (SC) with silt and gravel (Fill), brown, frozen to moist, medium dense.									Geotextile in sampler @6'
	10			10-13	23		6.0 - 11.0 ft. Clayey SAND (SC) with silt, tan, moist, medium dense.	10.6	109.1							S/C=0.1% @ 1000 psf

Bottom of Hole at 11.0 ft.



Boring Began: 11/1/2024
Boring Completed: 11/1/2024
Drilling Method(s): Hollow-Stem Auger

Total Depth: 12.0 ft
Ground Elevation: 7900
Coordinates: Lat: 37.638886 Long: -112.170357 (Not Surveyed) Inclination from Horiz.: Vertical
Location: 300 Feet south west of visitor center intersection in gravel shoulder of south bound lane. Night Work: ☐

Weather Notes: 25° F Partly Cloudy

Driller: ConeTec
Drill Rig: CME 75 Truck
Hammer: Automatic (hydraulic), ER: %

Logged By: M. Kelly
Final By: M. Kelly

Groundwater Levels: Not Observed

Symbol	-	-	-
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/Depth	Drilling Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
				Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
							0.0 - 1.5 ft. Gravelly SAND with Silt and trace clay (Fill), white and tan, dry, angular to subrounded.									
				4-5-4	9		1.5 - 5.0 ft. Silty Lean Clay (Fill), brown and tan, low plasticity, moist, stiff, angular yellow gravel fragments.	14.2	103.8	9.3	29.1	61.6	30	14	A-6 (6) CL	
	5			3-3-3	6		5.0 - 10.0 ft. Silty Lean Clay, brown, moist, medium stiff.									roots, organics @5
	10			9-22-27	49		10.0 - 10.5 ft. Poorly graded GRAVEL with clay and sand (GP-GC), red, moist, dense, angular.									

10.5 - 12.0 ft. CLAYEY SANDSTONE, red and white, predominantly decomposed, medium hard, weak to strong cementation.

Bottom of Hole at 12.0 ft.

Appendix B

DRILLING AND PAVEMENT CONDITION PHOTOS

Drilling and Pavement Condition Photos



YA-B1 Existing Shuttle Stop – 4 inches of ACP in good condition – Thermal crack and Joint separation at edge of driving lane.



YA-B2 – Mainline Pavement Northbound – 4 ½ inches of ACP – Only one Thermal Transverse Crack – Pavement appears to have recently received a chip seal

Drilling and Pavement Condition Photos



YA-B3 – Only distress large thermal crack and joint crack at edge of driving lane – shoulder boring



YA-B4 – Pavement in good condition - shoulder boring

Drilling and Pavement Condition Photos



YA-B5 – Pavement in good condition – shoulder boring

Appendix C

SOIL TEST DATA

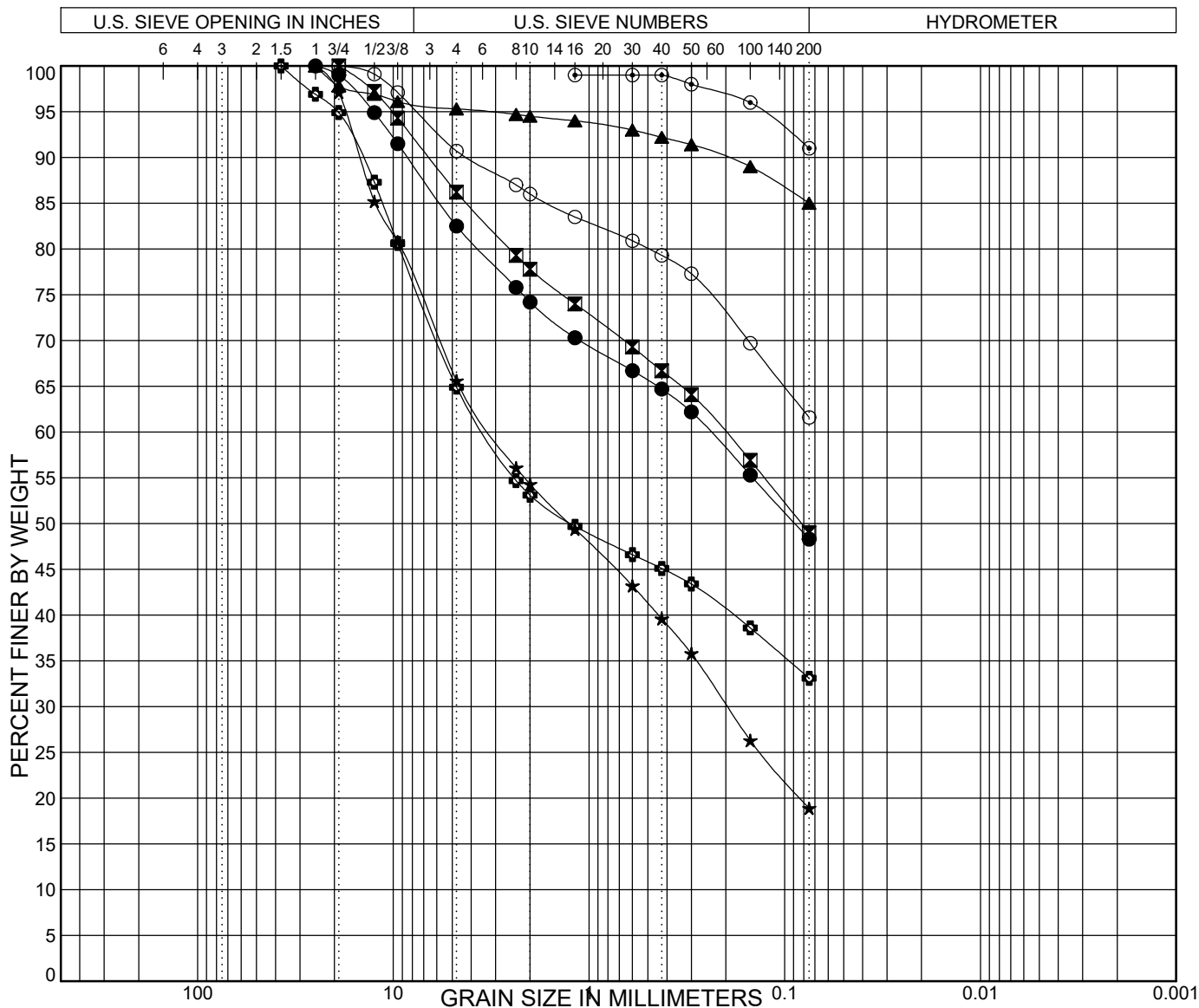


Summary of Laboratory Test Results

Project No: 224-307 Project Name: ES NPS Bryce Canyon National Park Visitor Center Shuttle Stops Date: 12-18-2024

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Water Soluble Chloride (%)	Resistivity (ohm-cm)	Swell (+) / Collapse (-) (% at Load in psf)	Unconf. Comp. Strength	R-Value	Classification	
Boring No.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
YA-B1	2.0	BULK	8.9		17.5	34.2	48.3	26	15	11								A-6 (2)	SC
YA-B2	2.0	BULK	12.8		13.8	37.2	49.0	23	13	10	7.7	0.003	0.0390	7950			18	A-4 (2)	SC
YA-B2	5.0	SPT	20		4.7	10.3	85.0	34	18	16								A-6 (13)	CL
YA-B3	0	BULK	7.3		34.4	46.7	18.9	19	14	5								A-1-b (0)	SC-SM
YA-B3	10.0	MC	17.6	112.4		8.0	91.0								-0.1 @ 1000				
YA-B4	2.0	BULK	7.3		35.1	31.8	33.1	25	13	12	7.2	0.003	0.0390	7650			24	A-2-6 (0)	GC
YA-B4	10.0	MC	10.6	109.1											0.1 @ 1000				
YA-B5	2.0	SPT	14.2	103.8	9.3	29.1	61.6	30	16	14								A-6 (6)	CL

04 GRAIN SIZE YEH 10 SAMPLES 224-307 NPS BRYCE CANYON GINT.GPJ 2021 YEH COLORADO TEMPLATE.GDT 2021 YEH COLORADO LIBRARY.GLB 12/18/24



BOREHOLE	DEPTH (ft)	AASHTO Classification	USCS Classification	LL	PL	PI	%Gravel	%Sand	%Fines	
									%Silt	%Clay
● YA-B1	2.0	A-6 (2)	SC	26	15	11	17.5	34.2	48.3	
☒ YA-B2	2.0	A-4 (2)	SC	23	13	10	13.8	37.2	49.0	
▲ YA-B2	5.0	A-6 (13)	CL	34	18	16	4.7	10.3	85.0	
★ YA-B3	0.0	A-1-b (0)	SC-SM	19	14	5	34.4	46.7	18.9	
⊙ YA-B3	10.0							8.0	91.0	
⊕ YA-B4	2.0	A-2-6 (0)	GC	25	13	12	35.1	31.8	33.1	
○ YA-B5	2.0	A-6 (6)	CL	30	16	14	9.3	29.1	61.6	



Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

SIEVE ANALYSIS

Project No. 224-307 Date: 12-18-2024
Report By: Yeh Lab:
Checked By:

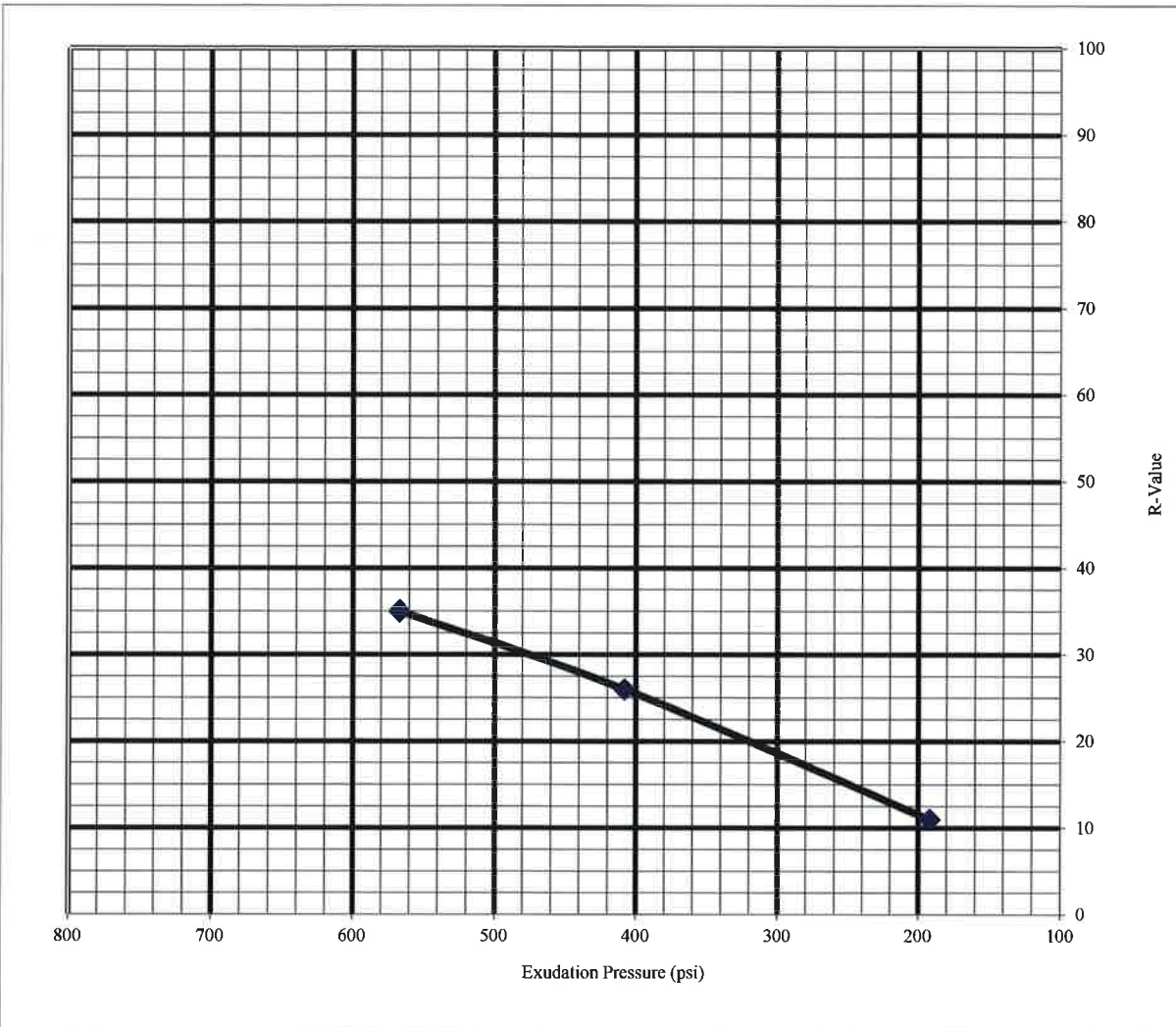
ES NPS Bryce Canyon National
Park Visitor Center Shuttle Stops
Bryce Canyon National Park

2000 Clay Street Suite 200
 Denver CO 80211

R-Value Test Report

Project Numb 224-307
 Sample Id: Mix: YA-B2
 Location: _____
 Date Sampled 11/4/2024
 R-Value at 300 psi exudation pressure =

Project Name Bryce Canyon
 Depth (ft): 2-5
 Classification A-4 (2) / SC
 Date Tested: 11/25/2024
18



Test No.	Compact. Press. (psi)	Density (pcf)	Moist. (%)	Horizont. Pressure (psi)'@ 160 psi	Sample Height (in.)	Exud. Pressure (psi)	R Value	R Value Correct.
1	350	119.8	10.2	86	2.47	567	35	35
2	350	118.0	12.0	100	2.46	408	26	26
3	350	117.9	13.8	130	2.51	192	11	11

Sampled by: Matt Kelly

Tested by: MA

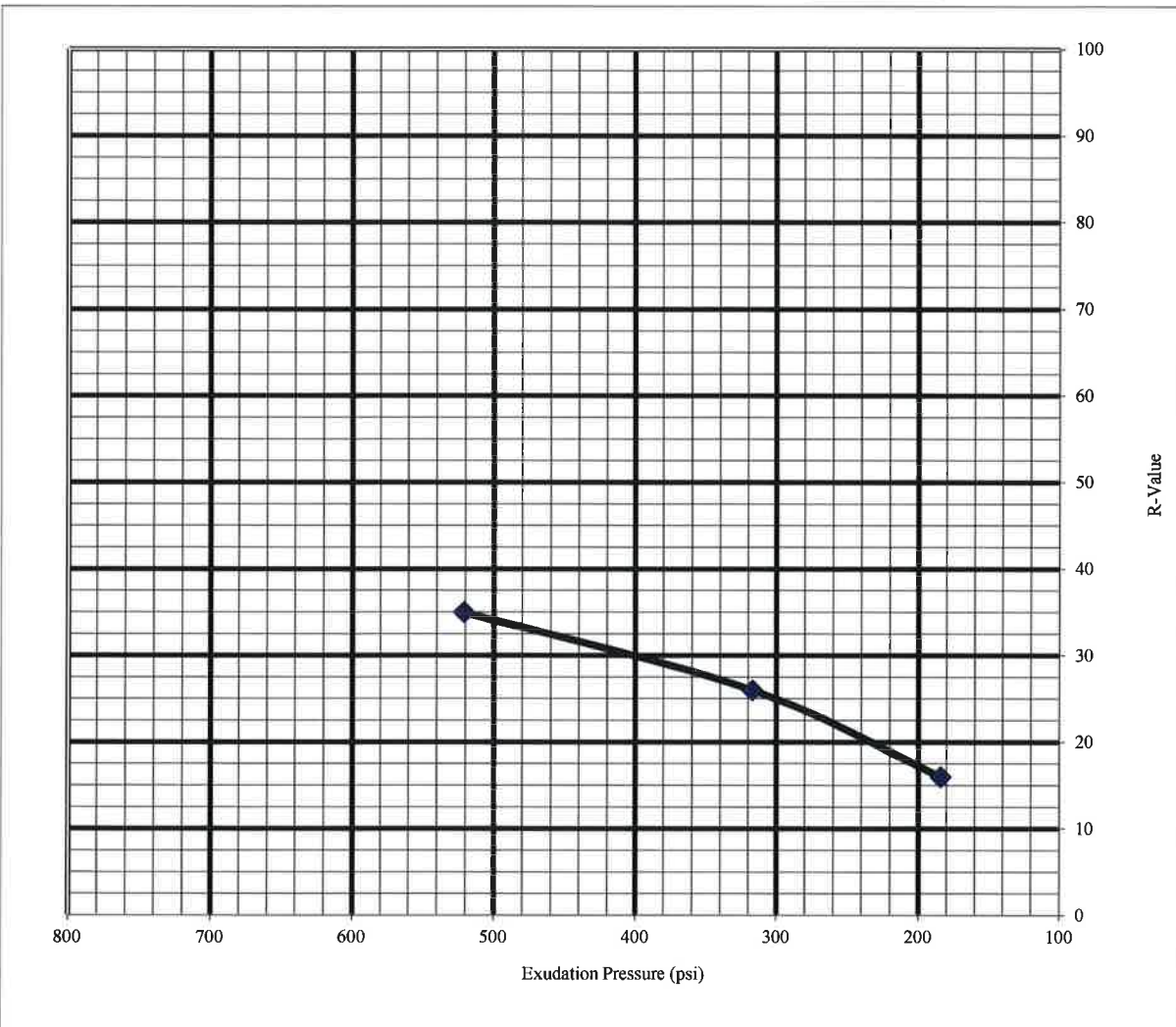
Checked by: RFL

2000 Clay Street Suite 200
 Denver CO 80211

R-Value Test Report

Project Numb 224-307
 Sample Id: Mix: YA-B4
 Location: _____
 Date Sampled 11/4/2024
 R-Value at 300 psi exudation pressure =

Project Name Bryce Canyon
 Depth (ft): 2-5
 Classification A-2-6 (0) / GC
 Date Tested: 11/25/2024
24



Test No.	Compact. Press. (psi)	Density (pcf)	Moist. (%)	Horizont. Pressure (psi)'@ 160 psi	Sample Height (in.)	Exud. Pressure (psi)	R Value	R Value Correct.
1	350	122.0	8.9	85	2.51	521	35	35
2	350	121.8	10.2	99	2.49	317	26	26
3	350	119.7	11.6	120	2.51	184	16	16

Sampled by: Matt Kelly

Tested by: MA

Checked by: RFL

Appendix D

TRAFFIC LOADING INFORMATION

Traffic Loading Calculations

Reported Bus Traffic Volumes

Assumptions: Vehicle Classifications and Truck Factors from Exhibit 11.2, page 11-10 & 11-11 of FHWA PDDM

Volume (ADT)		Low		High		Truck Factor = ESAL/Vehicle
AADT (2024)	12,132	Vehicle	ESAL	ESAL	Description	
AADT (2044)	12,132	Class	Factor	Factor		
Dir Dist	1	(Lane Corr. Factor)	3	0.0004	0.004	Pickups, Vans & SUVs
		Single Lane for Shuttle Stop	4	0.75	1.75	Tour Busses
			5	0.3	0.7	RVs, Motor Homes, Delivery Trucks
			6	0.5	1.5	Large RVs, Motor Homes, Garbage & Dump trucks
			9	2	2.3	Semis

ESAL Calculations (Low ESAL Values)		Low	
		ESAL/Veh	
Design AADT	(2020 vol + 2040 Vol)/2	12132	AADT

Design (Daily ESALS) = Design Vol X % Veh type X ESAL/veh

				Veh. ESAL				Check	
				Factor		ESAL/day		# Vehicles/day	
0	CL 3 Veh X	0.00%	X	0.004	ESAL/PU	=	0.0	0.0	Split Car & PU Vehicle ESAL
0	CL 3 Veh X	0.00%	X	0.0004	ESAL/PU	=	0.000	0.0	Loading between Hi & Lo factor
70	CL 4 Veh X	100.00%	X	1.5	ESAL/PU	=	105.0	70.0	
0	CL 5 Veh X	0.00%	X	0.3	ESAL/PU	=	0.0	0.0	
0	CL 6 Veh X	0.00%	X	0.5	ESAL/PU	=	0.0	0.0	
0	CL 9 Veh X	0.00%	X	2	ESAL/PU	=	0.0	0.0	
100.00%				Total Daily ESALs =		105.0	Daily Vol. :	70.0	Design ADT Volume

Design ESAL = (Daily ESAL) X (365 days/yr) X (20 Years) X (Lane Correction Factor)

105.0	ESAL/day X	200	da/yr X	20	Years X	1	Ln Cor F =	420000	Total Design ESAL Loading
EDLA =								57.5	

Bus service from April 6 to October 31, 2024

April	24
May	31
June	30
July	31
August	31
September	30
October	21
198 days of Bus Service	

USE	200	days of Bus Service to address some growth in demand in the future
-----	-----	--

Vehicle Count from Park

Here is more data for the subcontractor:

Because of the project location, we can use entrance station vehicle counts = traffic on the road segment through the project area. Over the past 12 months (November 1, 2023 - October 31, 2024) there were **689,188 vehicles** recorded on the entrance station counter. The park reports these vehicle counts monthly. If your folks need more granular data, I can pull hourly counts from the radar counter. The entrance station monthly data is publicly available. Link = <https://irma.nps.gov/Stats/Reports/Park/BRCA> > Traffic Counts by Location.

In 2024, the park shuttle service ran from April 6 - October 21 and there were **12,132 shuttle buses** that entered the park & stopped at the Visitor Center southbound. This works out to approximately **70 shuttle buses per day** that would use this new Southbound shuttle stop. The park anticipates continuing this level of shuttle service for the next several years. For background, the park shuttles run on about 15-minute headways, 8am-6pm April 5 - May 9, 8am-8pm May 10 - September 22, and 8am-6pm September 23, October 20. More shuttle info here: <https://www.nps.gov/brca/planyourvisit/shuttle.htm>

Please let me know if I can clarify or if you need anything else!

Thanks,

Kelly

Appendix E

PAVEMENT DESIGN AND BINDER RECOMMENDATION

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: Bryce Canyon NP Shuttle Stops
Route: Bryce Canyon National Park Drive
Location: Bryce Canyon NP,Utah
Owner/Agency: Bryce Canyon NP
Design Engineer: Shuttle Stop Pavement Design

Flexible Pavement Design/Evaluation

Structural Number	3.26		Subgrade Resilient Modulus	4,627.00	psi
Total Flexible ESALs	420,000		Initial Serviceability	4.20	
Reliability	80.00	percent	Terminal Serviceability	2.00	
Overall Standard Deviation	0.49				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.44	1.00	6.00	2.64
Granular Subbase	0.12	1.00	6.00	0.72
Σ SN				3.36

Asphalt Binder Recommendation

Report - 171 Selected Weather Stations

State/Province: UT

Weather Station: BRYCE CANYON N P HQ

Station ID	UT1008	Latitude	37.65
County / District	GARFIELD	Longitude	112.17
Last Year Data Avail.	1997	Elevation, m	2240

Air Temperature	Mean	Std Dev	Min	Max	Years
High Air Temperature, Deg. C	29.4	1.3	26.4	32.4	35
Low Air Temperature, Deg. C	-25.2	3.6	-32	-19	35
Low Air Temp. Drop, Deg. C	27.2	2.7	23	34	35
Degree Days over 10 Deg. C	2052	154	1751	2353	35

Pavement Temperature and PG	HIGH	LOW	High Rel	Low Rel
Pavement Temperature, C	47.9	-16.6	50	50
50% Reliability PG	52	-22	98	94
>50% Reliability PG	52	-28	98	98
=				
=				
=				
=				

? PG Chart PG Distribution Save Cancel

PG 52-28 may not be available. **We recommend PG 64-28 for all lifts.** PG 64-28 meets the low temperature requirements and exceeds the high temperature performance requirements for the project area and will help prevent rutting in the shuttle stop pavement.