Smithsonian Institution

Office of Planning, Design & Construction

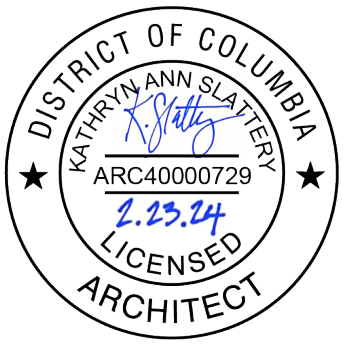
SPECIFICATIONS

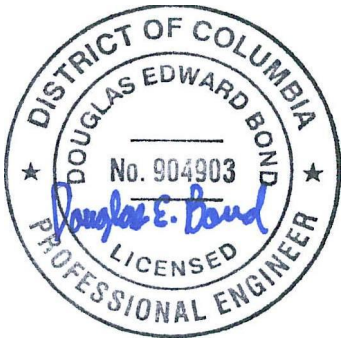
FORMER PROJECT NO.: 2033105
PROJECT NO.: 2233103

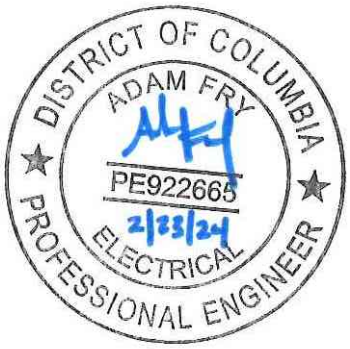
PROJECT TITLE: REPAIR ICE MELT AND WALK AT SEALS AND SEA LION

FACILITY: Smithsonian National Zoological Park

DATE: **23 February 2024 - Final Construction Documents**







This project is approved as being in conformance with applicable provisions of the Smithsonian Directive (SD) 410.

Michael J. Carranchó, P.E., Deputy Director — Date 5/3/24

600 Maryland Avenue, S.W.
Suite 5001
Washington, D.C. 20024
Voice: 202.633.6230 Fax: 202.633.6233

USPS Mail: OEDC Capital Gallery
MRC 511
P.O. Box 37012
Washington, D.C. 20013-7012

S P E C I F I C A T I O N S

TABLE OF CONTENTS

DIVISION 1 GENERAL REQUIREMENTS

010000 Supplementary Conditions for Construction

SECTION A - PROJECT SUMMARY AND INFORMATION

1. Project Information
2. Summary of Work
3. Contract Time for Completion
4. Schedule of Options for Bid – NOT USED
5. Schedule of Unit Prices – NOT USED
6. Bidder/Offeror Examination of Site
7. Availability of Documents

SECTION B - SPECIAL PROJECT REQUIREMENTS

8. Units of Measure
9. Non-Public, Tenant and Secured Spaces
10. NZP Artifacts and Scientific Research Materials – NOT USED
11. Protection of Historic Properties
12. Commitment to Sustainability
13. Commissioning

SECTION C - CONTRACTOR USE OF PREMISES

14. Hours of Work, Workdays and Government Holidays
15. Conditions Affecting Contractor's Work
16. Contractor Deliveries, Hauling and Access
17. Dress and Deportment
18. Contractor Parking
19. Eating, Drinking, Smoking, and Illegal Substance Use

SECTION D - PROJECT COORDINATION

20. Coordination of Trades

21. Quality Control
22. Permits, Licenses and Fees
23. Utility Service Interruptions and New Connections
24. Smithsonian-Furnished Items Installed by the Contractor – NOT USED
25. Salvage
26. Cutting, Patching and Matching Existing Work

SECTION E - PROTECTION OF THE SITE DURING CONSTRUCTION

27. Protection of the Site
28. Protection of Flora, Fauna and Irrigation Systems
29. Debris Control and Daily Cleanup
30. Dust and Air Quality Control
31. Noise Control
32. Vermin, Pest, and Rodent Control
33. Drilling, Welding, Torch Cutting and Other Operations That Produce Airborne Contaminants

SECTION F - TEMPORARY CONSTRUCTION FACILITIES

34. Contractor Field Offices, Trailers, and Sheds
35. Staging, Storage and Work Areas
36. Sanitary/Toilet Facilities
37. Temporary Utility Services and Extensions
38. Scaffolding and Platforms
39. Project Signs

SECTION G - MEETINGS

40. Preconstruction Meeting
41. Pre-Condition Survey of the Site
42. Project Meetings

SECTION H - SUBMISSIONS

43. Submittal Definitions
44. Submittals and Reviews
45. Criteria for Product Selection
46. Photographic Documentation
47. Contractor Correspondence and Daily Reports

SECTION I - SAFETY, HEALTH, AND FIRE PROTECTION

48. Jobsite Safety
49. Toxic and Hazardous Substances
50. Personal Protective Equipment
51. Barriers, Barricades and Walkways
52. Existing Fire Protection Systems

SECTION J - SECURITY REQUIREMENTS

53. General Security Requirements
54. Identification Badges
55. Security of Temporary Openings
56. Existing Building Alarm Systems
57. NZP Officer Duty Charges

SECTION K - SCHEDULES AND PAYMENTS

58. Schedule of Values
59. Scheduling & Payments / Critical Path Method
60. Assignment of Claims

SECTION L - PROJECT CLOSEOUT REQUIREMENTS

61. Project Closeout
62. Substantial Completion
63. Final Completion and Acceptance

DIVISION 2 EXISTING CONDITIONS

024119 – SELECTIVE DEMOLITION

DIVISION 3 CONCRETE

033713 - SHOTCRETE

DIVISION 4 MASONRY NOT USED

DIVISION 5 METALS

057300 – DECORATIVE METAL RAILINGS

DIVISION 6 WOOD, PLASTICS AND COMPOSITES NOT USED

DIVISION 7 THERMAL AND MOISTURE PROTECTION NOT USED

DIVISION 8 OPENINGS NOT USED

DIVISION 9 FINISHES NOT USED

DIVISION 10 SPECIALTIES NOT USED

DIVISION 11 EQUIPMENT NOT USED

DIVISION 12 FURNISHINGS NOT USED

DIVISION 13 SPECIAL CONSTRUCTION NOT USED

DIVISION 14 CONVEYING EQUIPMENT NOT USED

DIVISIONS 15-20 RESERVED NOT USED

DIVISION 21 FIRE SUPPRESSION NOT USED

DIVISION 22 PLUMBING NOT USED

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING NOT USED

DIVISION 24 RESERVED NOT USED

DIVISION 25 INTEGRATED AUTOMATION NOT USED

DIVISION 26 ELECTRICAL

260000 – LOW VOLTAGE DE-ICING SNOW MELTING SYSTEMS IN CONCRETE

260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

260533.13 – CONDUITS FOR ELECTRICAL SYSTEMS

260533.16 – BOXES AND COVERS FOR ELECTRICAL SYSTEMS

260544 – SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

DIVISION 27 COMMUNICATIONS NOT USED

DIVISION 28 ELECTRONIC SAFETY AND SECURITY NOT USED

DIVISION 29 RESERVED NOT USED

DIVISION 30 RESERVED NOT USED

DIVISION 31 EARTHWORK NOT USED

DIVISION 32 EXTERIOR IMPROVEMENTS NOT USED

DIVISION 33 UTILITIES NOT USED

Appendix NOT USED

END OF TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01000

SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

SECTION A - PROJECT SUMMARY AND INFORMATION

1. PROJECT INFORMATION

1.1. SF Project No. **2033103**
NZP-DC: Seal Exhibit – Faux Stair and Ice Melt
National Zoological Park
3001 Connecticut Avenue, NW
Washington, D.C. 20008

Smithsonian Institution Contacts:

Contracting Officer (CO), address for Fed Ex and UPS delivery:
Smithsonian Institution
Office of Contracting
600 Maryland Avenue, SW, Suite 500E
Washington, DC 20024

Contracting Officer (CO), address for USPS delivery:
Smithsonian Institution
Office of Contracting
MRC 1200
P.O. Box 37012
Washington, DC 20013-7012

Contracting Officer's Technical Representative (COTR), address for Fed Ex and UPS delivery:
Smithsonian Institution
Attn: Shayne Mister, Office of Planning, Design, and Construction
General Services Building
National Zoological Park
3001 Connecticut Avenue, NW
Washington, DC 20008

2. SUMMARY OF WORK

2.1. The Contractor shall furnish all supervision, labor, materials, and equipment needed to do the project work at the Smithsonian Institution's National Zoological Park (NZP) located at 3001 Connecticut Ave NW, Washington DC 20008 as set forth on the Drawings for SF Project No. 2033105 (Design) & 2033103 (Controls), sheets l through 18 and in these specifications, both dated 2/23/24.

2.2. The work includes but is not limited to:

2.2.1 Temporary shoring and bracing of existing shotcrete cove walls to perform shotcrete slab replacement.
2.2.2 Selective demolition of existing shotcrete seal exhibit beach, and replacement with new shotcrete slab beach with integral snow melt system.
2.2.3 Providing metal railings which conform to shape of existing shotcrete wall geometries while maintaining required heights and clearances from slab and walls.

When contractor has completed and checked his work, then contact COTR for an inspection. Contractor shall clean up and dispose all debris associated with job. Contractor will be responsible for all labor, materials, and equipment to complete project.

This brief description, however, shall not, in any way, be construed to limit the Contractor's obligation for compliance with the contract specifications.

2.3. Critical Elements of the Work: The successful Contractor shall be fully qualified to install critical elements of the Work. Upon request of the Contracting Officer, bidders shall submit a statement of qualifications to address the following critical elements of the Work:

2.3.1 Coordinating work in areas that public, staff, and animal access.

2.3.1.1 Site foreman's qualification shall have a minimum of five (5) years' experience with products being installed. SI may request the installation firm to provide proof of experience documentation and site visits for a least three (3) similar projects completed within the last five years.

2.3.1.2 Experience in coordinating work tasks around an operational public campus and collection animals.

2.3.1.3 Corporate wide culture that is fully committed to the Project's Approved Safety Plan.

2.3.2 Site Logistics for access and material storage.

2.3.3. Work plan and Schedule that meets or reduces the project's time requirements.

2.4 Delegated Design Services:

2.4.1 This project requires delegated design, wherein professional design services or certifications (e.g. design calculations and/or shop drawings signed, stamped, and sealed by a Registered Professional Engineer) are specifically required of the Contractor by the Contract Documents. Provide products and systems complying with specific performance and design criteria indicated.

2.4.1.1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to the COTR.

2.4.1.2. Shop drawings, calculations, and other submittals that are required by the technical specifications to be prepared and/or reviewed by a qualified Registered Professional Engineer shall display the stamp/seal, registration/license number, name, and signature of the individual holding responsibility. Individual must be registered/licensed in the District of Columbia.

2.4.1.3. See Contract Drawings and Specification sections identified below for delegated design requirements.

2.4.2. The following project elements require delegated design by the Contractor:

2.4.2.1. Temporary shoring and bracing design as required by sheets S001 & S701.

2.4.2.2. Decorative metal railings as specified in 057300.

2.5 Construction Layout

2.5.1. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to existing elevations & measurements. If discrepancies are discovered, notify COTR promptly.

2.5.2. General: Lay out the Work using accepted surveying practices.

2.5.2.1 Data Capture (Laser Scan): Contractor to survey, prepare digital 3D scan(s) of existing construction for full project area, including exhibit beach, cove walls and ceiling, and holding area, which can be used by Contractor and the Contractors subcontractors or installers to coordinate and develop shop drawings and for accurate installation of railings and shotcrete structures in accordance with the Contract Documents.

2.5.2.2. Survey is to include establishing the necessary Survey Control Network throughout the site and scanning as many points as may be required to create a reliable point cloud of the project area. If multiple scans are used, combine, or ensure common benchmarks and control points are coordinated between separate scans. The required object surface density of scanning shall be a minimum of 6mm (¼”). RGB color shall be mapped to both the exterior and interior scans. Point Cloud data should be broken into separate data sets as directed by COTR

and be registered in the same coordinate frame (origin point). Point cloud data to be submitted using Autodesk Recap (.rcp), or in alternate format as approved by COTR. Deliver digital copy of all record scans to COTR at project completion.

2.5.2.3 Establish benchmarks and control points to set lines and levels for construction and elsewhere as needed to locate each element of Project, including but not limited to high and low water levels, and common benchmarks and control points as necessary for installer use and coordination.

2.5.2.4. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

2.5.2.5. Inform installers of lines and levels to which they must comply.

2.5.2.6. Check the location, level and plumb, of every major element as the Work progresses.

3. CONTRACT TIME FOR COMPLETION

3.1 Work under this contract shall begin by the Contractor within seven (7) calendar days after the Notice to Proceed and shall be completed within the total contract time of 150 calendar days. All work, including inspections, testing, correction of deficiencies, and project close-out activities, shall be completed in every respect within the contract time.

Contract Time's Work Requirements

Based Upon a Preschedule and Agreed Start Date the contractor will comply or reduce the following stated durations:

- TWO WEEKS - Demolition of Existing Shotcrete
- ONE WEEK – Layout, Place Reinforcement, and install Ice Melt System
- ONE WEEK – Place new Shotcrete
- ONE WEEK – Paint new Shotcrete
- ONE WEEK – Final Cure and Install New Rail

SIX WEEKS - TOTAL DURATION OF ALL WORK ON SITE WORK

Note: Contractor is required to adjust crew size and work hours to meet the stated durations. **Animals must be provided full safe access to the exhibit pool after the six-week duration.**

3.2 The start date and completion date shall be as stated in the Notice to Proceed issued by the Contracting Officer.

4. SCHEDULE OF OPTIONS FOR BID – NOT USED

5. SCHEDULE OF UNIT PRICES – NOT USED

6. BIDDER/OFFEROR EXAMINATION OF SITE

6.1. Every effort was made to indicate all work necessary to complete the project as identified. All bidders must carefully examine the premises during the bid period and satisfy themselves as to the extent, nature and location of the work, general and local conditions, particularly those bearing on transportation, disposal, handling and storage of materials, availability of labor, water, electric power, access routes, uncertainties of the weather, type of equipment and facilities needed for the successful execution of the Work.

6.2. Pre-Bid Conference and Site Visit. Before the bid opening date, the COTR will announce a scheduled pre-bid conference and site visit. The purpose of the scheduled meeting is to provide an opportunity for all bidders to review the project site. Any comments, information or discussion during the site visit shall not modify the contract documents. All questions must be submitted in the form of an RFI to the designated representatives on the RFP.

6.3. This project requires special arrangements for access to a non-public area. Access to the site may be restricted at times other than during the scheduled visit. Coordinate access with COTR.

7. AVAILABILITY OF DOCUMENTS

7.1. The bidders will be provided electronic versions of drawings and specifications from:

Smithsonian Institution
Office of Planning, Design, and Construction
600 Maryland Avenue, SW., Suite 5001
Washington, DC 20024

7.2. The bidder is responsible for making their own hard copies of the solicitation documents.

SECTION B - SPECIAL PROJECT REQUIREMENTS

8. UNITS OF MEASURE

8.1. All fabrication and installation shall be performed in accordance with the units of measure given in the Contract Documents. Units of measure on this project are Imperial Units.

9. NON-PUBLIC, TENANT AND SECURED SPACES

9.1. Certain tenant spaces, non-public spaces, utility and equipment rooms and other areas related to or used for purposes of storage, conservation, research, curation of NZP collection and artifacts or for scientific research may have restricted access.

9.2. The Contractor shall identify to the COTR as soon as possible, but no less than two (2) workings days in advance, any occupied areas that the Contractor must access that are located outside the limits of the project site. The Contractor shall identify in writing:

9.2.1. Restricted areas to be accessed.

9.2.2. Specific reason for needing access.

9.2.3. Nature of the work to be performed.

9.2.4. Date(s) and hours needed to complete construction work activity.

10. NZP ARTIFACTS AND SCIENTIFIC RESEARCH MATERIALS (NOT USED)

11. PROTECTION OF HISTORIC PROPERTIES

11.1. The project site is located in a designated National Historic Landmark property and requires special attention to the quality of materials selected for installation and workmanship efforts to satisfactorily preserve and restore historic elements and finishes of an historic landmark structure.

11.2. Upon request of the COTR, the Contractor shall submit evidence of technical competence in restoration work for National Historic Landmark structures, including subcontractor resumes, references and photographs or previous similar work.

11.3. Without exception, all original building fabric of the National Zoological Park is designated historic.

12. COMMITMENT TO SUSTAINABILITY

(This is not a LEED project however Construction Waste Management and Disposal in Section 12.2 will apply.)

12.1. The Smithsonian Institution is a trust instrumentality of the United States (recognized as a tax-exempt organization under Section 501(c)(3) of the Internal Revenue Code) and although not an Executive Branch of the U.S. Government, is committed to planning, designing, constructing, maintaining and operating its owned and leased buildings and facilities consistent with Federal environmental and energy management requirements, as listed in the Smithsonian SF Codes, Standards and Guidelines document, dated February 15, 2012, to the maximum extent practical.

12.2. Construction waste management and disposal shall be tracked and documented using the Division 1 spreadsheet provided.

13. COMMISSIONING

13.1. The Smithsonian requires Fundamental Commissioning (as defined by the LEED NC and CI rating systems) of all eligible design and construction projects, even if the project is not eligible to pursue LEED certification. The Smithsonian additionally requires Enhanced Commissioning (as defined by the LEED NC and CI rating systems) for larger projects and projects pursuing LEED certification, based on the size and complexity of the project. The Contractor shall coordinate work of different trades, as necessary, with the activities of and the requirements issued by the Smithsonian and the Commissioning Provider, including:

13.1.1. The Commissioning Plan, a resource to identify the strategies, aspects, and responsibilities within the commissioning process for each phase of the project, outlining the overall project schedule, organization, responsibilities, and documentation requirements of the design process. Refer to specific trade commissioning requirements that may be located in other sections of the technical specifications.

13.1.2. The Owner’s Project Requirements (OPR), the functional requirements of a project and expectations of the building’s use and operation as they relate to systems to be commissioned. The OPR addresses the owner use and requirements, environmental and sustainability goals, energy efficiency goals, indoor environmental quality requirements, equipment, and system expectations, building occupant and operations and maintenance personnel requirements.

13.1.3. Basis of Design (BOD), which includes a narrative description of the design of any systems to be commissioned and any design assumptions.

SECTION C - CONTRACTOR USE OF PREMISES

14. HOURS OF WORK, WORKDAYS AND GOVERNMENT HOLIDAYS

14.1. Work shall be performed, under this contract, during the normal workdays of Monday through Friday, except Smithsonian holidays and special events as specified herein and the normal work hours of 5 AM to 3:30 PM. The NZP opens to the public at 8:00 a.m. daily, and use of public trails, roads, walks, etc. are limited during public hours and during special events.

14.2. Portions of the premises will be continually occupied, requiring that certain work under this contract may need to be performed during periods other than that specified above. All shutdowns and outages must be approved by and coordinated with the COTR and occur between the hours of 6:00 p.m. to 6:00 a.m., unless otherwise approved.

14.3. For each occasion, the Contractor intends to work on Saturdays, Sundays, or Smithsonian holidays or during hours other than those indicated above, the Contractor shall obtain written permission from the COTR, at least three (3) working days in advance.

14.4. The Contractor shall reimburse the Smithsonian Institution for security and inspection services provided by the Smithsonian when the Contractor chooses to work outside the normal workdays and hours, as identified herein. However, the Contractor will not be charged for NZP overtime security and inspection services, if in the opinion of the COTR, the work cannot be done during the normal workdays and hours due to requirements of the Smithsonian.

14.5. Smithsonian Holidays: For holidays that fall on Saturday, the Smithsonian holiday is observed on the previous Friday. For holidays that fall on Sunday, the Smithsonian holiday is observed on the following Monday. The Smithsonian Holidays are listed below. Also see the National Zoological Park website for a listing of special events.

New Year's Day	January 1
Martin Luther King Jr.'s Birthday	January, third Monday
George Washington's Birthday	February, third Monday
Memorial Day	May, last Monday
Juneteenth	June 19
Independence Day	July 4
Labor Day	September, first Monday
Columbus Day	October, second Monday
Veterans' Day	November 11
Thanksgiving Day	November, fourth Thursday
Christmas Day	December 25
President's Inauguration Day	January 20, 2025

15. CONDITIONS AFFECTING CONTRACTOR'S WORK

15.1. Existing Occupied Spaces: The premises will be occupied by visitors, staff, and collection animals during the performance of the Work. The Contractor shall schedule work activities to minimize interruption of occupants and occupied spaces. Efforts will be made to temporarily move employees and contents out of specific areas under construction, as needed, during the times requested by the Contractor. However, the needs of the Smithsonian Institution take precedence and free access for the Contractor cannot always be guaranteed. If the Contractor is required to work in animal areas, it must be in presence of authorized Smithsonian staff. Areas that will remain occupied include the grounds of the NZP.

15.1.1 Contractor to develop a work plan that incorporates all elements of work.

15.2. Contractor's Project Access Requirements

15.2.1 All project related tasks shall be accessed from the public walkway directly to the pool's beach area.

15.2.2 Contractor shall remove the existing Public Viewing Netting as required to access the Seal Pool's Beach Area. Netting shall be reinstalled upon completion of work.

15.2.3 Material access to the work area shall be with a Telehandlers piece of equipment (*also called teleporter, reach forklift, boom lift, lull, or cherry picker)*, which is multi-purpose machines that lift, move and place material. A telehandler — short for "telescopic handler" — contractor shall use different attachments to lift, move and place materials as required by work tasks, under the limitations of the equipment's design and site's restrictions.

15.2.4 Contractor shall build a temporary wood walkway with rails and steps for workers to safely access the work area from the public walkway.

15.2.5 Provide temporary perimeter public exclusion fencing as per requirements. Fence shall maintain a minimum of 10' wide walkway for the public to safely pass through the work area.

15.2.6 Due to jobsite restrictions and limitations the contractor is required shuttle debris and materials from the jobsite to the NZP Trash area, located on the Blue Road just over the stone bridge to the jobsite. NZP will provide an area for one contractor's roll off dumpster within the trash area.

15.2.7 All contractor's vehicles operating on the Public Walkway and not behind the jobsite perimeter fence must have two equipped flaggers to manage public/staff safety at all times.

15.2.8 Contractor is required to schedule all equipment's use of public walkway access between the hours of 05:00 AM to 09:00 AM.

Exceptions to this requirement will require prior approval from the COTR.

15.2.9 Contractor's work plan to include details on methods for controlling debris from falling into the pool and minimizing jobsite dust and noise.

15.3. Space for Contractor Use: The space available for Contractor's use shall be coordinated with COTR at the project site. Space allocation and availability are subject to change, at the discretion of the Smithsonian, to meet the needs of all parties requiring access and space within the work area, and the surrounding areas.

16. CONTRACTOR CONDUCT, DELIVERIES, HAULING AND ACCESS

16.1. Normal deliveries shall be made between the hours of 6:00 AM and 09:00 AM. The Contractor's materials and equipment shall be delivered, received, receipted for, and handled by the Contractor's personnel.

16.2. Access to the site for on- and off-loading of all material, structures and equipment shall be designated by the COTR.

16.3. SI's loading docks and delivery areas require special access requests and coordination for contractors use.

16.4 Comply with **NZP's Motor Vehicle Operations on Walkways**, responsibilities, and procedures for operating motor vehicles on walkways of the National Zoological Park (NZP) in Rock Creek.

16.4.1 **Definitions:**

Walkways. Interior paths on NZP grounds at Rock Creek intended for pedestrian visitors and staff, such as Olmsted Walk, Asia Trail, and American Trial.

Motor vehicle. Any motorized, gas or electric apparatus used to transport personnel or supplies, with the exception of individual motorized electric wheelchairs, or what are commonly known as Electric Control Vehicles (ECVs) and Police Segways.

16.4.2 **POLICY.**

Any motor vehicles on the grounds shall be operated at a speed considered safe for movement among pedestrians. The posted speed on Zoo public roadways is 25 miles per hour from Connecticut Avenue to the Crossroads, 15 miles per hour from the Crossroads to Adams Mill gate and 10 miles per hour from Adams Mill

gate to the Veterinary hospital. Speed limits may be reduced during construction and special events. Caution is required as pedestrians must cross public roadways when walking from parking lots to the Zoo exhibits.

i. Walkways are for the main purposes of providing safe movement of pedestrians throughout the Park's exhibit areas. Vehicular traffic on walkways is restricted to an absolute minimum needed to accomplish the NZP mission. Contractor vehicles whose business requires that they drive on walkways shall proceed with **extreme** caution. Individuals operating vehicles on walkways must remain constantly vigilant and be prepared to react quickly, if necessary.

ii. On walkways, vehicles shall be operated at a safe speed appropriate to the circumstances, never exceeding the equivalent of 5 miles per hour after 09:00 a.m. Prior to 09:00 a.m., vehicles below 26,000 lbs. gross vehicle weight rating (GVWR), may reach a maximum of 10 miles per hour. If installed, the vehicle's headlights and emergency flashers shall be on at all times.

iii. Motor vehicles are prohibited on all zoo walkways between the hours of 09:00 a.m. and 6:00 p.m. year-round, with limited exception (see part 5 below).

iv. Privately owned vehicles (POVs) must be off zoo walk-ways by 7:00 am.

v. All carts (including but not limited to; EZ Go, Gator, Club Car, and Cushman) must use an approved chock to keep the cart secured when not in use.

vi. Any individual operating a motor vehicle on NZP grounds must possess a current valid government issued driver's license.

16.4.3 **RESPONSIBILITIES**

vii. SI Staff ensures that:

1. Police officers observe and enforce the provisions of this directive.
2. A police escort is provided whenever possible if needed for safe transit of a vehicle on walkways.
3. All SI Staff shall take corrective actions when they observe violations of this directive and shall report the violation to the COTR.

16.4.4 **CONTROLLING TRAFFIC ON WALKWAYS**

viii. Vehicular traffic and parking are prohibited on zoo walkways between the hours of 10:00 am and 6:00 pm each day, with limited exceptions (see below). Deliveries should be scheduled whenever possible before 10:00 a.m. if access to walkways is required.

ix. The following vehicles are permitted on zoo walkways during the period of prohibition if they are escorted by a uniformed NZP Police or other approved escort (who must walk in front of the vehicle wearing a brightly colored safety vest or signaling caution with flags and voice notification) and approved by the COTR.

x. Police vehicles, as deemed necessary for security or emergency purposes. No escort required.

xi. Park Management and OFEO vehicles responding to an urgent maintenance requirement or an emergency with an escort.

xii. Veterinary vehicles responding to an animal emergency or a situation involving animal welfare with an escort.

xiii. Any motorized cart needed to perform a vital duty must request approval from the COTR.

xiv. Contractors must use vehicles to perform essential services within the prohibited hours must get approval from the COTR. When there is a need to bring in a company trucks, oversized vehicle, i.e., dump-truck, cranes, or other special equipment, at least two walking escorts must be provided. One forward and one aft with flags and safety vests; this also applies whenever this type of equipment has to back-up or perform any other special maneuvers, i.e., loading, unloading, lifting, dumping and so forth outside the designated work area.

xv. NZP Police, NZP, FONZ and OFEO senior staff have the authority to stop any motor vehicle operating on a walkway and determine whether or not such operation is in violation of policy.'

xvi. In instances where the motor vehicle's operations do not meet the criteria for being on the walkway, the Police or NZP Senior Staff member may direct the driver to remove the motor vehicle from the walkway and proceed to the nearest available NZP roadway or street. Failure to comply with this policy, or to follow this sub-part instructions could lead to disciplinary action.

xvii. The Police may stop and expel from the walkway any vehicle exceeding the speed limit, operating the vehicle in an unsafe manner, or not in compliance with this policy. The following situations create unnecessary risk and will not be tolerated while operating a motor vehicle on pathways in the Zoo:

1. Talking, texting, or using devices that require manual manipulation.
2. Eating or drinking.
3. Smoking by the operator or a passenger in any motor vehicle as referenced in the Smithsonian Directive (SD 209).
4. Exceeding the maximum seating capacity or design of the vehicle.
5. Transporting personnel in cargo area or failure to secure load.
6. Operating any vehicle with a visible or known safety defect.

17. DRESS AND DEPORTMENT

17.1. Contractors' personnel shall be fully and appropriately clothed at all times and shall conduct themselves in a manner appropriate to a public place. The COTR may require removal of any individual from the premises and project for unacceptable dress, demeanor, or disruptive conduct, if the Contractor superintendent fails to correct conditions in violation of this paragraph.

17.2. The Government reserves the right to exclude or remove from the site or building any employee of the Contractor or Subcontractor as the Government deems incompetent, careless, insubordinate, or otherwise objectionable, or whose continued employment of the work is deemed by the Government to be contrary to public interest.

18. CONTRACTOR PARKING

18.1. One parking space will be assigned to the Contractor for use during the contract period. The space will be located as close to the project site as possible. Coordinate with COTR.

18.2. The assigned space can only be used by the company vehicle. The vehicle must be clearly marked with company name and/or logo. The permit shall be displayed on the vehicle dashboard on the driver's side. Vehicles not in compliance with this clause are subject to ticketing and towing by the Smithsonian Police. Costs associated with parking violations shall be the sole responsibility of the Contractor.

18.3. Parking spaces will not be provided for the Contractor’s employees. Employees will be required to comply with the NZP’s pay parking regulations. Arrangements for

Contractor's parking are the sole responsibility of the Contractor. Parking may not be available at the project site.

19. EATING, DRINKING, SMOKING, AND ILLEGAL SUBSTANCE USE

19.1. Eating and drinking in Smithsonian buildings or leased space will be allowed only in designated areas. Offenders may be subject to removal from the premises and project should the Contractor's Superintendent fail to correct conditions, which, in the opinion of the COTR, violate this clause.

19.2. Gambling and the consumption of alcoholic beverages by the Contractor's personnel is prohibited in all Smithsonian buildings or leased space.

19.3. Smoking, vaping, using E-cigarettes or carrying lighted tobacco products is prohibited in all Smithsonian buildings or leased space, in exhibition and public spaces, in areas where hazardous materials are stored or handled and in areas undergoing construction, renovation or repair. Acceptable areas for smoking are outside of the building, as designated by the Smithsonian Facility Manager, and/or Office of Safety, Health, and Environmental Management (OSHEM).

19.4. The possession, sale and/or use of narcotics or other illegal substances or firearms by Contractor employees are strictly prohibited in all Smithsonian facilities and leased space. Contractor employees are strictly prohibited from working on the project under the influence of alcohol and/or illegal substances. Contractor employees in violation of any of the above prohibitions will be removed from the project.

SECTION D - PROJECT COORDINATION

20. COORDINATION OF TRADES

20.1. The Contractor shall coordinate work of different trades so that interference between mechanical, electrical, architectural, and structural work, including existing services, shall be avoided.

20.2 Where work by separate entities requires off-site fabrication of products and accurate interfacing of materials to produce the required results, the Contractor shall prepare coordination drawings to indicate how work shown on separate shop drawings will be interfaced, intermeshed, and sequenced for installation. Coordination drawings shall be submitted in accordance with the requirements of the "Submissions" section.

20.2.1. Work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interferences shall be made without additional expense to the Smithsonian. If an interference develops, the COTR will decide which work shall be relocated, regardless of which was installed first.

20.3. Installation of equipment and systems shall allow the maximum practical space for operation, repair, removal, and testing, within the limits indicated on the Contract Documents. Pipes, conduit, ducts, and other system components shall be installed as close as possible to ceiling slabs, walls, and columns to minimize space used while accommodating function and maintenance.

21. QUALITY CONTROL

21.1. The Contractor shall provide qualified site personnel responsible for quality control, inspections, testing and re-testing as necessary for all work, including that of Subcontractors, to assure compliance with the contract documents.

21.2. Testing Requirements: Contractor shall be responsible for all field sampling and in-place testing required by the contract documents **(this statement supersedes all other section references)**

21.2.1. Independent Testing Laboratory: The Contractor shall provide an independent, commercial testing laboratory to perform all sampling and testing services required. The testing services shall be on- or off-site as required. Submit complete documentation of all tests performed in connection with the construction contract.

21.2.2. Smithsonian Acceptance of Laboratories: Except for factory tests, all field sampling and testing normally performed by commercial laboratories shall be performed by an independent commercial laboratory employed by the Contractor and accepted by the COTR. The Contractor shall submit the following information to the COTR for approval:

21.2.2.1. Name, registration number and engineering discipline of the Registered Professional Engineer in charge of the laboratory.

21.2.2.2. Affidavit of compliance and certification that the laboratory performs work in accordance with requirements as stated in the contract documents.

21.2.2.3. A list of testing equipment proposed for each test procedure including latest calibration data.

21.2.2.4. A copy of the latest Laboratory Inspection Report by an independent agency with laboratory certification that deficiencies (if any) have been corrected.

21.2.2.5. Names and qualifications of persons actually performing testing and sampling. Changes in personnel shall be approved by the COTR prior to performance of work under this contract.

21.3.4. Test Results: Test results shall cite the contract requirements; the test or analytical procedures used the actual results and include a statement that the item tested or analyzed conforms or fails to conform to specification requirements. The cover sheet for each report shall be conspicuously stamped in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, as the case may be. All test reports shall be signed by a testing laboratory representative authorized to sign certified test reports. The Contractor shall arrange for immediate and direct delivery of the signed reports, certifications, and other documentation to the COTR.

21.8. Documentation: The CQC shall prepare or assist with the preparation of the following documents:

21.8.1. Daily Reports: The Contractor's Daily Report, as discussed in the section Contractor Correspondence and Daily Reports, shall be signed by the CQC Representative as well as the Superintendent. The CQC Representative's signature certifies that, to the best of his or her knowledge, the report is complete and correct and that all materials, equipment and work described on the report are following the contract plans and specifications, except as noted otherwise.

21.8.2. Special Inspection and Documentation: Reports of Special Inspections shall be signed by both the CQC Representative and the CQC Specialized Supplemental Person who witnessed the test or inspection certifying compliance with the specific contract requirement.

21.8.3. As-Builts: The CQC Representative shall ensure that all requirements for as-built record drawings and specifications are met. The CQC Representative or Specialized Supplemental Personnel assigned to inspect that particular portion of work shall initial

each as-built drawing or technical specification section to certify its accuracy prior to submission in accordance with the Project Close-Out Requirements section.

22. PERMITS, LICENSES& FEES

22.1. The Contractor shall obtain and pay for all applicable permits and licenses required by D.C. regulating agencies, including but not limited to storm water management, water quality as it relates to Rock Creek disturbance, elevator permits, etc.

22.2. The Contractor shall pay all duties, fees, taxes, and other charges and give all notices necessary and incidental to the due and lawful execution of the work.

22.3. The Contractor shall keep the Smithsonian indemnified against all penalties and liability for breach of provisions of any national, provincial, district or city statute, ordinance or law and the regulations and by-laws of any local or other duly constituted authority, which may be applicable to the Work and with such rules and regulations of public bodies and companies.

22.4. Accessibility for Physically Disabled Persons: The Contractor's shall provide temporary constructions at the site as necessary to maintain access for physically disabled persons. All provisions for temporary access shall be subject to the approval of the COTR.

23. UTILITY SERVICE INTERRUPTIONS AND NEW CONNECTIONS

23.1. Any planned interruption in utility service must be approved by and coordinated through the COTR. The Contractor shall submit a written request as far in advance of scheduled interruption as possible, but no less than two (2) full working days in advance. The Contractor shall make the necessary temporary provisions to supply continuous electrical power, HVAC space conditioning and security as required during periods when service is interrupted.

23.2. Work shall be coordinated to minimize the number and duration of outages.

23.3. All planned shutdowns and outages must occur between the hours of 6:00 p.m. to 6:00 a.m., unless otherwise approved by the COTR.

23.4. The Contractor's work efforts to restore service shall be continuous until the interrupted utility is back in service.

23.5. The electrical power for may not be interrupted without advanced coordination with the COTR.

23.6. A fire watch shall be provided for the time periods when fire suppression and detection systems are out of service.

24. SI-FURNISHED ITEMS INSTALLED BY THE CONTRACTOR – NOT USED

25. SALVAGE

25.1. The Smithsonian Institution assumes no responsibility for salvage value or any loss or damage to materials or structures on the site for which the Contractor may have reflected a salvage value in his or her offer.

25.2. Except as specifically stated in the contract documents, construction materials, equipment or other items that are to be removed and neither re-used under this contract nor reserved as property of the Smithsonian Institution shall become the property of the Contractor and shall be removed from the premises by the Contractor.

26. CUTTING, PATCHING AND MATCHING EXISTING WORK

26.1. Existing work shall be cut, drilled, altered, removed, or temporarily removed and replaced as necessary for performance of work under the contract. The work that is replaced shall match similar existing work. Structural members shall not be cut or altered, except where noted on drawings, without authorization of the COTR. Work to remain in place, which is damaged or defaced during this contract shall be restored to match the conditions existing at the time of award of the contract, at no additional cost to the Smithsonian.

26.2. Conditions exposed by removal of existing work that do not match new finishes or align with new work shall be called to the COTR's immediate attention. Necessary corrective work directed by the COTR will be subject to adjustment provisions as stated in the General Conditions of the contract.

SECTION E - PROTECTION OF THE SITE DURING CONSTRUCTION

27. PROTECTION OF THE SITE

27.1. The Contractor shall provide adequate protection for all parts of the building, including interior and exterior surfaces, its occupants, contents, and grounds wherever work under this contract is performed.

27.2. Plan for Protection of the Site: The Contractor shall submit a plan for protection of the site to the COTR for approval. The plan shall be submitted no less than five (5) working days after the Preconstruction Meeting. As a minimum, the Plan shall describe:

27.2.1. Proposed method, location, and construction of temporary enclosures.

27.2.2. Routes of access and egress, including those for people with disabilities.

27.2.3. Location and maintenance of emergency exits.

27.2.4. Methods of protection of existing surfaces and occupants.

27.2.5. Means of connection of temporary enclosures/surfaces to existing historic materials.

27.3. During construction, temporary enclosures shall be constructed to prevent unauthorized access or egress. Dust and fume barriers shall be constructed, as needed, or as determined by the COTR, to seal and isolate the work area from the remainder of the interior areas while the work is in progress. Wood used for protection of the site shall be pressure-impregnated, fire-retardant. All plastic sheeting shall be fire retardant 6-mil polyethylene. Submit product data to the COTR for review and approval.

27.4. The Contractor shall submit information describing the proposed construction of temporary enclosures and methods of installation to the COTR for approval. Any connections to existing structures must be accomplished in such a way as to minimize disturbance of existing surfaces.

28. PROTECTION OF FLORA, FAUNA, AND IRRIGATION SYSTEM

28.1. Flora Protection: The Contractor is expressly prohibited from collecting plant materials on Smithsonian property.

28.2. The Contractor shall not store materials inside the dripline of trees or shrubs. Prior to the start of the work on site, the Contractor shall surround trees within the project site and adjacent areas with a protective 6-foot-high chain link fence located 1 foot minimum outside the drip line.

28.3. Vehicular traffic inside the dripline of trees, on turf areas or on flowerbeds is not permitted without prior approval of the Smithsonian's Department of Horticulture through the COTR. If flowerbeds must be crossed by vehicles, bridging is required. Bridging shall be 100 mm

thick timbers 2 layers of ¾ inch exterior grade plywood or 2" x 10" or 1" protective plastic decking such as Bravo mat or equal to help prevent soil compaction of the soil in the lawn areas and flowerbeds. Any turf area used for parking with prior approval as noted above must first be planked by the Contractor.

28.4. Where aerial work is being performed above flower/shrub beds, the Contractor shall protect them with an approved protective framework installed at least 300 mm above the tops of the plant materials. The Contractor shall submit the proposed method of protection to the COTR for approval. Trees and shrubs shall only be tied back with the approval of the COTR.

28.5. Any damage to the existing irrigation systems during construction shall be repaired by the Contractor within two calendar days from when the damage occurred.

28.6. NOT USED

28.7. The Contractor shall bear all costs for repairs to the damaged irrigation system. Where the low voltage control wiring is damaged due to construction, then said wiring shall be replaced from the zone valve to controller. No splicing will be permitted.

28.8. Identification tape, when damaged, shall be replaced with an identification wire from valve to controller.

28.9. All damaged irrigation piping shall be cleared of debris prior to making the connections.

28.10. The Contractor shall bear all costs for replacement of damaged plant materials. Replacement plant materials shall meet the criteria established by the NZP's Department of Horticulture.

28.11. Plant material removed by the Contractor for reuse shall be balled, bagged, and protected in accordance with instructions prepared by the NZP's Department of Horticulture.

28.12. Turf areas damaged during construction shall be repaired by the Contractor by rototilling a minimum depth of 6 inches, backfilled with sandy-loam topsoil. Sod shall be certified sod, none netted and a minimum of one year old. Sod shall be 90:10, consisting of a minimum of three varieties tall fescues and one Kentucky Bluegrass. The NZP's Department of Horticulture, through the COTR, must approve the source of the sod. The Contractor shall bear all costs for these repairs. Suggested sources are:

Oakwood Sod Farm, Inc.
29307 Waller Road
Delmar, MD 21875
Phone: (410) 896-4009
Toll-Free: (800)379-8488

Collins Wharf Sod
25361 Collins Wharf Rd

Eden, MD 21822
Phone: 410-334-6676
Fax: 410-749-3815
cwsod@collinswharfsod.com

Summit Hall Sod Farm
21300 River Road
Poolesville, MD 20837-9114
Phone: 301-948-2900
Fax: 301-349-2668

28.13. The Contractor shall be responsible for the daily removal of trash and construction debris from turf and flower/shrub beds within the limits of construction.

28.14. Any plant material destroyed and/or damaged by the Contractor during construction shall be replaced with like genus and species of the same size, at no additional cost to the Smithsonian. The damaged plant materials must be replaced prior to final payment. The same applies to artifacts or furniture collection pieces. The COTR requires five (5) working days' notice should any of the artifacts or furniture collection need to be removed to facilitate construction.

28.15. Any construction scaffolding on turf and planted beds must be coordinated with the NZP's Department of Horticulture, through the COTR, to ensure that its installation will not damage or destroy existing plant materials or turf area or interfere with daily maintenance of the grounds. Trees may be tied back to permit scaffolding erection, no more than 4 feet if possible. The tying back must be performed by a certified Arborist with the approval of NZP's Department of Horticulture through the COTR. Where scaffolding is necessary to facilitate construction, NZP's Department of Horticulture requires a three (3) workday notice for said work.

28.17. Fauna Protection: The Contractor is prohibited from hunting, collecting, or feeding animals on Smithsonian property. All food and food wrapping brought on the premises must be properly disposed of in approved containers, which are secured from animals.

28.18. If a generator is placed on the turf, Contractor must have the COTR's approval of its placement. Generator shall be placed on anti-compactor boards. The generator must be placed in a drip containment basin.
28.19. A schedule of values for plant material is not required.

28.20. Use requirements for 28.21 topsoil, 28.22 screened leaf mold, 28.23 soil mix aggregate, and 28.25 ground limestone when any of the following conditions occur:

a) When landscaping is part of the work, but a separate soil spec is not provided
b) When a Contractor has damaged an area that includes soil or landscaping and is to be repaired
c) For backfill as noted under 28.24

28.21. Topsoil: ASTM D 5268, fertile, naturally sandy loam as defined by USDA Handbook no.

18, Figure 38. It shall be natural, surface soil in a friable condition and contain less than 3% subsoil. The topsoil shall be free of hardpan material, stones, and clods larger than ½ inch in diameter, sticks, tree or shrub roots, debris, toxic substances (e.g. Residual herbicides) and other material detrimental to plant growth. The area and the topsoil shall be free of plant or plant parts of undesirable plants such as, but not limited to, Bermuda grass, nut sedge, mugwort, Johnson grass, Quack grass, Canada Thistle, or noxious weeds as set forth in the Federal Seed Act. It shall be certified free of Southern Blight.

28.21.1 Contractor shall notify COTR of location of all sources of the topsoil and furnish the COTR a certified report from the agricultural experiment station or approved agricultural laboratory of an analysis performed not more than 60 days prior to the date of submission. If the topsoil is a mix, it shall be mixed off-site. The topsoil shall be certified to meet the following requirements:

a. Shall be a natural, original surface soil of a sandy loam texture with a mechanical analysis of 60-65% sand, 15-25% silt and 10-15% clay.

b. Shall have at least 2%, but not more than 5%, organic matter.

c. Soil pH shall be 5.5 to pH 6.5 inclusive unless otherwise specified.

d. Soil salinity by electrical conductivity measurement shall not exceed 600 parts per million (ppm) as determined by Black, Editor “Method of Soil Analysis,” Part 2, published by the American Society of Agronomy, 1965.

e. The soil nutrient level shall be greater than 100 lbs./acre of magnesium, 150 lbs./acre of phosphorous and 120 lbs./acre of potassium.

28.21.2. Agricultural limestone at not more than 5 pounds per cubic yard of topsoil may be used to adjust an acidic condition provided it is well mixed in a manner, which does not destroy the structure of the soil.

28.21.3. Topsoil that has been synthesized by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH, and soluble salts requirements.

28.21.4. The COTR reserves the right to inspect and sample all topsoil at the source and at the time of delivery. These inspections will be made without cost to the Contractor.

28.21.5. Topsoil must not be delivered or handled in a frozen or muddy condition.

28.21.6. Shipment and Delivery - All soil must be approved by the COTR before delivery to the site. Any material not meeting requirements of this specification will be rejected on or after delivery.

28.22. SCREENED LEAF MOLD

As available through Maryland Environmental Services, 2020 Industrial Drive, Annapolis, MD 21401 (301/261-8596) or approved equal, completely composted, and free from all materials such as glass, paper, plastics, etc. Composted sewage sludge shall not be used.

28.23. SOIL MIX AGGREGATE

Aggregate shall be Solite 3/8 as manufactured by Solite Corp., 2508 Chamberlain Avenue, Richmond, VA or approved equal. Lightweight aggregate shall be expanded shale or slate expanded by the rotary kiln process. The aggregate shall meet the requirements of the American Society of Testing Materials C331-81 and C33-80.

28.24. BACKFILL

28.24.1 When existing soil is acceptable for use: Existing topsoil shall be used unless so directed otherwise by the COTR. The following mixture in accordance with the specifications herein, thoroughly mixed by volume shall be used as backfill:

6 parts existing soil
2 parts leaf molds
2 parts Solite #388

28.24.2. When existing soil is not acceptable for use: If so, determined by the COTR that the existing soil is not acceptable for use, the Contractor shall excavate all soil to a depth of 24 inches and disposed of off-site. The following backfill mixture, thoroughly mixed by volume in accordance with the specifications herein, shall replace the excavated soil:

60% sandy loam topsoil
20% Solite #388
20% Composted leaf mold

28.24.3. Backfill shall be mixed off site. If requested, backfill shall be mixed in the presence of the COTR. Backfill must be approved by the COTR before delivery to the job site.

28.25. GROUND LIMESTONE

Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80% calcium carbonate equivalent with a minimum 99% passing a No. 8 (2.36 mm) sieve and a minimum 75% passing a No. 60 (250 micrometer) sieve.

28.25.1. Provide lime in the form of dolomitic limestone.

29. DEBRIS CONTROL AND DAILY CLEANUP

29.1. The Contractor shall regularly clean up the work areas and shall, at all times, maintain the project in as neat and orderly a manner as is consistent with normal operations. Debris resulting from construction operations shall be removed from the site daily by the Contractor. The Contractor shall keep all access, haul routes and site areas free of dirt, debris and other materials resulting from construction activities.

29.2. Under no circumstances shall any rubbish or waste be dropped or thrown from material lifts, one level of scaffolding to another, or within or outside the building. Rubbish may be lowered by way of chutes, taken down on hoists or lowered in receptacles.

29.3. In addition to a general daily clean-up and removal of rubbish, the Contractor shall immediately prior to final inspection for completion and acceptance, or when directed by the COTR, have all surfaces swept and dusted, and all finished surfaces washed and in a new appearing condition with all stains, soil marks, dirt and other forms of defacement removed.

29.4. Trash receptacles: The Contractor shall provide enclosed trash receptacle(s) in quantity and size necessary to meet project needs, located as approved by the COTR. Trash receptacles shall be placed out of public viewing.

29.5. Refer to *Construction Waste Demolition Waste Tracking Sheet*, following section 010000.
The Contractor shall recycle, salvage, or otherwise divert from landfills and incinerators, at least 50%, with a goal of at least 75%, by weight (tons), unless otherwise noted, of non-hazardous construction and demolition material. The contractor shall track recycling efforts and diversion rates using the Construction and Demolition Waste Tracking Sheet, attached. Before any work is started, the contractor shall submit a Construction Waste Management Plan, consisting of waste identification and a waste reduction work plan. Waste identification shall indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates. Waste reduction work plan shall 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. With each application for payment, the contractor shall submit the Construction and Demolition Waste Tracking Sheet, attached, with data compiled for the payment period, including receipts from hauler or destination. Before request for substantial completion, the contractor shall submit calculated end-of-Project percentage of waste diverted from landfills and incinerators (recycled, salvaged, or disposed) as a percentage of total waste generated by the Work. With request for final payment, the contractor shall submit actual percentage of waste diverted from landfills and incinerators (recycled, salvaged, or disposed) as a percentage of total waste generated by the Work.

29.6. All food and food wrappings brought on the premises must be properly disposed of in approved containers that are secured from animals and pests.

30. DUST AND AIR QUALITY CONTROL

30.1. The Contractor will execute the Work by methods that minimize dust, vapors and gases raised by construction operations. The Contractor will utilize engineering controls and work practices to prevent airborne dust, vapors, gases, and objectionable odors from dispersing into the atmosphere and from being drawn into existing air-intake louvers, ductwork, and adjacent elevator shafts. A work plan of methods and means for this section shall be submitted to the COTR for review and approval.

30.2. Dust barriers shall be erected, where necessary, to protect adjacent areas from dust infiltration as required by the COTR. Dust barriers shall be rigid and visually opaque and shall seal the work area by affixing to the structure on all sides (i.e. ceiling, walls, and floor). Wood used for dust barriers shall be pressure-impregnated, fire-retardant treated lumber. All plastic sheeting shall be fire-retardant 6-mil polyethylene. Submit product data for review and approval to the COTR.

30.3 Erect barriers to prevent the contamination of exhibit pool and holding pool water by wet-saw run-off and construction debris. Exhibit pool surfaces contaminated by dust, run-off, and debris shall be cleaned by the contractor per the direction of the COTR at no additional cost to the Smithsonian prior to project substantial completion.

30.4. Means of connection of dust barriers to existing structures shall not damage the building fabric. Details of barriers shall be submitted for approval to the COTR.

30.5. No open fires or burning of trash are permitted.

31. NOISE CONTROL

31.1. The Contractor shall comply with the regulations of the District of Columbia and OSHA Standards 1926.52 and 1910.95 and all other regulations relative to safety noise control.

31.2. Activities that generate excessive noise or vibration and interrupt NZP functions or create public disturbances may be required to be performed during off-hours at the discretion of the COTR.

31.3. The Contractor shall provide sound attenuation to maintain acoustic level below 75 dBA at a distance of 15 m or below 75 dBA in occupied staff areas if less than 15 m away from noise source.

32. VERMIN, PEST, AND RODENT CONTROL

32.1. The Contractor shall use non-chemical means and practices that deter or prevent the introduction of pests into the project site or premises. No chemical means shall be permitted. Contractor’s focus should be NO FOOD DEBRIS on site with mandatory daily cleanup and removal.

33. DRILLING, WELDING TORCH CUTTING AND OTHER OPERATIONS THAT PRODUCE AIRBORNE CONTAMINANTS

33.1. Daily Permits:
When welding, torch cutting or other heating operations are to occur inside existing structures, the Contractor shall obtain a daily **HOT WORK PERMIT**.

During the course of the Work, all existing smoke and heat detectors and sprinklers heads must remain operable. Coverings may be applied to protect them from spray coatings or other hazardous conditions only during the actual operations. Coverings must be removed immediately after the operations have concluded, but at the end of each working day at a minimum. When work produces dust or other airborne contaminants, e.g. spray painting, that could impair existing fire suppression or detection system(s) or when the system itself is otherwise impaired (drained down, etc.), the Contractor shall obtain a daily **FIRE SYSTEM IMPAIRMENT PERMIT**. Each permit must be obtained at least two working days in advance from the COTR and posted at the job site prior to beginning the scheduled work.

33.2. Fire Watch: No welding or torch cutting shall be performed unless adequate fire protection is provided. The Contractor shall maintain a fire watch for the duration of welding, cutting, and heating operations and for at least 30 minutes after the 'hot' work has stopped. A fire extinguisher (minimum 10 pounds, dry-chemical type, typical) shall be on hand when drilling, welding, or cutting.

33.3. Use of Impact Hammers: The use of impact hammers or other equipment causing vibration, noise and dust may be harmful to collection animals and/or building occupants. The Contractor shall request approval from the COTR at least five (5) working days before beginning this type of work to ensure adequate time for notification of building occupants and protection of objects and collections.

33.4 Ventilation: The Contractor shall provide adequate ventilation to prevent air contamination or the accumulation of toxic materials. Take necessary measures to prevent welding fumes from entering mechanical ventilation systems, or passive transfer to adjacent areas. Seal all adjacent ducts and equipment openings with plastic. Where transfer is deemed likely or verified by the COTR, utilize local exhaust ventilation with HEPA filtration to control welding fumes. The Contractor shall submit means and methods for controlling air contamination to the COTR for review and approval.

SECTION F - TEMPORARY CONSTRUCTION FACILITIES

34. CONTRACTOR FIELD OFFICES, TRAILERS, AND SHEDS

34.1. The Contractor may establish a temporary office at the project site. The Contractor shall provide information about proposed locations of any temporary office, sheds, trailers and staging and storage areas and designation of size, color, and materials to the COTR for approval at least fourteen (14) days prior to mobilization.

34.2. The Contractor may provide his own locking device on the door to the temporary office, trailer or shed. The Contractor shall be solely responsible for the safekeeping and security of the construction facilities, materials, and equipment.

34.3. Upon completion of the Work, the temporary offices, trailers, and sheds shall be removed, and the area returned to its original pre-contract condition.

35. STAGING, STORAGE AND WORK AREAS

35.1. Staging and Storage Areas: The Contractor shall coordinate with the COTR the use of any area proposed for staging and storage of materials and equipment at least five working days prior to mobilization or at the Preconstruction Meeting, whichever is first.

35.2. The Contractor shall provide adequate storage and protection of materials and equipment delivered to the site to prevent theft, weather damage, mold infiltration, moisture damage and other physical damage. The site shall be maintained in a neat and orderly manner as to further minimize hazards to personnel, animals, visitors, materials, and equipment.

35.3. Plan for Staging, Storage & Work Areas: The Contractor shall submit a drawing of areas proposed for construction operations for approval by the COTR at least fourteen (14) days prior to mobilization or at the Preconstruction Meeting, whichever is first. The drawing shall show buildings, utilities, temporary toilet facilities, temporary utility extensions, temporary interior walls and barriers to limit unauthorized intrusion and to control noise and dust, pedestrian walkways, vehicular access, temporary fencing, trailers, sheds, storage areas and the Contract's desired route for access and egress to the premises and to the project site.

35.4. All wood used for temporary, interior construction shall be pressure-impregnated with a "Dricon" treatment or an equal treatment approved by the Smithsonian Institution. All pieces must bear the UL "FR-S" stamp. Intumescent (fire-retardant) paint shall not be used. All plastic sheeting shall be fire retardant 6-mil polyethylene. Submit product data to the COTR for review and approval.

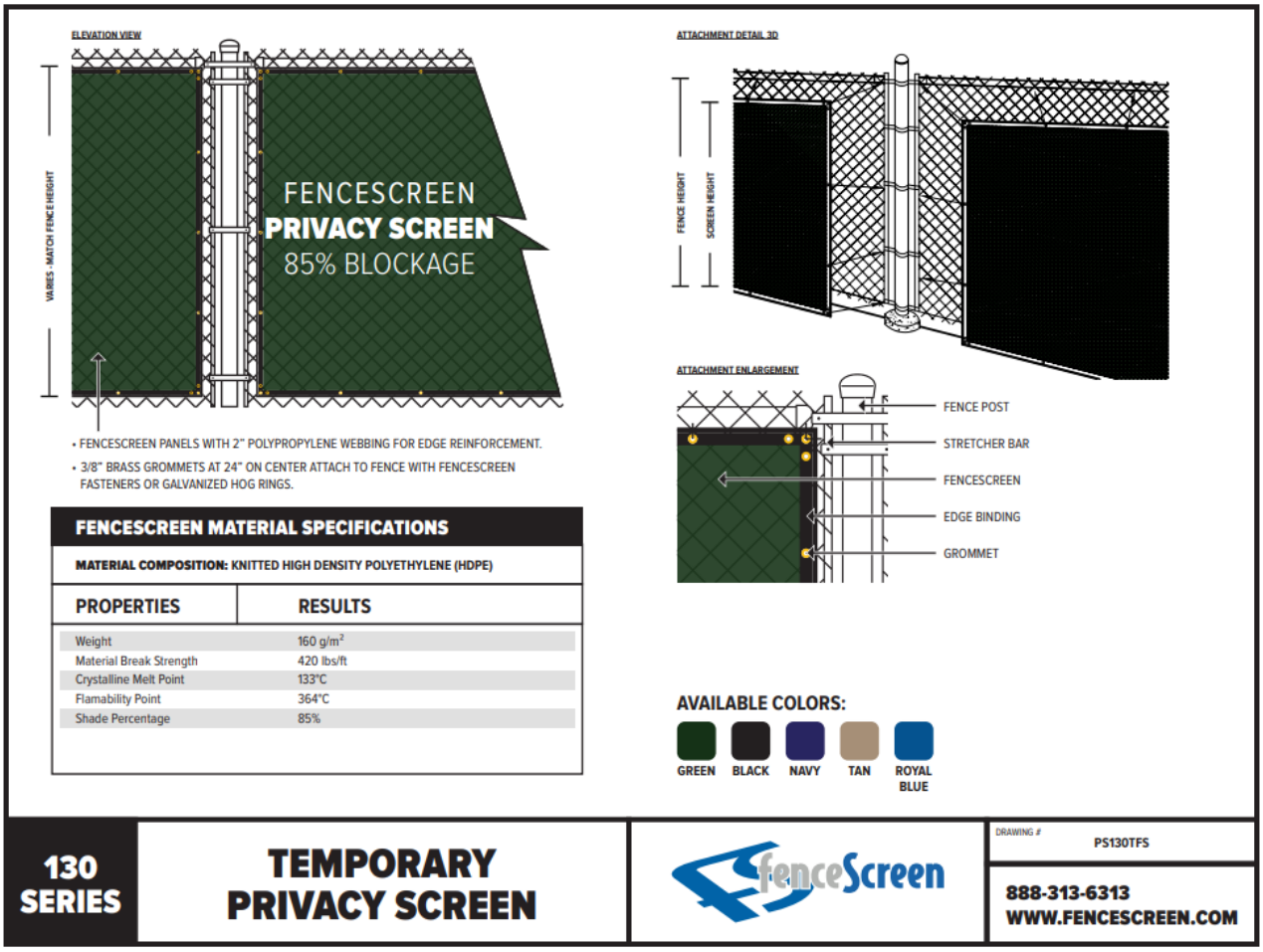
35.5 Temporary Chain Link Fencing with Lockable Gates shall isolate the public, SI staff and collection animals in accordance with the contract plans and technical specifications. In the event that all the work area locations are not specifically indicated within the contract documents, the contractor shall identify and implement a safe isolation barrier. All fence sections will be maintained in a new or like new condition. Damaged sections will be removed from site. *Also reference paragraph 51.*

35.6 **FENCE TYPE 1 - Temporary Chain Link Fencing:** Contractor shall provide and maintain a 6’ 0” tall by 7’ 0’ wide steel pipe framed fence with 2” x 2” galvanized steel fabric barrier surrounding the construction site and or work zones. Provide panel support bracing - 1-3/8" Pipe 7' L with (2) bends and bases to add extra support to chain-link panels as required to ensure fences is stabilized from in order for the fencing to withstand anticipated winds while remaining upright.

35.5. **BASE TYPE B -** Temporary Post Stands: Hi-Viz Anchor Stand Temporary Fence Base to Prevent stubs, trips, and other accidents with a high-visibility temporary fence base when placed on or near walking surfaces.

35.6 Public Screening Sectional Privacy Screen

- Color Green
- Brass Grommets
- One Screen Section per One Fence Section
- Attached with UV stabilized Outdoor Fence Fasteners
- Or Equal to the information provided below.



36. SANITARY/TOILET FACILITIES

36.1. Contractors' personnel will be permitted to use designated the public restrooms located on the premises, subject to the regulations and control of the COTR. If, in the opinion of the COTR, the Contractors' personnel fail to maintain acceptable dress and conduct appropriate to a public place, permission to use the public restrooms may be rescinded.

37. TEMPORARY UTILITY SERVICES AND EXTENSIONS

37.1. Existing electrical, and water utilities are available for the Contractor’s use as designated by the COTR.

38. SCAFFOLDING AND PLATFORMS

38.1. The Contractor shall erect temporary scaffolding in accordance with OSHA 29 CFR 1926.451 and ANSI A10.8. The Contractor shall provide landing platforms with stairways or ladders for proper access and egress to all work areas.

38.2. For all frame scaffolding greater than 4 m in height, the Contractor shall submit working drawings to the COTR a minimum of ten (10) working days in advance of scaffolding erection. Working drawings submitted by the Contractor shall be certified by a registered Professional Engineer. Provide additional safety plan and training certifications for any motorized scaffolding or lifts. Provide weight and size of any proposed motorized lifts for approval.

38.3. During non-working hours, the Contractor shall close and lock the scaffolding/lifts with a physical barrier to prevent access by unauthorized persons.

39. PROJECT SIGNS – N/A

SECTION G - MEETINGS

40. PRECONSTRUCTION MEETING

40.1. A Preconstruction Meeting will be scheduled with the Contractor before any work is started at the site. As soon as possible after the Date of Award, the COTR will contact the Contractor to arrange a time, date, and place for the conference. Items to be discussed at the Preconstruction Meeting include, but are not limited to:

40.1.1. Contract Time: Notice to Proceed date and Completion date.

40.1.2. Scheduling and Submittals.

40.1.2.1. Progress Schedule

40.1.2.2. Payment Breakdown Schedule

40.1.2.3. Required Submittals

40.1.3. Mobilization and Staging – Area for Materials and Equipment.

40.1.4. Access to the Premises, Haul Routes, Loading Dock.

40.1.5. Contractor Deliveries.

40.1.6. Security Requirements/List of Contractor's Personnel.

40.1.7. Emergency Procedures and Phone Numbers.

40.1.8. Protection of Site and Premises.

40.1.9. Fire Protection, Safety and Health Requirements.

40.1.10. Utility Interruptions, Rough-in Inspections, Testing.

40.1.11. Applications for Payment.

40.1.12. Pre-Condition Survey of the Site.

40.1.13. Accessibility Requirements.

40.1.14. Sequence of Construction.

40.1.15. Quality Assurance and Inspection of the Contract Work.

40.1.16. Sustainability Requirements.

40.1.17. Building Systems Commissioning.

40.1.18. Quality Control.

40.1.19. Preservation of Wildlife and Natural Resources.

40.2. All of the Contractor's staff and Subcontractors or Suppliers whose presence is necessary or requested by the COTR shall attend the Preconstruction Meeting.

40.3. Coordination Plan: The Contractor shall use the Preconstruction Meeting to develop a Coordination Plan for interaction with other parties working in or using the facility. The plan shall be submitted no less than five (5) working days after the Preconstruction Meeting and shall address interactions with other contractors, tenants, the public and any others making use of the site and surrounding areas. As a minimum it shall include:

40.3.1. Locations of overlap in use of the site by the Contractor and others, including work areas, delivery points, access/egress areas.

40.3.2. Specific items of work by others required to support critical milestones in the Contractor's schedule.

40.3.3. Completion or delivery of work by others that may impact the Contractor's schedule.

40.3.4. Portions of the work that create special hazards or disturbances.

40.3.5. Portions of the work that affect utilities, fire-protection or detection systems or security systems.

40.3.6. Events requiring access to areas outside of the project site or secured spaces.

40.3.7. Protection to be provided by the Contractor for work completed by others either before or during this project.

41. PRE-CONDITION SURVEY OF THE SITE

41.1. After the Preconstruction Meeting and before the start of work on the site, the project site (i.e. building, yards, contents, grounds, and equipment) shall be inspected by the Contractor, major Subcontractors, COTR and other Smithsonian Institution and NZP personnel as may be required for the purpose of verification of the existing conditions. Any damages or defective equipment will be noted at this time and this survey will serve as the basis for the establishment of the pre-contract conditions. The Contractor and Smithsonian Institution will jointly establish the identification of pre-contract conditions.

4.1.2. Any damage to the buildings, yards, their contents, grounds, or equipment that occurs during the contract period, unless noted as existing during the inspection as specified above shall be repaired to its pre-contract condition by the Contractor at no cost to the Smithsonian. The COTR will determine the adequacy of the repairs as required in the previous paragraph.

41.3. Written and photographic documentation: The Contractor shall prepare photographic presentation report in PDF format to identify all damages or defects of materials, equipment, and the site. The Contractor shall submit report electronically to the COTR before staring any work on site.

42. PROJECT MEETINGS

42.1. Progress Meetings: The COTR will lead regular progress meetings with an interdisciplinary integrated management team consisting of representatives (as required) of the Contractor, Smithsonian, Architect/Engineer, Commissioning Provider, major Subcontractors and other critical Subcontractors and suppliers. The purposes of these meetings are to expedite the work, coordinate and schedule the Work and coordinate the work with Smithsonian activities. Progress meetings shall be held weekly unless otherwise directed by the COTR. The time and place of the meetings will be established at the Preconstruction Meeting. The Contractor shall ensure that all required Subcontractors and suppliers attend the Progress Meetings and the COTR will ensure that all necessary SI personnel attend.

42.2. Special-Topic Meetings: At the discretion of the COTR, additional separate meetings may be scheduled to address issues of quality control, sustainability requirements, coordination between contractors on the premises, coordination with other agencies, scheduling of the work, application for payments, etc. The Contractor's staff and Subcontractors or Suppliers whose presence is necessary or requested by the COTR shall attend.

42.3. Meeting Minutes: The Contractor shall promptly prepare minutes of each meeting and transmit to the COTR, within five (5) working days.

SECTION H - SUBMISSIONS

43. SUBMITTAL DEFINITIONS

43.1. Submittals are defined to include shop drawings, product data, samples and additional data required for submission to the COTR for review and approval prior to incorporation into the work. All documentation transmission shall be electronic, unless otherwise requested.

43.1.1. Shop Drawings: Detailed drawings, schedules, diagrams, and illustrations prepared specifically for this project by the Contractor or any subcontractor, manufacturer, supplier, or distributor to illustrate fabrication and/or installation of a portion of the Work.

43.1.2. Schedule: A detailed tabulation of components, items, or parts to be furnished for use on this project.

43.1.3. Statement: An affirmation prepared by the Contractor, the installer or manufacturer of a material, product, or system, to satisfy a requirement defined in a technical section.

43.1.4. Factory Test Report: A written report of the findings of a test performed by the Contractor on an actual portion of the Work or prototype prepared for this project before it is shipped to the site.

43.1.5. Field Test Report: A written report of the findings of a test performed by the Contractor on a portion of the Work during or after installation.

43.1.6. Certificate of Compliance: A written statement, signed by an authorized official of the manufacturer of a product or system or supplier of a material attesting that the product, system, or material meets the requirements of the contract documents. The certificate of compliance must be dated after the award of this Contract and must name the project and cite the specification section, paragraph, and requirements, which it is intended to address.

43.1.7. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature and catalog information illustrating a material, product or system to be installed on this project, including all data related to LEED requirements, such as recycled and regional content information, Volatile Organic Compound (VOC) product schedules, Forest Stewardship Council (FSC) chain-of-custody documentation and other documentation as requested by the COTR.

43.1.8. Color Charts: Pre-printed brochures showing the color range of a material.

43.1.9. Test Reports: Reports verifying that a material, assembly, system, process, or laboratory meets requirements established in the Contract Documents. Reports shall

indicate compliance by naming and describing the test method and test results. Testing must have occurred within three (3) years of the date of award of this contract.

43.1.10. Samples: Physical examples of materials, equipment, assemblies, or workmanship establishing standards for evaluating finished Work.

43.1.11. Color/Texture Selection Sample: Samples of an available range of textures and/or colors of a material formed of the actual finish material over a substrate identical to that which will be used in the field.

43.1.12. Mock-up: An assembly or sample panel constructed in accordance with specifications to show construction details, finished appearance and/or performance.

43.1.13. Material Safety Data Sheets: Instructions, warnings and recommended and required handling and use procedures for individual hazardous materials published by the product manufacturer.

44. SUBMITTALS AND REVIEWS

44.1. Contractor Responsibility for Submittals: The Contractor shall provide all required submittals, by technical specification section, in accordance with the contract documents. All submittals, with exception of mockups or samples, are to be submitted electronically by email in PDF format. The Contractor shall clearly indicate on the submittal that it has been reviewed by the Contractor and found to meet the project requirements. Any items submitted as substitutions shall be clearly identified as such on the submittal and the transmittal document. If shop drawings show variations from the contract documents because of standard shop practices or for other reasons, the Contractor shall provide a separate, written description of variations along with the submittal. The Contractor shall:

44.1.1. Review each submittal for conformance with requirements of the contract documents and coordination with related work.

44.1.2. Determine and verify all field measurements, required material quantities, method of assembly or erection, installation requirements and proper connection to adjoining materials installed by others.

44.1.3. Assure that all submittals use the appropriate units of measure. All drawings and technical data shall be in SI (metric) units for projects designed in SI units. Preprinted literature in other units shall be accompanied by documentation to show conformance to project requirements.

44.1.4. Transmit all required submittals for a technical specification section at the same time unless prior written waiver of this requirement has been provided by the COTR.

44.1.5. Transmit submittals to the COTR in a logical and orderly sequence in accordance with the Submittal Schedule to prevent project delays or adversely impact work by the Smithsonian Institution or other contractors.

44.1.6. Correct and resubmit submittals according to response from Smithsonian Office of Planning Design & Construction.

44.1.7. Commence work on items requiring submittals only after all related submittals are reviewed and approved by the Smithsonian. All Work shall conform to approved submittals.

44.2. Submittal Schedule and Control Log: The Contractor shall submit, to the COTR, a schedule of work-related submittals using the Smithsonian SF Submittal Log form within *fourteen (14) calendar days after the effective date of the Notice to Proceed. (An electronic Submittal Log form is available upon request.) Submittals shall be listed in the order they are scheduled to be submitted and the following information shall be given:

44.2.1. Project Name, Project Number, Contractor Name, Contract Number.

44.2.2. Technical Specification Section for each submittal.

44.2.3. Unique Submittal Number.

44.2.4. Description of item to be submitted, as listed in the specifications.

44.2.5. Date item must be submitted to the Smithsonian in order to support the project schedule.

44.2.6. Subcontractor providing submittal (in "Comments" column).

44.3. Quantities for Submittals: Unless otherwise noted in the technical specification, the Contractor shall deliver to the COTR:

44.3.1. Shop Drawings: Submit electronic copy of shop drawings in PDF format. Submittal will be forwarded electronically to the AE for review. After submittal review, submittal will be returned to the Contractor electronically, in PDF format. Submit in DWG format, if requested. Submit two reproducible black line prints, if requested.

44.3.2. Product Data, Test Reports, Color Charts, etc. The Contractor will make electronic submittals in PDF format, except for Color Charts. Submit two (2) original Color Charts from each product representative to be retained by the Smithsonian; copies or printouts from the computer will not be accepted. After submittal review, submittal will be returned to the Contractor electronically, in PDF format.

44.3.3. Color/Texture Samples: Submit two (2) samples, minimum size 600 mm by 600 mm, unless otherwise specified. After submittal review, the Smithsonian may retain one (1) sample.

44.3.4. Mock-up and Sample Installations: Unless otherwise specified, minimum size shall be as noted to complete a panel section or normal break in the work.

44.3.5. Written Text Documents, Plans and Reports: Submit electronic copy of written text documents, plans and reports in PDF format. Submittal will be forwarded electronically to the AE for review. After submittal review, submittal will be returned to the Contractor electronically, in PDF format.

44.4. Submittal Reviews by the Smithsonian: Reviewed submittals will be marked "Approved," "Approved as Noted," "Resubmit" or "Disapproved." Submittal approval by the Smithsonian shall not relieve the Contractor of responsibility for submittal errors, omissions, or deviations from the contract documents. Approval of submissions does not constitute acceptance of substitutions except as covered under sub-paragraph entitled "Contract Requests for Substitutions."

44.5. Submittal Review Period: The Contractor shall transmit, to the COTR, all submittals sufficiently in advance of the time necessary for fabrication and installation to allow for review by the Smithsonian and return to the Contractor, including any time needed for correction and resubmission by the Contractor. The expected time required by the Smithsonian for review of initial submission is 14 calendar days. No extension of the Contract Time will be granted for the Contractor's failure to allow sufficient time for review and processing, including resubmission of items that are initially rejected due to improper submission or non-compliance with the Contract Documents.

44.6. Contractor Requests for Substitutions: Contractor requests for items identified by manufacturer, brand name, make, catalog number, etc. in the contract documents shall be submitted to the Contracting Officer for approval prior to contract award, in accordance with the General Conditions. After award of the contract, contractor requests for substitutions may be considered and accepted by the Smithsonian at the discretion of the Contracting Officer. Substitution requests shall be submitted with fully completed and signed two-page CSI Form 13.1A or substitution request form containing the equivalent information. Include all necessary documentation in support of the substitution request including, but not limited to, product data, certificates, material test reports, certificates, and qualification data.

44.7. Construction Progress Schedule Submittal: The Contractor shall submit a progress schedule within one (1) calendar day from the date of the Notice to Proceed. No work shall start at the site until the progress schedule has been approved by the COTR. The schedule shall provide a weekly breakdown of activity including interaction between trades and be subdivided in accordance with items of work or areas of the job where the work is to take place. The schedule shall also list equipment, special devices, hardware, products, or other items requiring long lead time, when these items are ordered and the projected delivery dates. The last week of the schedule shall reflect final inspection, testing, and the correction of deficiencies.

45. CRITERIA FOR PRODUCT SELECTION

45.1. To the greatest extent possible, subject to the restrictions of the Buy American Act, provide products, materials, or equipment of a singular generic kind from a single source. Where more than one choice of a product or material is available for Contractor's selection, select an option, which is compatible with other products and materials already selected.

45.2. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation for intended use and effect.

45.3. Products, which, by nature of their application, are likely to be needed at a later date for maintenance and repair or replacement work, shall be current models for which replacement parts are available.

45.4. Product selection shall be done in accordance with the following requirements:

45.4.1. Standards, Codes and Regulations: Select from among products that follow the project requirements, as well as with construction standards, all applicable codes and regulations and LEED requirements.

45.4.2. Performance Requirements: Provide products that comply with specific performances indicated and are recommended by the manufacturer (in published product literature or by individual certification) for the application indicated.

45.4.3. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components and complying with specified requirements for mixing, fabricating, curing, finishing, testing and other operations in the manufacturing process.

45.4.4. Visual Matching: Where matching with an established sample for color, pattern and/or texture, the COTR shall determine whether a proposed product matches the sample.

45.4.5. Avoidance of banned materials: The Contractor will commit to not using the following toxic and hazardous materials:

45.4.5.1. Products containing asbestos, urea formaldehyde, polychlorinated biphenyls (PCBs) and/or chlorinated fluorocarbons.

45.4.5.2. Products containing lead content, including older or flux containing more than 0.2 percent lead; domestic water pipe or pipe fittings containing more than 8 percent lead; and paint containing more than 0.06 percent lead.

46. PHOTOGRAPHIC DOCUMENTATION

1.2 SUMMARY

A. Provide weekly digital photos that represent construction progress.

B. The Contractor shall provide digital photographs of the project site and construction activities throughout the progress of the Work, acceptable to the Smithsonian Institution. The COTR shall determine the vantage points from which photographs will be taken.

1. At least 24 color progress photographs shall be taken monthly. The actual number and location of views shall be directed by the COTR. Photographs shall be taken at the start and finish of various elements of construction designated by the COTR.

C. Data Capture (Laser Scan): digital scans are required for survey and layout purposes. Refer to 2.5 Construction Layout within this section.

47. CONTRACTOR CORRESPONDENCE AND DAILY REPORTS

47.1. The Contractor shall correspond with the COTR for all matters related to this construction project, unless otherwise directed. All correspondence shall be signed and dated by the Contractor and shall reference the project, project number and contract number.

47.2. The Contractor shall maintain daily reports using the Smithsonian Institution Contractor's Daily Report form. Reports shall be numbered consecutively, and all sections shall be completed or noted as "not applicable." Reports shall contain detailed remarks each day, including but not limited to progress on the job, problems discovered and discussions with Smithsonian staff. Reports shall be submitted to the COTR each day for the previous workday.

SECTION I - SAFETY, HEALTH, AND FIRE PROTECTION

48. JOB SITE SAFETY

48.1. Safety Coordinator: The Contractor shall designate a person responsible and accountable for personnel safety at both corporate and project level at the project site for the duration of the project. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes. Qualifications for the Safety Coordinator shall include the OSHA 30-hour course or equivalent course.

48.2. Job Site Safety Plan: The Contractor shall submit a Jobsite Safety Plan at least 15 calendar days prior to mobilization to the site for approval by the COTR. As a minimum, the plan shall detail the procedures, designated persons, instructions, and reports to be used to assure jobsite safety for all contractors, subcontractors, Smithsonian personnel, the public and others on the site.

48.2.1. Site Specific Safety Plan: Upon award of this contract, the contractor shall provide a Site-Specific Safety Plan (SSSP). The SSSP is a safety and health policy and program document and outlines how the contractor will safely conduct their work. This plan shall be job-specific and shall also address any unusual or unique aspects of the project or activity for which it is written. The SSSP shall interface with the employer's overall safety and health program, and a copy shall be available on the work site. Any portions of the employer's overall safety and health program that is referenced in the SSSP shall be included as appropriate. The plan shall include but not limited to the following:

a. Signature Sheet that must include plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional, project QC). Provide concurrence of other applicable corporate and project personnel (Contractor).
b. Background Information that must include Brief project description, description of work to be performed, and location; phases of work anticipated these will require a Job Hazard Analysis (JHA's). OSHA 3071
c. Statement of Safety and Health Policy
d. Responsibilities and lines of Authority
e. Subcontractors and Suppliers
f. Training
g. Safety and Health inspections that include assignment of responsibilities for a minimum daily/weekly job site safety and health inspection during periods of work activity level of technical proficiency needed to perform the inspections, proof of inspector's training/ qualifications.
h. Accident Reporting
i. Plans (programs, procedures) required by the Safety Manual. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. Using the 29 CFR 1926 and/or current and accepted procedures in the EM 385-1-1 as a guide.
j. Risk Management Processes Detailed project-specific hazards and controls shall be provided by a Job Hazard Analysis for each major phase/activity of work, including but not limited to work involving confined space, fall protection, trenching/excavation, crane/rigging, steel erection, hot work, protection of the public, scaffolding, and other activities that involve high risk potential.
k. Jobsite foreman/superintendent shall sign safety plan and JHA submissions with a final approved copies kept on the jobsite for operational references.

48.3. Occupational Safety and Health: This contract is subject to Title 29 of the Code of Federal Regulations, Part 1910 "Occupational Safety and Health Standards" and Part 1926 "Safety and Health Regulations for Construction" pursuant to the Occupational Safety and Health Act (OSHA) of 1970 administered by the US Department of Labor, Occupational Safety and Health Administration.

48.4. Emergency Assistance: The Contractor shall post, at the site, telephone numbers for reporting emergencies, including the NZP's Police Station, ambulance, police, fire department, gas utility, electric utility, water/sewer utility, poison prevention aid and hazardous-waste handling. This information shall be posted in a conspicuous location within the project area prior to the start of any work at the site.

48.5. Safety Signs: The Contractor shall post legible accident prevention signs in construction areas in accordance with OSHA standards. Safety signs shall conform to ANSI 235.1 and 235.2 Vehicular traffic control devices, barricades and signals shall conform to ANSI D6.1.

48.6. Report of Accident or Illness: In the event of any accident or illness for which medical assistance is required, any criminal action or any fire, the Contractor shall notify the appropriate authority (Ambulance, Police, and Fire Dept.), Smithsonian Security, NZP Police, and the COTR.

48.7. Emergency Evacuation: The Contractor shall post evacuation routes and facility emergency/self-protection plans at the site, train all employees in emergency procedures, and document such training. In the event of a fire, the Contractor shall immediately activate the alarm at the nearest fire alarm pull station and notify NZP Police. Upon the activation of the audible alarm, the building will be evacuated. No personnel shall reenter the facility until security personnel signal that the building is safe.

48.8. Contractor Personnel to be Contacted: The Contractor shall submit a written list of emergency telephone numbers and names of persons to contact for the General Contractor superintendent and for each major sub-contractor working on the project site. The initial list shall be submitted to the COTR at the Preconstruction Meeting. The list shall be updated and resubmitted to the COTR as needed.

49. TOXIC AND HAZARDOUS SUBSTANCES

49.1. The Contractor shall submit to the COTR for approval, at least ten (10) working days prior to their intended use, a written list of toxic and hazardous substances that will be used on the project. The Contractor shall submit a "Material Safety Data Sheet" similar to OSHA Form No. 20 for these substances to identify the following information:

49.1.1. Product Identification.

49.1.2. Hazardous Ingredients.

49.1.3. Physical Data.

49.1.4. Fire and Explosion Hazard Data.

49.1.5. Health Hazard Data.

49.1.6. Emergency and First Aid Procedures.

49.1.7. Reactivity Data.

49.1.8. Spill or Leak Procedures.

49.1.9. Special Protection Information.

49.1.10. Special Precautions.

49.1.11. Volatile Organic Compound (VOC) Content.

49.2. The Contractor will commit to not using the following toxic and hazardous materials:

49.2.1. Products containing asbestos, urea formaldehyde, polychlorinated biphenyls (PCBs) and/or chlorinated fluorocarbons.

49.2.2. Products containing lead content, including solder or flux containing more than 0.2% lead; domestic water pipe or pipe fittings containing more than 8% lead. and paint containing more than 0.06% lead.

49.2.3. Chlorofluorocarbon (CFC)-based refrigerants in new base building heating, ventilating, air conditioning and refrigeration (HVAC&R) systems and comprehensive CFC phase-outs when reusing existing base building HVAC equipment.

49.2.4. The Contractor hereby understands that historic properties may contain pre-existing harmful materials and coatings including, but not limited to, arsenic, lead, dioxide, polyvinylchloride (PVC) and asbestos. Upon discovery of hazardous or toxic materials, the Contractor shall alert the COTR immediately.

49.3 The Contractor shall monitor the use of all toxic and hazardous substances to ensure that exposure to their workers from airborne concentration of, or physical contact with, these substances does not exceed applicable regulatory worker health and safety exposure limits.

49.4. The Contractor shall monitor the use of all toxic and hazardous substances to ensure that exposure to Smithsonian Institution and NZP employees and visitors to airborne concentrations of, or physical contact with, these substances is maintained as low as reasonably achievable. Any equipment or technical measures for this purpose must first be approved by the NZP's Safety Office through the COTR. Under no circumstances shall exposure exceed the established Short-Term Exposure Limit or 50% of the established Threshold Limit Values or Permissible Exposure Limits (whichever is less) as specified in either:

49.4.1. "Threshold Limit Values and Biological Exposure Indices" of the American Conference of Governmental Industrial Hygienists, latest revision, or

49.4.2. Title 29 CFR Part 1910, Subpart Z - "Toxic and Hazardous Substances" of the Occupational Safety and Health Standards, latest revision.

49.5. Exposure of the NZP's animals to air-borne or any other physical contact with any toxic or hazardous substance will be prohibited.

49.6. All toxic and hazardous substances and materials used by the Contractor must be removed from the NZP property upon completion of the project.

49.7. The Contractor shall provide methods, means and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations. The removal of contaminated waste shall follow applicable laws and regulations.

49.8. To achieve compliance with the requirements of this section, administration or engineering controls shall first be implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep exposure of all persons within the prescribed limits. Descriptions of equipment or technical measures to be used for this purpose must be submitted to the COTR for approval. The Contractor's requirements for compliance with all applicable Local, Federal, and State regulations remain in force.

49.9. The SI may reject any product that poses a high risk of fire or health hazard to staff, visitors, or the building, based on flammability criteria (e.g. low flashpoint) or established toxicity data (e.g. designation as a human carcinogen).

49.10. The Contractor shall submit, to the COTR, a list of the hazardous materials to be stored on site and the manner in which they will be stored. All containers and storage cabinets shall be approved by the COTR and labeled as to hazard and content.

49.11. The SI has made every effort to identify and to notify the Contractor of hazardous materials that may be encountered during the work. However, if suspected asbestos-containing material, lead-based paint, or other suspected hazardous materials are encountered during demolition or other phases of the work, the work involving the suspected material shall cease and the Contractor shall notify the COTR immediately.

50. PERSONAL PROTECTIVE EQUIPMENT

50.1. Personal protective equipment for eyes, face, ears, nose, head, extremities and/or full body shall be provided, used, and properly maintained by the Contractor whenever necessitated by reasons of hazards encountered in a manner capable of causing illness, injury, or impairment in the function of any part of the body.

50.2. Persons required to use personal protective equipment shall be thoroughly trained. Training programs shall, as a minimum, meet OSHA and EPA requirements where applicable. The Contractor shall submit proof and criteria for employee training as requested.

51. BARRICADES, BARRIERS, AND WALKWAYS

51.1. The Contractor shall provide safety barricades in accordance with the District of Columbia Building Code and applicable OSHA regulations. The Contractor shall also provide

barricades, subject to approval by the COTR, to deter passage of persons and/or vehicles into construction areas as specified or necessary.

51.2. The Contractor shall install temporary barriers, in a manner satisfactory to the COTR, to contain and secure the site from unauthorized entry and to minimize the adverse effects of noise, dust and vapors generated by construction activities on surrounding areas. Barriers shall be constructed of pressure-impregnated fire-retardant treated wood, with fire-retardant 6-mil polyethylene, as necessary. Submit all product data to the COTR for review and approval.

51.3. If the work interferes with public or employee access to the facility or parts of the facility, as determined by the COTR, the Contractor shall provide personnel barriers and signage to create easily identifiable, accessible (to people with handicaps) walkways around the work. Signs shall be posted at decision points to prevent unnecessary travel along changed routes and to dead ends. The barriers shall be erected and dismantled in phases so that a clear route is always available. The COTR and Contractor personnel shall have access through the barriers to the work areas. The Contractor may use hardware on the barrier doors to prevent entry by unauthorized persons.

51.3.1. Interior barriers shall be of standard drywall partition construction, painted and terminated at the underside of the existing ceilings. All requirements for fire protection shall be maintained.

51.3.2. Exterior barriers shall be of dimensional lumber and plywood, painted on both sides and supported to prevent overturning. Barriers shall be repainted and maintained as necessary to remain in good condition as long as they are required.

51.4. Unless specifically indicated otherwise, barricades, barriers and associated signs shall be removed upon completion of the Work. The Contractor shall coordinate the dismantling and removal with the COTR.

52. EXISTING FIRE PROTECTION SYSTEMS

52.1. During the course of the Work, all existing smoke and heat detectors and sprinkler heads must remain operable. Coverings may be applied to protect them from spray coatings or other hazardous conditions only during the actual operations. Coverings must be removed immediately after the operations have concluded. Damaged detectors and sprinkler heads shall be replaced immediately by the Contractor at no additional cost to the Smithsonian Institution. The Contractor shall test replaced detectors and sprinklers after installation to the satisfaction of the COTR.

SECTION J – SECURITY REQUIREMENTS

53. GENERAL SECURITY REQUIREMENTS

53.1 The Contractor and his/her employees must comply with security requirements imposed by the National Zoological Park, including any necessary security clearances. Failure to inspect the site or obtain knowledge of security regulations shall not relieve the Contractor from security requirements or from performance of any part of the work.

53.2. Fourteen (14) days prior to the start of work on the site, the Contractor, after receiving the Notice to Proceed, shall submit to the COTR for approval, a list of the names and addresses of all employees and subcontractor employees who will be working on the site. The list shall identify the Prime Contractor and each subcontractor and trade. It shall be updated as necessary to accurately identify all workers who will be working on the site during the project.

53.3. Provide at the Preconstruction Meeting the name and telephone number of the Contractor's Superintendent and authorized alternate individual who can be reached on a 24-hour basis.

53.4. Notify the COTR prior to disturbing any alarm wiring, devices, systems, etc. Planned disturbances will be coordinated at least three (3) working days in advance of when the work is scheduled. Any alarm wiring, devices or systems that are disturbed for any reason must be reported to the COTR within five (5) minutes of the occurrence. The COTR will determine the procedures for repairing the damage and who will perform the repair work. The Contractor will bear the cost of such repairs.

53.5 The contractor shall provide adequate security to prevent the presence of unauthorized persons on the work site area, and to keep doors secured when not in actual use to ensure the integrity of the barrier as well as for the property security.

53.6. The Contractor is prohibited from hunting, collecting, or feeding animals on Smithsonian property.

53.7. The Contractor is prohibited from feeding, petting, or harassing any NZP animal(s).

54. IDENTIFICATION BADGES

54.1 Key personnel may apply for an SI issued security badge with COTR’s approval.

55. SECURITY OF TEMPORARY OPENINGS

55.1. Any temporary opening in the building perimeter or between non-public and public interior spaces must be closed and secured with means acceptable to the COTR at the end of each workday. A clear and safe path shall be maintained at all times to allow visitors entrance into the National Zoological Park and its buildings. The Contractor shall secure his facilities and

equipment during non-working times at his own expense. Authorized Smithsonian personnel shall have access to the work site.

56. EXISTING BUILDING ALARM SYSTEMS

56.1 Contractor and COTR shall review work plans prior to starting work to identify alarms and notifications that will be impacted by the scheduled work.

56.2 COTR shall approve all modifications and adjustments to inactivate notifications.

57. NZP POLICE OFFICER DUTY CHARGES

57.1. If the Contractor is required to accelerate the work in order to complete the project within the specified Contract Time or if other conditions arise as a result of the Contractor's management of the work, which require that construction be accomplished during other than the normal workdays and hours defined for this project, the Contractor will be required to assume the cost of any additional inspection and NZP police officer at overtime rates.

SECTION K - SCHEDULES AND PAYMENTS

58. SCHEDULE OF VALUES

58.1. The Contractor shall submit, to the COTR, a schedule of estimated values of all parts of the work. The breakdown of costs on the Schedule of Values shall follow the divisions used in the project specifications and shall reflect major items and groups of items shown on the Contractor's project schedule. All values shall be in US dollars.

58.2. Wages: The contractor shall verify wages and comply with regulated wage scales, i.e. Davis-Bacon, Service Contract Act, etc.

59. SCHEDULING & PAYMENTS / CRITICAL PATH METHOD

59.1. CPM Scheduling: The work under this project will be scheduled and reported by the Contractor using the Critical Path Method. Submit Project Schedule in both PDF format and original scheduling software format. The approved Project Schedule(s) shall be used by the Contractor for planning, organizing, executing, and directing the work; for monitoring and reporting progress; and for requesting payment for work completed. All costs shall be identified in US dollars.

59.1.1. Order and Inter-Dependence of Activities: The Critical Path Method will be followed to show the order and interdependence of activities and the sequence in which the work is to be accomplished. Each activity shall be tied to all activities that must logically precede or follow it and all paths shall be continuous through to completion date(s).

59.1.2. Work Breakdown Parameters for Activities: The activities shown on the network diagram shall include construction activities, submittal processing by the Contractor, submittal processing by the Smithsonian, procurement activities for major equipment, fabrication of special materials and equipment, installation of special materials and equipment, inspections, and tests. All field activities that affect progress toward contractually required dates for completion of all or parts of the Work shall be shown. The level of detail shall be such that the duration of any activity will be no longer than ten (10) working days and no activity will have a dollar value exceeding $30,000, except as allowed by prior and specific approval of the COTR. All aspects of the contract activities are to be identified and priced accordingly in the proposal. This is to include, but shall not be limited to, separate pricing for bonds, insurance, CQC related work, etc. As-built drawings and all closeout requirements shall be line item priced.

59.1.3. Cost-loading of Activities: The Project Schedule shall include a dollar value (cost) for each work activity. The cost shall include labor, materials, equipment, small tools, incidentals and a prorated portion of overhead and profit. The sum of all activity costs shall be equal to the total Contract Price. Each activity cost shall be coded with a cost code corresponding to a line item on the Schedule of Values.

59.1.4. Computer Software: The Contractor shall use a computerized CPM scheduling software designed for use on MS computers. The name of the software proposed for use shall be submitted to the COTR, along with literature about the program's capabilities, functions, and operations, demonstrating that the requirements of the entire section entitled "Scheduling of the Work / Critical Path Method" can be met.

59.2. Required Schedules: The Contractor shall prepare and submit a Preliminary Project Schedule, Complete Project Schedule, Condensed Summary Schedule, Progress Schedules, and Recovery Schedules as described below.

59.2.1. Complete Project Schedule: Within 14 calendar days after receipt of Notice to Proceed, the Complete Project Schedule shall be submitted to the COTR for review and approval. The Contractor's submission of the Preliminary Project Schedule shall include four (4) copies and one (1) reproducible.

59.2.2. Condensed Summary Schedule: Along with each copy of the Complete Project Schedule, the Contractor shall submit to the COTR for approval, a condensed summary version consisting of not more than 250 activities summarizing major work elements.

59.2.3. Progress Schedules: Each month, the Contractor shall prepare a Progress Schedule by inputting all information regarding actual start and actual finish dates, projected through the end of the month, into the computerized Project Schedule. Complete discussion of this requirement is contained in the section "Reporting Progress and Applying for Payment."

59.2.4. Recovery Schedule: If the work falls substantially behind the approved Project Schedule the COTR may require the Contractor to submit a Recovery Schedule in accordance with the Construction Contract Clauses paragraphs relating to "Commencement, Prosecution and Completion of Work." Upon request, the Contractor shall submit a Recovery Schedule to the COTR for approval within ten (10) working days. The requirements set forth herein in the sub-paragraph entitled "Complete Project Schedule," shall apply to all activities shown on the Recovery Schedule.

59.3. Changes Related to Requests for Proposals: For all proposals involving requests for time extensions or other significant changes to schedule, the Contractor shall submit a listing of all the activities affected, added, or deleted (by node numbers). The effect in time and money shall be described for each activity. If, in the opinion of the COTR, the proposed change may impact the completion date(s), the Contractor shall submit a diagram of that portion of the network schedule affected by the changes, along with standard reports for analysis.

59.3.1 Diagrams and reports submitted to illustrate the impact of a proposed change shall show the necessary revisions to activities, along with their costs, durations, and trade responsibilities. Failure to submit such a diagram with a proposal shall constitute a waiver of any claims for time extensions associated with the subject of that proposal.

59.3.2 Modification of activity times shall be agreed to by both the Contractor and the COTR. In the event that agreement on modified activity times cannot be reached, the COTR will direct the specific time adjustments to be entered into the program to determine approved, revised, contract completion dates.

59.4. Response to Application:

59.4.1. Payment shall be made only for progress agreed upon by the COTR, performed on original Contract Work or approved modifications, in accordance with the current, approved Project Schedule. Failure to submit the Application in accordance with the specifications will prevent the processing of payments.

59.4.2. Payments will be mailed to the Contractor's address as identified in the contract documents on record with the Contracting Officer. Any changes of address or requests for wire transfer of progress payments must be made in writing, signed by the Contractor's authorized person, and submitted to the Contracting Officer.

60. ASSIGNMENT OF CLAIMS

60.1. Assignment of Claims are subject to the approval of the Contracting Officer. Any Assignment of Claim or subsequent re-assignment shall meet the requirements of the General Conditions contract clause entitled "FAR 52.232-23 Assignment of Claims."

60.2. All documents for assignments shall be written in the English language and shall be original ink signatures of the Contractor and assignee. All monies shall be identified in US dollars.

SECTION L - PROJECT CLOSEOUT REQUIREMENTS

61. PROJECT CLOSEOUT

61.1. Definition: Project closeout is a scheduled process for fulfillment of remaining contract requirements at the end of the project in preparation for final acceptance, final payment, and normal termination of contract, beneficial occupancy, and establishment of the warranty period.

62. SUBSTANTIAL COMPLETION

62.1. Definition: The date of Substantial Completion of a project or specified part of a project is the date, as confirmed by inspection by the COTR, when the construction is at least 95% complete and ready for beneficial occupancy, so that the Smithsonian can take possession of that area or part of the work. Portions of the work that are specified to be phased for completion, areas required for Smithsonian's use prior to completion of the total project or items of work identified by the COTR as necessary for partial beneficial occupancy may be inspected for substantial completion separately from the rest of the Work.

62.1.1. The Smithsonian Institution reserves the right to occupy or install equipment in completed areas of the building prior to substantial completion provided that such occupancy does not interfere with the completion of the work. Such partial occupancy shall not constitute acceptance of any part of the work.

62.2. Request for Substantial Completion Inspection: The Contractor shall submit a written request to the COTR for an inspection to establish Substantial Completion status. This request shall specify areas or parts of the work to be considered and shall include a listing of all exceptions to the request, that is, items not considered to be substantially complete.

62.3. Submission of Operation and Maintenance Manuals: Prior to requesting Substantial Completion Inspection, the Contractor shall submit, to the COTR, three (3) sets of manuals for all systems and equipment, as specified in the technical sections of this specification. The manuals shall be bound in letter-sized, three-ring, loose-leaf binders with durable plastic covers. They shall be organized into suitable volumes of manageable size using the divisions of the Specifications as a guide. Each manual shall have a table of contents and shall be assembled to conform to the table of contents with tab sheets locating each subject. The instructions shall be legible and easy to read. Where oversize drawings are necessary, they shall be folded to be not greater than letter-size. The words "Operation and Maintenance Manual," the name and location of the project, project number, contract number, date, and the name of the general contractor, shall appear on the cover. Data shall be specific to the equipment that is installed and reflect all approved changes and substitutions. Data shall also reflect any required or recommended seasonal adjustments or inspections. Include electronic copy of manual, in PDF format, on a thumb drive. Manuals shall include, as a minimum, the following data:

62.3.1. Detailed description of each system and each of its components, including layout showing piping, valves, controls, and other components and including diagrams and illustrations where applicable.

62.3.2. Wiring and control diagrams with data to explain detailed operation and control of each component.

62.3.3. Control sequence describing start-up, operation and shut down.

62.3.4. Procedures for starting, operating, and shut down.

62.3.5. Installation instructions.

62.3.6. Maintenance and overhaul instructions.

62.3.7. Lubricating schedule, including type, grade, temperature range and frequency.

62.3.8. Emergency instructions and safety precautions.

62.3.9. On-site acceptance test results for equipment installed under this contract.

62.3.10. Approved product data, shop drawings and system as-builts.

62.3.11. Copies of approved certifications and laboratory test reports (where applicable).

62.3.12. Notarized copies of warranties (originals to be provided as required by "Warranties and Guarantees").

62.3.13. Written instructions for test procedures.

62.3.14. Performance curves and rating data.

62.3.15. Parts list, including source of supply, recommended spare parts and service organization convenient to Smithsonian.

62.3.16. Name, address, and telephone number of each subcontractor who installed equipment and systems, local representative for each type of equipment and each system.

62.3.17. Other pertinent data applicable to the operation and maintenance of particular systems or equipment and/or other data as specified Divisions 2 through 16 of the Specifications.

62.4. Other Prerequisites for Substantial Completion Inspection: The Contractor shall also complete the following prior to requesting inspection for certification of substantial completion:

62.4.1. Testing and start-up of systems.

62.4.2. Installation of all signage, including accessibility related signs, equipment instructions, identification labels and permanent directional signs.

62.4.3. Submission of spare parts, tools and surplus materials as required in technical specifications. Submit to the COTR an MSDS for each surplus material that contains toxic or hazardous substances. Surplus materials that the SI determines not to retain shall be removed and properly disposed of by the Contractor according to all applicable regulations.

62.4.4. Scheduling of training sessions for Smithsonian personnel.

62.4.5. Removal of all waste, rubbish and temporary facilities and services. Means of access to all areas of the work to be inspected by the COTR shall be maintained.

62.4.6. Disposition of samples and mock-ups not incorporated into the work.

62.4.7. Arrangement for permanent utility connections and billing responsibility transfer to Smithsonian's Office of Facilities Management and Reliability (OFMR).

62.4.8. Arrangement for transfer of security responsibility for the project site and changeover of locks by Smithsonian's Office of Protection Services (OPS).

62.4.9. Hazardous Waste Disposal: Submit copies to the COTR of the following hazardous waste records for hazardous waste generated on SI property and disposed of by contract personnel.

1. Hazardous Waste Manifests
2. Notification and Certification Forms
3. Material Profile Sheet or characterization
4. Container Content Sheets
5. Certificates of Disposal

62.5. Scheduling of the Substantial Completion Inspection: Within seven (7) calendar days after receipt of the Contractor's written request, the COTR will either schedule an inspection or advise the Contractor of work that must be completed or prerequisites that must be met prior to scheduling the Substantial Completion Inspection. In that case, another written request for Substantial Completion Inspection must be submitted when all requirements have been met.

62.6. The Substantial Completion Inspection: The Substantial Completion Inspection will be performed by representatives of the Smithsonian Institution led by the COTR. During the inspection, the COTR will prepare a punch list of deficiencies in the work. If the punch list

becomes too extensive the COTR may cancel the inspection and require additional work to be performed for a repeat inspection.

62.6.1. For satisfactory inspection results, the COTR will issue the written punch list to the Contractor as soon as possible after the inspection. Items on the punch list must be completed prior to final acceptance of the total project work.

62.6.2. For unsatisfactory inspection results, the COTR will, within three (3) calendar days, give written notice to the Contractor that the Work or portion of the Work is not substantially complete in accordance with the contract documents and therefore does not meet Substantial Completion status. Requests for re-inspection shall meet all requirements for the original request for Substantial Completion inspection.

62.7. Punch List: Incomplete contract requirements identified during the Substantial Completion Inspection will form an initial basis for a punch list for final acceptance. The Contractor within the Contract Time must complete all punch list items. If additional days are needed to complete the punch list items beyond the Contract Time, then the Contractor shall submit, prior to the end of the Contract Time, a written request to the Contracting Officer stating:

64.7.1. Items requiring additional time.

64.7.2. Amount of time needed to complete each item.

64.7.3. Reasons why the items cannot be completed by the contract completion date.

63. FINAL COMPLETION AND ACCEPTANCE

63.1. Definition: The date of final completion of a project is the date, as confirmed by inspection by the COTR, when the Work is satisfactorily completed and accepted in accordance with the contract documents, as amended and/or modified.

63.2. Request for Final Completion Inspection: When all items on the punch list have been corrected to the satisfaction of the COTR and additional requirements as described below have been satisfied, the Contractor shall submit a written request for Final Completion Inspection.

63.3. Prerequisites for Final Completion: Prior to requesting the inspection for certification of Final Completion, the Contractor shall complete the following:

63.3.1. Submission of a copy of a prior punch-list stating that each item has been completed or otherwise resolved for acceptance.

63.3.2. Provision of Instructions to Smithsonian Personnel -where instructions to Smithsonian personnel are specified in other sections, furnish, without additional expense to the Smithsonian, the services of competent instructors, who will give full instruction in the care, adjustment and operation of the systems and equipment to designated Smithsonian employees.

1. Each instructor shall be familiar with all parts of the system on which he or she is to give instruction and shall be knowledgeable about the systems' operation and required maintenance. Factory trained instructors shall be employed wherever practical and available.

2. Unless otherwise required or approved, the instruction shall be given during the regular work week after the equipment has been accepted and turned over to the Smithsonian for regular operation. Where significant changes or modifications in equipment are made under the terms of the contract, additional instruction shall be provided as may be necessary to acquaint the operating personnel of the changes or modifications. Unless otherwise stated, at least half of the time allocated for instruction shall be "hands-on," using the actual system installed.

3. Upon completion the Contractor shall obtain written acknowledgment from the COTR that the required instruction was completed.

63.3.3. Posting of operating instructions approved by the COTR for each system and each principal piece of equipment. Include wiring and control diagrams showing the complete layout of the entire system including equipment, piping, valves, and control sequence framed under clear laminated plastic and posted where directed by the COTR. Printed or engraved operating instructions for each principal piece of equipment including start-up, proper adjustment, operating lubrication, shut-down safety precautions, procedure in the event of equipment failure and any other necessary items of instruction as recommended by the manufacturer of the unit shall be attached to or posted adjacent to the piece of equipment. Operating instructions exposed to the weather or wet or humid conditions shall be made of weather-resisting materials or shall be suitably framed and enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling. The Contractor shall coordinate the location of posted instructions with the COTR.

63.3.4. Provision of equipment demonstrations for each equipment item. The Contractor shall coordinate scheduling of all demonstrations through the COTR.

63.3.5. Submission of original warranties for all products, equipment, and systems.

63.3.5.1. The Contractor shall assemble original warranty certificates or notarized copies of warranty certificates executed by the Contractor, Subcontractors, suppliers, and manufacturers in a tab-indexed, three-ring loose-leaf binder with a durable plastic cover. Provide electronic copy, in PDF format, on CD. The table of contents shall identify the item covered, the location of the item, the date of Substantial Completion, expiration date of the warranty and the supplier, vendor and installing contractor. Duplicate notarized copies of warranties shall be provided as required by "Manuals for Operation, Maintenance and As-Built Product Data."

63.3.5.2. Each warranty certificate or bond shall identify the date(s) for:

(1) Substantial Completion status in accordance with project closeout requirements.

(2) Beginning and ending of the warranty period.

(3) The Contractor shall provide any coincidental product warranty, which is available on a product incorporated in the Work, but for which the warranty is not specifically required by the contract documents.

63.3.5.3. Warranty of Construction: The Contractor shall warrant that the work performed under this contract conforms to the contract requirements and is free of any defect in equipment, materials, design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. Unless otherwise stated in the technical sections of the Specifications, the warranty of the Work shall continue for a period of one (1) year from the date of Final Completion status. If the Smithsonian takes partial occupancy before Final Completion, then the warranty for that portion shall be in effect for a period of one (1) year beginning on the date of Substantial Completion for that portion of the Work.

63.3.5.4. Response Time for Warrantee Items – For all items under the warrantee period that are deemed by the COTR as essential to the 24/7 operations of the facility, the contractor will provide (at no additional cost to SI) emergency response and corrective actions as required (less than 4 hours). Provide 24/7 contact personal.

63.3.6. Not used

63.3.7. Arrangement for change-over locks through the COTR and Smithsonian Office of Protection Services as required for security for Smithsonian occupancy.

63.3.8. Submission of evidence of payment and transfer date of utility company accounts for those utilities previously billed to the Contractor during construction, as necessary.

63.3.9. Submission of evidence that all regulatory agency permits, and code requirements have been completed and recorded, as necessary.

63.3.10. Submission of a signed, written statement that no damage has occurred to the site as documented by the pre-condition survey report.

63.3.11. Final clean up, including:

1. Sweep and dust all surfaces and wash all finished surfaces to appear new and free of all stains, soil marks, dirt, and other forms of defacement.

2. Remove labels that are not required as permanent labels.

3. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances that are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.

4. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of dust stains, films, and similar noticeable substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

5. Wipe surfaces of equipment clean. Remove excess lubrication and other substances.

6. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, utility access holes, attics, and similar spaces.

7. Wet-mop concrete and clean other hard-surface floors according to manufacturers' recommendations.

8. Vacuum clean carpeted surfaces and similar soft surfaces.

9. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

10. Clean project site (yard and grounds) of litter and foreign substances. Sweep exterior paved areas to a broom-clean condition; remove stains, petro-chemical spills, and other foreign deposits. Rake grounds, which are neither planted nor paved, to a smooth, even textured surface.

63.4. Inspection of the Work for Final Completion: Upon receipt of the Contractor's written notice that the work has been completed, the COTR will inspect the work to confirm Final Completion status and acceptance of the work. As soon as possible after inspection, the COTR will either provide written acknowledgment of final acceptance or advise the Contractor of work not completed or obligations not fulfilled as required for final completion and acceptance.

63.5. Application for Final Payment:

63.5.1. Application for Final Payment shall be submitted only after Final Acceptance has been certified in writing to the Contractor by the COTR. Application shall include final labor data and progress schedule update.

63.5.2. Final Payment will be approved when Final Acceptance has been certified and the following conditions have been met:

1. Certification signed and submitted by the Contractor that all contract requirements, including contract modifications, have been met.

2. Final Release of Claims submitted.

3. Release of assignment of claims or consent of surety submitted, as necessary.

4. All security ID badges, and parking permits returned to Smithsonian.

5. As-Built Record Drawings Submitted: During the progress of the work the Contractor shall maintain a complete and up-to-date set of record prints, open to inspection by the COTR at any time. These prints shall provide a complete and accurate as-built record of all changes to the Contract Drawings, including rerouting of runs, relocation of items or control points and all other modifications. The exact location of pipes, conduit, or other features concealed underground, under concrete, in chases or above ceilings shall be shown by perpendicular dimensions from at least two available landmarks. As-built drawings shall be neatly marked with colored pencils or ink, marked "As-Built" and signed and dated by the Contractor. Upon completion of the Work and before final payment, the Contractor shall submit the following to the COTR: photographically produced as-built record drawings sized the same as the contract drawings; electronic copies of as-built record drawings in PDF and DWG formats.

6. As-Built Record Survey of Underground Utilities Submitted: If outside or underground utilities are part of the work, the Contractor shall furnish, to the COTR for approval, an acceptable and accurately dimensioned (GIS) survey showing location and elevation of underground storage tanks, all utility lines for water, gas, electrical, sewer, steam, etc., including valves, connections and changes in direction, as installed under the contract, within the property lines and outside the building walls. Points where utility lines emerge from the building shall be located from lot monuments. The survey shall be made to scale and must be marked "As-Built" and signed and dated by the Contractor. The Contractor shall furnish an electronic copy of as-built record drawings in PDF and DWG formats to the COTR on the same size as the contract drawings

7. As-Built Record Specifications Submitted: The Contractor shall submit one (1) hard copy and a digital (scanned) set of project specifications with annotations to identify any changes made during construction, referencing modification numbers, dates and originators of authorizing letters or memos and other sources of changes. The cover shall be marked "As-Built" and signed and dated by the COTR

Construction and Demolition Waste Tracking Sheet:
To be submitted with each application for payment for the payment period, and at project completion with total waste data and total percentage of waste diverted from landfill for entire project period.

Project Name: _____
Start Date: _____
End Date: _____

Material Description	**Disposal date**	**Diverted from Landfill or incinerator? (Y/N)**	**Diversion method (Recycled, Salvaged, etc.)**	**Hauler or Destination (submit receipts)**	**Volume (in cubic feet)**	**Weight (in tons)**
Land Clearing Debris						
Gypsum Wallboard Scrap						
Cardboard						
Paper goods						
Beverage containers						
Assorted Plastic						
Wood Pallets						
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Non-Window Glass						
Glazing						

Material Description	**Disposal date**	**Diverted from Landfill or incinerator? (Y/N)**	**Diversion method (Recycled, Salvaged, etc.)**	**Hauler or Destination (submit receipts)**	**Volume (in cubic feet)**	**Weight (in tons)**
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Piping Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panel boards						
Transformers						
Other:						
Other:						
Other:						
				Total Diverted		
				Total Not Diverted		
				Total All Waste = Total Diverted + Total Not Diverted		
				% Diversion Rate* = Total Diverted/Total All Waste		

**Percentage Diversion Rate to be compiled after project completion. Minimum Diversion rate is 50%. Goal Diversion rate is 75%*

END OF SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of the Seal Exhibit shotcrete beach slab and control density fill.
2. Demolition and removal of portions of the existing concrete holding slab for routing of underslab electrical conduit.
3. Demolition and removal of selected areas of shotcrete wall surface for railing bracket installation.
4. Small diameter core drilling as required for installation of electrical conduits.
5. Preparation of existing areas to receive new Work.

B. Related Requirements:

1. Section 010000 "Supplementary Conditions for Construction" for restrictions on use of the premises, Owner-occupancy requirements, protection, and phasing requirements.

2. Drawing G002 for additional related project definitions.

3. See Structural Drawings for shoring requirements.

C. Work Not Included: Removal or encapsulation of any materials containing asbestos or other hazardous substances is not within scope of Work of Project Contract Documents.

1.2 DEFINITIONS

A. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled. Provide protection suitable for maintaining existing items to remain that are near or directly impacted by demolition activities.

B. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site with COTR, demolition contractor, and shotcrete contractor present.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
    a. Review extents of demolition and preparation of substrates necessary for tie-in of shotcrete slabs, slab-edge, and for railing brackets.
5. Review areas where existing construction is to remain and requires protection.
6. Following predemolition conference, and prior to demolition, mark and review proposed demolition extents in non-permanent markings (see demolition plan notes on Drawings).

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, dust, debris, and wet-saw runoff control and , for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of adjacent Seal holding area.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 010000 for Photographic Documentation. Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 PROJECT CONDITIONS

A. Owner and collection animals will occupy animal holding areas immediately adjacent to areas of selective demolition. Conduct selective demolition so Owner's operations will not be disrupted, and to minimize disturbance to animals as outlined in Section 010000.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify COTR.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure or leakage into animal pools.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 010000.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Specific requirements for temporary shoring design are found elsewhere in these Contract Documents. Refer to “Related Requirements” within this section.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not over-extend cuts past indicated areas of work. Demolish in a manner that will not produce cut marks, lines, or markings that will be visible in the completed Work.
5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

6. Maintain fire watch during/after flame-cutting operations as defined in 010000.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Dispose of demolished items and materials promptly. Comply with requirements in Section 010000.29 "Debris Control and Daily Cleanup."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic.

D. Removed and Salvaged Items:

1. Remove and salvage items as designated/identified in Contract Documents. If no salvaged items are identified in Contract Documents, confirm with COTR at predemolition meeting that salvage of items is not required.
2. Clean salvaged items.
3. Pack or crate items after cleaning. Identify contents of containers.
4. Store items in a secure area until delivery to Owner.
5. Transport items to Owner's storage area per COTR direction.
6. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by COTR, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Shotcrete & Concrete slabs: Demolish in sections. Cut concrete to depth required at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Shotcrete walls:
   1. Slab edge areas:
      a. Prepare wall surface to receive slab tie-in, including filleted edge detail.
   2. Rail bracket areas:
      a. Use small power-driven chisels and hand tools to chip and remove wall surface to depth indicated and to receive handrail brackets and shotcrete patching.
      b. Coordinate exact extents and necessary surface preparation with shotcrete contractor to ensure detailing for shotcrete parging can occur and provide a blended finish with minimal visible seaming.

C. Core Drilling:
   1. Do not core drill without COTR's review and acceptance of sizes and locations.
   2. Provide core drills in exhibit and building walls, number and location as needed to complete work.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Comply with requirements specified in Section 010000.29 "Debris Control and Daily Cleanup."

B. Burning: Do not burn demolished materials.

3.7 REPAIR

A. Repair or replace existing finishes or construction scheduled to remain which are damaged during demolition Work.

3.8 CLEANING

A. Remove debris from site in prompt and continuous operation once demolition Work is started.

B. Broom clean areas where Work is performed or used as access to Work.

C. Remove temporary assemblies and materials promptly at completion of Work.

D. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033713 - SHOTCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish labor, materials including supports, backforms, reinforcement, concrete materials, mixture design, pigments, stains, paints, tools, and equipment necessary to place, texture and finish shotcrete textured paving by pneumatically projected concrete.

B. Related sections:
1. Section 260000 for embedded low voltage de-icing/snow melting system

1.2 DEFINITIONS

A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.

B. Dry-Mix Shotcrete: Shotcrete with most of the mixing water added at nozzle.

C. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

D. Shotcrete leveling compound: shotcrete placed over partially demolished concrete or control density fill, used to provide an even surface from which new work can be installed. Shotcrete leveling compound is to have the same mix properties as shotcrete defined in this section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with shotcrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for shotcrete design mixtures.
c. Shotcrete Installer.

2. Review methods and procedures related to shotcrete, but not limited to, the following:

a. Qualification data, equipment, and facilities needed to make progress and avoid delays.
b. Shotcrete finishes and finishing.
c. Cold- and hot-weather shotcreting procedures.
d. Curing procedures

e. Construction joints.
f. Reinforcement accessory installation.
g. Shotcrete repair procedures.
h. Protection of shotcrete.

3. Before submitting design mixtures, review each shotcrete design mixture and examine procedures for ensuring quality of shotcrete materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.

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

1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.

C. Shop Drawings: For shotcrete installation.

1. Include plans, elevations, sections, and support and anchor details

2. Coordinate shop drawings with section 260000 shop drawings, to show extents of embedded snow melt system and showing cabling location and spacing in referenced details, and relationship cabling to shotcrete reinforcement. Provide coordination details to facilitate coordination between trades.

3. Elevations are to be indicated in reference to contractor-surveyed benchmarked high water level and list surveyed/measured elevations for top of exposed pool shell wall (north cove), and all existing shotcrete slab elevations where tying to new work, with design elevation listed in brackets [ ] for reference.
4. Detail fabrication, bending, and placing of reinforcement; number and location of splices; and special reinforcement required for openings through shotcrete structures.
5. Indicate locations of proposed construction joints.
   a. Aesthetic Placement of Joints:
   b. Position construction and control joints to conform to the locations of cracks and joints in adjacent simulated rock and earth forms when aligning new joints to existing construction.

D. Samples:
1. Mock-up sample panel - Prior to beginning work the Shotcrete Contractor shall submit one sample panel measuring at least 4 feet by 4 feet as described below for the COTR's review.
   a. Sample panels shall represent the finished surfaces, texturing and coloring to match the existing seal exhibit shotcrete. Panels will also represent high levels of detail. Panels will be used as the basis for review and acceptance of the work.

1) Panel will include a minimum of (2) steps, one riser (including sloped sides), a slab to slab connection joint, a slab to wall connection.

b. Sample panels may not be fabricated in place and may not remain as part of the Work.

c. Panels shall not be removed until the completion of all work.

d. Rejected sample panels shall be re-submitted for review at no additional cost to the Owner.

2. Mock-up of in-place demolition and repair/parge at handrail bracket.

a. Sample panels shall represent the finished surfaces, texturing and coloring to match the existing seal exhibit wall shotcrete. Provide additional staining/coloring outside patch area to sufficiently blend existing and patch areas, as determined by inspection by COTR at 6’-0” viewing distance.

b. Mock-up location to be non-publicly visible location as selected by COTR.

c. Rejected mock-up repair/parge shall be re-submitted for review at no additional cost to the Owner.

d. Approved parge mock-up may become part of the completed work; maintain mock-up as a standard of quality and workmanship for project duration.

3. Integral color samples: provide manufacturer full range of integral colors for selection. COTR to review the samples in-situ next to existing beach with Shotcrete Contractor for final approval.

E. Models:

1. Within sixty days after the Contractor has received the Owner's Notice to Proceed, submit the following for the COTR's approval:

a. Provide 1/2"=1'-0" scale model(s) of the shotcrete shown on the drawings.

b. The model(s) shall clearly show the shape, sizes, conformation and relationships between all shotcrete elements existing and new.

c. The model shall accurately represent in dimension and shape all shotcrete elements in the existing work area including cove walls and ceiling, extending back to the holding area. Extents modeled are to match the plan area shown on A101. To achieve this the model may be created from point scan and or other 3D capture method and existing portions may be computer molded or routed. Model to accurately reflect existing shotcrete formations to a minimum of 3’-0” below water level. Coordinate with COTR the lowering of water level for measuring or scanning.

d. The model shall clearly delineate between existing to remain shotcrete and new.

e. The model shall accurately reflect maximum water level and the waterline shall be indicated for reference by a line or marking.

f. Show new metal railings on model with a 1/16” wire. Rail must be attached to model to accurately reflect rail location & height above grade. Rail brackets do not need to be modeled at this scale and may be approximated by 1/16” wire connecting back to shotcrete wall.

g. Model shall mark existing vacuum hose location with a pin.

1) See mock-up section for additional COTR review requirements during full-scale work.

h. During and after the COTR's review, provide modifications to the model. The new work areas of the model must be of a material that can be modified during review meetings.

i. Following the COTR's review provide modifications to the model.

j. Following its acceptance, the model(s) will establish the three dimensional character which will govern all work of this Section.

F. Progress Photography:
1. Submit a weekly photographic progress record to the COTR and Owner's representative.
2. Submittal may be via email or ftp transfer on Friday morning each week.

G. Surveying
1. General:
a. The Contractor will provide surveying for layout as frequently as is required to accurately locate all shotcrete structures. Confirm locations, elevations, and profiles of work in progress or completed work by surveying regularly. Provide survey notes from a registered surveyor at the request of the COTR.
2. Tolerance:
a. For conditions wherein shotcrete structures are associated with an animal barrier; only tolerance which exceed the requirements of the barrier are acceptable.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer,and preconstruction testing service.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Fiber reinforcement.
5. Waterstops.
6. Curing compounds.

C. Preconstruction Test Reports: For shotcrete.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Art Direction:
1. The COTR explicitly reserves the right to monitor the work for aesthetic quality and to assume control of the work through direction of the Shotcrete contractor's project superintendent until specified effects are achieved.
2. The dimensions and angles shown in the Drawings are provided only as guidelines with which to produce physical models, and shop drawings

B. Follow recommendations of ACI 305R when placing shotcrete during hot or cold weather.

C. Schedule of Minimum Reviews by the COTR:
1. Model progress photography review of model per paragraph 1.4.E.
Review of model(s) for massing, form and general character at Contractor's shop prior to shipping to job site.

2. Review of shop drawings prior to execution of any site work. This includes any revisions to shop drawings.
3. Review of sample panels of all finishes including a minimum of one set of revisions.
4. Prior to demolition, review of demolition extents marked in non-permanent markings (See demolition plan notes on Drawings)
5. Review south beach boulder with COTR for art direction on extents of reduction in profile and form.
6. Review of armatures for form shape and height prior to application of any shotcrete.
7. Review of interface with all adjacent built elements including mesh barriers, door openings, access hatches, pathways and guardrails.
8. Review first application of Texture Coat for conformance with accepted sample panels.
9. Review of surface-applied color stains.

D. Qualifications of the Shotcrete Contractor and Personnel:
1. Established firm with a minimum of five (5) years experience in successfully constructing artificial earth and rock formations for natural habitat exhibits of similar nature to this project.
2. Foreman:
   a. Project Foreman with a minimum of 3000-hours experience in the management of similar project crews and experience in coordination with other trades in the completion of simulated artificial exhibitry fabrication projects.
3. Nozzleman:
   a. Certified as required by ACI CP-60 (2009) with a minimum of 3000-hours and able to demonstrate by test his abilities to apply shotcrete as required by the specifications.
4. Artists:
   a. Provide artists skilled in the simulation of natural formations of rock and earth to supervise and perform the application of all aesthetic work
   b. Assure that personnel assigned to required sample panels is assigned to the same work in place throughout the duration of the project.
   c. Arrange for artists who will perform the work to be present at all pre-bid and pre-construction meetings pertaining to shotcrete and that they are on the distribution list for addenda.
5. Project Personnel:
   a. Provide full documentation of all construction crew members listing specific personnel to be used and detailing the experience of each person listed and their ability to perform all phases of the work.
6. The following is a non-restrictive list of Shotcrete Exhibitry Contractors, subject to compliance with the requirements of these specifications:

   a. Cost of Wisconsin (attn: Rick Haas)
      4201 Highway P
      Jackson, WI 53037
      Phone: (800) 221-7625
   b. Cemrock Landscapes, Inc. (attn: Bryan Olson)
      4790 South Julian Avenue
      Tucson, AZ 85714
      Phone: (520) 571-1999, Fax: (520) 571-1888, Toll Free: (800) 843-6067
   c. Turnstone Construction Shop (attn: John Fulford)
      1229 N. 97th Street

Seattle, WA 98103
Phone: (206) 634-1521, Fax: (206) 634-1570

d. David L. Manwarren Corp.
9146 9th St.
Rancho Cucamonga, CA 91730
(909) 989-5883, Fax: (909) 989-5493

e. The Nassal Company
415 W. Kaley Street,
Orlando, FL 32806
Phone: (405) 648-0400

f. Dixon Studios, Inc. (Contact: Kay Nichols)
912 South Park Ave
Tucson, AZ 85719
Phone: (520)-628-3699

A. Installer Qualifications: A qualified installer employing nozzle operators for Project, each of whom attains mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests as appropriate to the required shotcrete work.

B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

C. Standard: Comply with ACI 506.2, "Specification for Shotcrete," unless otherwise indicated.

D. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.

E. Mockups: Build mockup sample panel as indicated under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each finish required and for each design mixture, shooting orientation, and nozzle operator.
2. Build mockups in the location and of the size indicated or, if not indicated, as directed by COTR.
3. Demonstrate curing and protecting of shotcrete, finishes, and joints, as applicable.
4. In presence of COTR, damage part of the exposed-face surface for each color and finish, and demonstrate materials and techniques proposed for repair of holes and surface blemishes to match adjacent undamaged surfaces.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless COTR specifically approves such deviations in writing.
6. Confirm final form shaping with COTR and provide any adjustments as directed based on COTR direction.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on shotcrete.

1. Produce and test shotcrete test panels before shotcrete placement according to requirements in ACI 506.2 for each design mixture, shooting orientation, and nozzle operator. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 3-1/2 inches (90 mm).
2. From each test panel, testing agency to obtain six test specimens: one set of three specimens unreinforced, and one set of three specimens reinforced. Agency will perform the following:

    a. Strength Testing: Test each set of unreinforced specimens for compressive strength according to ASTM C42/C42M.
    b. Core Grading: Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Stainless Steel Reinforcing Bars: ASTM A955/A955M, Grade 60 (Grade 420), Type 304, deformed.

B. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice" and as follows:

1. For stainless steel reinforcement, use CRSI Class 1, plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2, stainless steel bar supports.

2.2 SHOTCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type III. Use only one brand and type of cement for Project.

1. Fly Ash: ASTM C618, Class C or Class F.
2. Slag Cement: ASTM C989/C989M, Grade 100 or Grade 120.
3. Silica Fume: ASTM C1240, amorphous silica.

B. Normal-Weight Aggregates: ASTM C33/C33M, from a single source, and as follows:

1. Combined Aggregate Size: ACI 506R or ASTM C1436, Grading No. 1 sieve analysis.
2. Deleterious Substances: As specified for coarse-aggregate Class 3S according to ASTM C33/C33M.

C. Water: Potable, complying with ASTM C94/C94M, and free from deleterious materials that may affect color stability, setting, or strength of shotcrete.

D. Ground Wire: High-strength steel wire, 0.8 to 1.0 mm in diameter.

E. Admixtures: ASTM C1141/C1141M, Class A (liquid) or Class B (nonliquid) but limited to the following admixture materials. Provide admixtures for shotcrete that contain no more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.

1. Accelerating Admixture, Conventional: ASTM C494/C494M, Type C or Type E.
2. Pozzolanic Admixture: Fly ash, slag cement, and silica fume as limited in "Portland Cement" Paragraph in this article.
3. Coloring Admixture: ASTM C979/C979M, synthetic mineral-oxide pigment or colored, water-reducing admixture, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.
4. Air-Entraining Admixture: As limited in "Shotcrete Mixtures" Article.

2.3 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry, or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Curing Compound: ASTM C309, Type 1, Class B; clear, waterborne, membrane-forming curing compound.

2.4 SHOTCRETE MIXTURES

A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.

B. Design Mixtures: Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixture or field test data, or both.

C. Cementitious Materials Replacing Portland Cement: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

D. Cementitious Materials, Maximum Content: Limit use of fly ash slag cement and silica fume to not exceed, in combination, 25 percent of portland cement by weight.

E. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301 (ACI 301M).

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

G. Coloring Admixture: Add integral concrete colorant to shotcrete mixture according to manufacturer's written instructions and to result in hardened shotcrete color consistent with approved mockup.

H. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

I. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having an air content before pumping of 7 percent with a tolerance of plus or minus 1-1/2 percent. Do not use air-entraining admixtures in dry-mix shotcrete.
3. Color of Finish Coat: As selected by COTR from manufacturer's full range of industry colors.

2.5 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.

1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
2. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.

C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.6 BATCHING AND MIXING

A. Dry-Mix Process: Measure mixture proportions by weight batching according to ASTM C94/C94M or by volume batching complying with ASTM C685/C685M requirements.

1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
2. Prepackaged shotcrete materials may be used at Contractor's option. Pre-dampen prepackaged shotcrete materials and mix before use.

B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C94/C94M and ASTM C1116/C1116M and furnish batch ticket information.

1. Comply with ASTM C685/C685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

2.7 INTEGRAL CONCRETE COLORANTS

A. General:
1. Conform to ASTM C979.
2. Compatibility with Concrete Mix:
a. Assure compatibility of selected pigments with proposed concrete mix design and admixtures.
b. All exposed shotcrete will be integrally colored in addition to the surface applied stains.
3. Color Selection:
a. Provide color admixtures to match approved sample.

B. Manufacturer's Recommendations:
1. Conform to all manufacturers' recommendations for mixing, finishing, and curing colored concrete.

C. Approved Manufacturers:
1. Davis Colors, Phone: (213) 269-7311
2. Sika 'SikaColor-100P' Color Admixtures, Phone: (800)933-7452

2.8 STAINS

A. General:
1. Non-fading, non-toxic, penetrating concrete stains.
2. Range of finished colors capable of achieving the effects specified in this section and on the drawings.
3. Colors guaranteed for a minimum of ten years with no more than 25% fade.
4. Verify that proposed stains are appropriate for the conditions which will affect the exhibit: local microclimate, chlorinated water, or other bleaching or corrosive environments.

PART 3 - EXECUTION

3.1 GENERAL

A. Structural Substrate:
1. The first shotcrete application shall be a structural substrate, capable of maintaining the intended shape, and supporting live and dead loads as specified or as required by codes.

B. Texture Coat:
   1. The second shotcrete application shall produce the intended color and texture.
   2. Provide sufficient thickness in the texture coat to assure its structural integrity and bonding to the structural substrate and to create the specified finishes.
   3. Provide fine textured surfaces for all shotcrete surfaces in view of visitors.

3.2 PREPARATION

A. Concrete and Masonry Substrates: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.

   1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Earth Substrates: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces to saturated, surface-dry condition before shotcreting.

C. Rock Substrates: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding. Dampen surfaces to saturated, surface-dry condition before shotcreting.

D. Steel Substrates: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.

C. Securely embed reinforcing anchors into existing substrates, located as required.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.

E. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

F. Install welded wire reinforcement in largest practical sheets on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.4 JOINTS

A. General: Construct joints at locations indicated or as approved by COTR.

B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.

C. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide by one-third of slab depth or joint-filler strips 1/4-inch- (6-mm-) wide by one-third of shotcrete depth unless otherwise indicated.

1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
2. Space joints at 15 feet (4.5 m) o.c. horizontally and vertically.
3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.

3.5 ALIGNMENT CONTROL

A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

3.6 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.7 APPLICATION

A. Apply shotcrete applied by dry-mix or wet-mix process and according to ACI 506.2.

B. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.

C. Apply dry-mix shotcrete materials within 45 minutes after predampening and wet-mix shotcrete materials within 90 minutes after batching.

D. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.

1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.

2. Remove and dispose of cuttings during the trimming or rodding process to prevent unconsolidated material from falling onto lower reinforcement.

E. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray, and prevent buildup against front face during shotcreting.

F. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.

G. Do not permit shotcrete to sag, slough, or dislodge.

H. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.

I. Do not disturb shotcrete surfaces before beginning finishing operations.

J. Remove ground wires or other alignment-control devices after shotcrete placement.

K. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.

L. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117 (ACI 117M), increased by a factor of two.

M. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling.
2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and no more than 90 deg F (32 deg C).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.

N. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305.1 when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

1. Cool ingredients before mixing to maintain, at time of placement, shotcrete temperature below 100 deg F (38 deg C) for dry mix and 90 deg F (32 deg C) for wet mix.
2. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

3.8 3.10 PREPARATION OF SURFACES FOR TEXTURE COAT

A. Repair of Surface Defects:

1. Remove and replace shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids, or sand pockets.
2. Repair defective areas by a method acceptable to the COTR.
3. Repair core holes in accordance with Chapter 9 of ACI 301. Do not fill core holes with shotcrete.
4. Replace any shotcrete which subsides after placement.

3.9 FINISHES

A. Structural Substrate:
1. 1. Provide natural gun finish on all shotcrete which does not receive texture coat.
2. 2. Provide Broom Finish on all base layers which are to receive texture coat.
3. 3. Do not scrape or cut to remove high spots until the shotcrete has become stiff enough to withstand pull of the cutting device.

B. B. Texture Coat Finish:
1. The Shotcrete Contractor will provide an expert(s) to perform all texturing, shaping and coloring of the shotcrete. See qualifications requirements within this section.
2. Finished product of the texture coat or finish shall simulate natural formations of earth and rock in shape and texture to match existing adjacent seal beach and in accordance with approved sample panels and mock-ups.
3. Extend texture coat finish 300mm (12-inches) below finish grades.
4. Provide texture coat with integral colorant to provide a base color for finish stains. Color as approved by COTR.
5. Highlight and contrasting colors will be applied after installation with a medium that is non-toxic, durable and can withstand the daily service environment.
6. Cracks and crevices between rock forms shall be colored darker than the surrounding rock surface to accentuate depth and contrast.

C. Determination of Shotcrete Types: When Drawings and Notes do not specifically identify the type of surface to be produced, obtain direction from the COTR. Finished product should appear as a cohesive geologic formation. The following types of finishes will be produced:

1. Rock: Texture to simulate the boulders in the habitat. Simulate appearance, patterns, and ridges both above and below water. Work to include integral color, texture coat and surface painting.

2. Smooth Gun Finish (minimal texture): Smooth trowel finish to exposed surfaces, where indicated (typically areas out of public view).

3.10 CURING

A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.

B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.

C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Water-saturated absorptive covers or moisture-retaining covers. Lap and seal sides and ends of covers with 12-inch (300-mm) lap over adjacent covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Apply curing compound to natural gun and flash-coat finishes at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).
b. Do not use curing compounds on the following surfaces:
1) Texture coat.
2) b. Structural substrate which is to receive texture coat.
3) Any surface against which additional shotcrete, color stains, or cementitious finishing materials are to be bonded.
a) 4. Employ positive measures, such as sandblasting, to remove over-sprayed curing compounds completely prior to the application of such additional materials.

D. Final Curing:
1. General:
a. Provide additional curing immediately following the initial curing and before the shotcrete has dried. Continue the method used in initial curing.
2. Formed Surfaces:
a. If forms are removed during curing period, immediately use one of the curing materials or methods listed for initial curing. Continue such curing for the remainder of the curing period.
3. Duration of Curing:
a. Continue curing for the first seven (7) days after shotcreting, or for first 3 days if high-early-strength cement is used, or until specified strength is obtained. During the curing period, maintain shotcrete above 5C (40F) and in a moist condition as specified for initial curing.
b. Prevent rapid drying at the end of the curing period.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Air Content: ASTM C173/C173M, volumetric method or ASTM C231/C231M, pressure method; one test for each compressive-strength test for each mixture of air-entrained, wet-mix shotcrete measured before pumping.

C. Shotcrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mixture and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 4-1/2 inches (115 mm). Testing agency will obtain sets of test specimens from each test panel.

1. Compressive Strength Testing: One set of three unreinforced specimens. Test each set of unreinforced specimens for compressive strength according to construction testing requirements in ACI 506.2.
2. Visual Core Grading: One set of three reinforced specimens. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

E. In-Place Shotcrete Testing: One set of three unreinforced cores for each mixture and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C42/C42M. Do not cut steel reinforcement.

F. Strength of shotcrete will be considered satisfactory according to the following:

1. Specimen Cores: Mean compressive strength of each set of three unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
2. Specimen Cubes: Mean compressive strength of each set of three unreinforced cubes to equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

G. Shotcrete will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

3.12 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.
2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
3. Dampen surfaces and apply new shotcrete. Match adjacent color and finish.

B. Repair core holes from in-place testing according to repair provisions in ACI 301 (ACI 301M), except do not use shotcrete. Match adjacent color and finish.

3.13 CLEANING

A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 033713

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel decorative pipe railings.

1.2 COORDINATION AND SCHEDULING

A. Coordinate with digital scan and benchmarks per section 010000-2.5 to accurately locate, fabricate, and install railings with clearances as indicated in the Contract Documents.

B. Coordinate selection of activators, cleaners, and protective coatings with patina finish. Comply with patina finish manufacturers' written instructions to ensure that all components are compatible.

C. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

D. Coordinate shotcrete parging over handrail brackets with shotcrete installer; mix designs per section 033713.

1.3 ACTION SUBMITTALS

A. Product Data:

   1. Materaial product data for all metal components of railing system
   2. Fasteners.
   3. Post-installed anchors.
   4. Handrail brackets.
   5. Nonshrink, nonmetallic grout.
   6. Anchoring cement.
   7. Black patina metal finish, activators, and protective coating.

B. Shop Drawings: Include plans, elevations, sections, and attachment details. Show anchorage, accessory items.
   1. Clearly identify all joints, seams, or exposed fasteners on shop drawings.
   2. Railings are to be designed and fabricated to allow for full shop-applied finish.

C. Samples for Initial Selection:
   1. Patina selection sample:

a. Full range of black patina finishes prepared on 6" sections of stainless steel tube matching handrail diameter, for initial selection.
b. Provide (6) six visibly distinct samples, by varying number of patina coats (1x, 2x, etc.), dilution with distilled water (by ratio), or other means as recommended by manufacturer to achieve variation in darkness of finish.
c. Company responsible for final finishing is to prepare all samples to match specified railing material finish, including abrasive preparation, activators, cleaners, patina finish, and protective coatings.

2. Edge finish selection sample:
   a. One 6" section of 6" steel or stainless steel ¾" plate (same as railing brackets) with pairs of edges eased, each to a different radius (1/16", 1/8" & 1/4").
3. Clearly label all samples for initial selection.

D. Samples for Verification:
1. Fittings, end caps, and brackets.
2. Welded connections.
3. Assembled minimum 2'-0" long Sample of railing system, made from full-size components, including handrail, mounting bracket, radiused return and end-cap.

   a. Show method of connecting and finishing members at intersections.

   b. Demonstrate required finishing including eased edges, radius as selected from Samples for initial selection.

   c. Demonstrate final selected finish, including protective coatings. Finishes are to be uniform and free of blemishes.
4. Samples rejected for quality or workmanship or those not closely resemble samples for initial selection, shall be resubmitted by Contractor for review by COTR at no additional Contract cost.

E. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Metal Fabricator Qualifications:
1. Established firm with a minimum of five (5) years experience in successfully constructing custom stainless steel metal fabrications of similar complexity and nature to this project.

2. Provide a listing of previous projects, and photo documentation of a minimum of (3) completed projects that demonstrate skilled metal working with similar materials and finishes. Include one (1) example of black oxide stainless steel finishing.
3. Project foreman with a minimum of 3000-hours experience in the management and installation of project crews, installations, and coordination with other trades. Submit all additional qualifications for fabrication team members that that will be involved with the work. List years of experience and previous projects.
4. Firm must be capable of providing a coordinated Delegated Design submittal as described in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect patinated finishes on exposed surfaces of railings from damage during shipping or storage.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a licensed professional engineer to design railings, including attachment to structure.

B. Structural Performance: Railings, including attachment to structure, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 STAINLESS STEEL DECORATIVE RAILINGS

A. Custom architectural metal fabricator with experience in fabricating custom metal fabrications fabrications of similar complexity. The following is a non-restrictive list of Metal Fabricators, subject to compliance with the requirements of these specifications:
1. Allen Architectural Metals - 646-400-0707
2. Chase Architectural Metals – 804 230-1136
3. Arch Metal Fabrications

B. Source Limitations: Obtain stainless steel railing components from single source manufacturer.

C. Pipe: ASTM A312/A312M, Grade TP 316L.

D. Castings: ASTM A743/A743M, Grade CF 8M or CF 3M.

E. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316L.

F. Flat Bar: ASTM A666, Type 316L.

G. Bars and Shapes: ASTM A276/A276M, Type 316L.

2.4 FASTENERS

A. Fastener Materials:
1. Stainless Steel Railing Components: Type 316 stainless steel fasteners.
2. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

1. Provide countersunk square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated; locate fasteners away from visible vantages.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Bent Stainless Steel plate dimensions as indicated..

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Black patina finish
1. Black patina finish
   a. Liquid black patina finish intended specifically for stainless steel materials as specified in this section.
   b. Activators and surface preparation – To prepare stainless steel finish for application of black patina, provide all surface activators, abrasive, or chemical surface preparation as recommended by manufacturer for finish product.
   c. Acceptable manufacturers/products:
      1) Birchwood Technologies, Presto Black SSB
      2) Sculpt Nouveau, Stainless Black Patina
      3) JAX Chemical Company, Stainless Steel Blackener
   d. Provide manufacturer recommended surface finish protective coating over patina finish product.
   e. Finish appearance: uniform, lacking brush markings or directionality.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide leveling grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Form railing of materials to greatest length possible to minimize the number of joints. Where joints are necessary, distribute evenly so that rail is divided into equal segments.

C. Provide shop finish for entire railing assembly, including brackets, to ensure uniformity of finish. Fabricate railing in a manner that allows for field assembly and installation without marring or disturbing finish.

D. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

E. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease all exposed edges to a radius as approved during Sample selection unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

F. Form work true to line and level with accurate angles and surfaces.

G. Fabricate connections that will be exposed to weather in a manner to exclude water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

H. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

I. Connections: Fabricate railings with welded connections unless otherwise indicated.

J. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

K. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.

1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
3. Where connection by concealed fasteners are not possible, locate fasteners in inconspicuous locations not visible from public vantages.

L. Form changes in direction as follows:
1. By bending. Bend by radius as needed to meet clearances as indicated in Drawings
2. By bending to radius that will not result in distortion of railing member.

M. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

N. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

O. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns to within 1/2 inch clearance of wall, or as required for installation of end-caps, not to exceed 1 inch.

P. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

R. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Stainless Steel Tubing Finishes:
1. Remove initial nickel and chrome layer by evenly distributed abrasive blasting or manufacturer approved means.
2. Prepare and finish with black oxide patina and protective coating.

C. Stainless Steel Sheet and Plate Finishes:
1. Prepare with matching products and methods, and in a manner to match stainless steel tubing finish and appearance.

D. Fasteners – for exposed fasteners, match metal fabrication finish and appearance.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3 m).

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.3 ATTACHING RAILINGS

A. Anchor railing ends to concrete with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Provide brackets with clearance as indicated on Drawings.

1. Use type of bracket predrilled hole for bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. With adhesive anchors as indicated.

3.4 REPAIR

A. Touchup Patination:

1. Immediately after erection, clean and repatinate minor touch-up areas with the same material used for shop finishing and apply protective film

a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness, or thickness specified by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to prepare test reports.

B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894 and ASTM E935 for compliance with performance requirements.

C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.

D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING

A. Clean stainless steel by washing thoroughly as directed by patina and protective coatings manufacturer recommends.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 260000 - LOW VOLTAGE DE-ICING / SNOW MELTING SYSTEM IN CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:
   1. Furnish and install low voltage de-icing / snow melting cable system in new concrete as described in Contract Documents.

1.2 SYSTEM DESCRIPTION

A. The system shall consist of all equipment and materials for a complete snow melting system to be installed in new shotcrete.

B. The area covered and heat density (measured by Watts or BTU equivalent) per linear foot of heating element or square foot of area for each Heatizon System product are determined by the spacing between adjacent runs of heating element, the total length of heating element, and the size of the transformer. See manufacturer's installation instructions for more detailed information.

C. The extent of the snow and ice melting system is as shown on specification sheets, architectural and electrical drawings. Whenever possible, The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) design criterion should be followed. Control Joints shall be identified and marked for jumpers.

1.3 ELECTRICAL CODES AND STANDARDS

A. National Electrical Code (NEC) for US installations; Canadian Standards Association (CSA) for Canadian Installations. (Current Editions).

B. Requirements of the "Authority Having Jurisdiction".

C. All Tuff Cable® Heaters shall be approved to CSA and UL Standards for this application.
   1. Self-regulating cables are not acceptable for this application.
   2. Cables that are not copper stranded conductors are not acceptable for this application.
   3. Line voltage cables are not acceptable for this application.

1.4 SUBMITTALS

A. Product Data:
   1. Submit manufacturers technical product data and written installation instructions for snow melting cable system.

B. Shop Drawings:

1. Provide fully coordinated drawings with Section 033713 Shotcrete, indicating layout has been coordinated with shotcrete layout, dimensions, shotcrete placement sequence, and detailing. Submit drawings showing layout of system Control Unit, activation device, grounding connections, and heating cables required to provide complete operating system. Include the following:
   a. Locations for activation devices.
   b. Location of low-voltage heating cable step-down transformer and control box.
   c. Cold-lead cable runs from transformer to heating element connection points.
   d. Heating element layout and spacing.
   e. Cold-lead jumpers between non-adjacent areas.
   f. Connections between cold-lead and heating element.
   g. Low-voltage wiring between control box and activation device.
   h. Location of aerial or slab-mounted temperature/moisture sensor(s).
   i. Low-voltage wiring between sensor(s) and activation device(s).
   j. Differentiate between:
      1) Control wiring.
      2) Heating element.
      3) Cold-lead.
      4) Branch-circuit wiring.
   k. Differentiate between zones of heating element.

C. Operation and Maintenance Data:
   1. Submit manufacturer's written maintenance and operation instructions for system.

D. Warranty:
   1. Submit signed copy of system manufacturer's standard warranty for system.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Firm regularly engaged in manufacturing of electric cable heating elements, of type, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer Qualifications:
   1. Licensed Contractor with a minimum of two years successful certified experience installing projects utilizing electric heating cable systems equal to systems specified in this section.

C. Testing Agency Qualifications: Member company of NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

D. Regulatory Requirements:
   1. Comply with applicable local electrical code requirements of local authorities having jurisdiction.
   2. Provide products that are listed, recognized, and labeled by Nationally Recognized Testing Laboratory (NRTL) that include but are not limited to:
      a. ETL subsidiary of Intertek.
      b. Canadian Standards Association (CSA).
      c. Underwriters Laboratories (UL).
   3. Conform to requirements for Standard for Safety for Electric Radiant Heating Panels

and Heating Panel Sets (UL - 1693, 3rd Edition, dated October 14, 2011).
4. Conforms with requirements of "Power Units other than Class 2" (UL-1012).
5. Conform to requirements of "Dry-Type General Purpose and Power Transformers" (UL – 1561).
6. Conform to "Requirements for Electrical Resistance Heating Cables and Heating Device Sets" (CSA – 22.2, No 130-03, dated January, 2008)

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle in accordance with manufacturer's written instructions. Store the materials in dry indoor location off the ground.

B. Remove damaged materials from job site and replace with new at no additional cost to Owner.

1.7 WARRANTY

A. Provide Manufacturers Standard with following requirements:
1. Control Unit Components: 1 year
2. Power Transformer: 5 years
3. Heating Element: 25 years

PART 2 - PRODUCTS

2.1 MANUFACTURER

1. Basis of design manufacturer is Heatizon Systems.
2. Substitutions: Raychem, Thermon & Watts.

2.2 COMPONENTS

A. Heating Element:
1. Copper stranded cable insulated with chemical- and gasoline-resistant thermoplastic vinyl and sheathed with nylon jacket for corrosion and mechanical protection.
2. Rated for operating at variable output of 0 to12 watts per linear foot.
3. Maximum Operating Voltage: 0.118 volts per linear foot of heating element.
4. Maximum Secondary Voltage: Not to exceed 65.5 volts.
5. Heating Element Operating Temperature: Not to exceed 80 degrees C.
6. Heatizon Systems Tuff Cable number E101 (UL E174340).

B. Heating Cable Power Transformer:
1. Properly sized so cable heating element operation is less than 96 amps.
2. Multi tapped on primary side to allow for operation of supply of 120, 208, 240, and/or 277 volts.
3. Multi tapped on secondary side to allow proper operation when operating range of heating elements lengths.
4. Heatizon Systems:
a. S103 (3kVA)
b. S104 (4kVA)

C. Control Unit:

1. Provide unit that:
   a. Soft starts transformer.
   b. Monitors overall system for proper and safe operation.
   c. Interfaces with activation device.
   d. Shuts system off in event of fault.
   e. Provides protection for overcurrent, undercurrent and high temperature transformer (CBX6T and CBX23T models have a 24VAC power supply for Activation Device).
2. Provide means of faults and fault status.
3. Fitted with power service disconnect rated for system operating range.
4. Heatizon Systems Control Units: SLC500, CBX6, CBX6T, CBX23, CBX23T, CBX7, and RADIANT8 (CBX6T, CBX23T, and RADIANT8 models have a 24VAC power supply for Activation Devices).
5. NEMA 4 Enclosure.

D. Activation Device:
1. Provide unit with a dry contact.
2. Provide one or more of the following:
   a. Pavement Mounted Temperature / Moisture Sensor: Examples: M428
3. Multiple Circuits for Control, Monitoring, and Load Management:
   a. Where controls exceed 3 in total on one activation scheme, use M329 12 Channel Selector Box or M346 Monitor Station.
   b. Where remote monitoring is necessary use M346 Monitor Station
   c. Where individual zone control is necessary use M329 12 Channel Selector Box or M346 Monitor Station.

2.3 ACCESSORIES

A. Rigid Insulation:
1. Concrete slab and pavers:
   a. Provide 1-1/2" thick extruded polystyrene insulation below concrete slab prior to concrete pour. Insulation shall be rated at the appropriate mechanical properties for each application.

B. Reinforcing:
1. Provide welded wire fabric of the appropriate pattern and gauge to accommodate the spacing of the heating element in new pour applications. Wire fabric will hold heating element in place while concrete is poured. Concrete or Plastic chairs support the welded wire fabric and the heating element at the appropriate depth from the surface of the slab.

C. Control Joints:
1. Jumper under any and all joints and markers in asphalt and concrete using Heatizon JUMPERKIT joint/marker jumper kit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where heating element is to be installed for proper installation, cleanliness, or conditions that may hinder successful installation of snow melting system.

1. Notify COTR in writing of items needing correction.
2. Do not install snow melting system until faulty conditions are corrected.

3.2 INSTALLATION

A. Interface with Other Work:
   1. Coordinate installation of low voltage cable snow melting system with appropriate sections of Division 26 Electrical.
   2. Coordinate sequencing of low voltage cable installation with sequence of installation for Division 3 Shotcrete.

B. Install snow melting system, including Heating Element, Transformer, Control Unit, and Activation Device, in accordance with Manufacturer's written instructions and approved Shop Drawings.

C. For new pour concrete applications:
   1. Install insulation on grade and reinforcement on insulation. Join edges of reinforcement with wire ties.

   2. Place reinforcement with attached cable on chairs such that it will be 1½" - 2" below the finished surface of the concrete slab.

3.3 FIELD QUALITY CONTROL

A. Testing as directed by system manufacturer:
   1. Prior to covering, visually inspect heating element and cold leads for cuts and damage; repair as necessary.
   2. Check for continuity to any conductive material, including but not limited to metal; eliminate as necessary.
   3. Conduct After-Installation Element Tests per manufacturer's installation instructions. Test system in presence of Contractor, and COTR, to be certain system functions in accordance with design intent.

B. Verify that all heating elements are completely embedded.

C. Immediately prior to and immediately following shotcrete placement, check each cable element system for electrical continuity and check for electrical isolation (resistance) to ground and any metallic materials near cable heating element.

3.4 DEMONSTRATION

A. Provide adequate demonstration and training to Owner in operation and maintenance of system.

END OF SECTION 260000

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Copper building wire.
2. Connectors, splices.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cerro Wire LLC.
2. General Cable Technologies Corporation.
3. Service Wire Co.
4. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable Technologies Corporation.
2. Service Wire Co.
3. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

H. Armor: Steel, interlocked.

I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products.
2. Hubbell Power Systems, Inc.
3. Ideal Industries, Inc.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. ABB (Electrification Products Division).
6. Thomas & Betts Corporation.
7. Service Wire Co.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway Metal-clad cable, Type MC is only allowable for specific installations as indicated herein or on the drawings.

C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and under floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. Steel, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

1.3 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 the following:

a. Slotted support systems, hardware, and accessories.

2. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; Atkore International.
b. B-Line, Eaton Electrical Sector.
c. Caddy; nVent.
d. ABB, Electrification Products Division.
e. Unistrut; Atkore International.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

3. Material for Channel, Fittings, and Accessories: Galvanized steel.
4. Channel Width: Selected for applicable load criteria.

5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Supports for conduit and cable tray on roofs.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

    a. Arlington.
    b. B-line, Eaton, Electral Sector.
    c. Caddy; nVent.
    d. Gregory Corp, G-Strut.

2. Rooftop support block shall be made of recycled material, UV resistant with 14 gauge 1-inch (25 mm) high galvanized channel.
3. Rooftop support shall raise conduit or cable tray a minimum of 4-inches (100 mm) off the top of roof material.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti, Inc.
        2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti, Inc.
        2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) B-Line; Eaton, Electrical Sector.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A235.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

    1. NECA NEIS 101, “Standard for Installing Steel Conduits.”

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT, IMC, and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Type EMT-S duct raceways and elbows.
2. Type LFMC duct raceways.
3. Type LFNC duct raceways.
4. Type PVC duct raceways and fittings.
5. Fittings for conduit, tubing, and cable.
6. Electrically conductive corrosion-resistant compounds for threaded conduit.
7. Solvent cements.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

1.3 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-S duct raceways and elbows.
2. Type ERMC-A duct raceways, elbows, couplings, and nipples.
3. Type ERMC-S duct raceways, elbows, couplings, and nipples.
4. Type LFMC duct raceways.
5. Type PVC duct raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Electrically conductive corrosion-resistant compounds for threaded conduit.
8. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Type EMT-S duct raceways and elbows.
2. Type ERMC-A duct raceways, elbows, couplings, and nipples.
3. Type ERMC-S duct raceways, elbows, couplings, and nipples.
4. Type LFMC duct raceways.
5. Type PVC duct raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Electrically conductive corrosion-resistant compounds for threaded conduit.
8. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit; Atkore International.
   b. Calconduit; Atkore International.
   c. Emerson Electric Co., Automation Solutions.
   d. Picoma; Zekelman Industries.
   e. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
   f. Topaz Lighting & Electric.
   g. Western Tube; Zekelman Industries.
   h. Wheatland Tube; Zekelman Industries.
2. Material: Steel.

2.2 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYIX - PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Bluesteel Services LLC.
c. Calbond; Atkore International.
d. KorKap; Robroy Industries.
e. Perma-Cote; Robroy Industries.
f. Plasti-Bond; Robroy Industries.

2. Options:

a. Exterior Coating: PVC complying with NEMA RN 1.
b. Interior Coating: Zinc with organic top coating.
c. Minimum Trade Size: Metric designator 21 (trade size 3/4).
d. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

2.3 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ABB, Electrification Business.

b. Anaconda Sealtite; Anamet Electrical, Inc.
c. Electri-Flex Company.
d. International Metal Hose Co.

2. Material: Steel.
3. Options:
   a. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.4 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB, Electrification Business.
   b. Atkore International.
   c. CANTEX INC.
   d. JM Eagle.
   e. NAPCO; Westlake Chemical Corp.
   f. Opti-Com Manufacturing Network, Inc (OMNI).
   g. Topaz Lighting & Electric.

2. Dimensional Specifications: Schedule 40.
3. Options:

   a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
   b. Markings: For use with maximum 90 deg C wire.

2.5 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.6 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FOIZ; including UL Subject 2419.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ABB, Electrification Business.

2.7 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Sustainable Design Submittals: Prepare and submit the following documentation:

3. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings:

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:

1. Exposed and Subject to Severe Physical Damage: ERMC.
2. Exposed and Not Subject to Physical Damage: ERMC.
3. Concealed Aboveground: ERMC.
4. Direct Buried: PVC-40.

C. Indoors:

1. Exposed and Subject to Severe Physical Damage: ERMC. Locations include the following:

a. Loading docks.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.

2. Damp or Wet Locations: ERMC .
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

D. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
2. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
3. Expansion Fittings: NEMA FB 2.40.
4. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:

a. Complete duct raceway installation before starting conductor installation.

b. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch (300 mm) of changes in direction.
c. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
d. Support conduit within 12 inch (300 mm) of enclosures to which attached.
e. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
f. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:

    1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    2) Where an underground service duct raceway enters a building or structure.
    3) Conduit extending from interior to exterior of building.
    4) Conduit extending into pressurized duct raceway and equipment.
    5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    6) Where otherwise required by NFPA 70.

g. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
h. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
i. Keep duct raceways at least 6 inch (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
j. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
k. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire.
l. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

    1) Termination fittings with shoulders do not require two locknuts.

m. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts.[Install insulated throat metal grounding bushings on service conduits].

2. Types EMT-A, ERMC-A, and FMC-A: Do not install aluminum duct raceways or fittings in contact with concrete or earth.
3. Types ERMC:

    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

4. Type ERMC-S-PVC:

    a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
    b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC duct raceway.
    c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

5. Types PVC:

    a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F (50 deg C). Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
    b. Comply with manufacturer's published instructions for solvent welding and fittings.

6. Stub-ups to Above Recessed Ceilings:

    a. Provide EMT or ERMC for duct raceways.
    b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

7. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:

    a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG.

8. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

    a. EMT: Provide [setscrew] [compression] fittings. Comply with NEMA FB 2.10.
    b. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

9. Expansion-Joint Fittings:

a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft (7.6 m). Install in runs of aboveground ERMC[and EMT] conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft (30 m).
b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
3) Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

c. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
d. Install expansion fittings at locations where conduits cross building or structure expansion joints.
e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

10. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.
11. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.

a. Provide warning signs.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533.13

SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.

B. Sustainable design submittals.

1. Nonmetallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.

5. Hoods for outlet boxes.

PART 2 - PRODUCTS

2.1 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arlington Industries, Inc.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. MonoSystems, Inc.
i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
j. Pass & Seymour; Legrand North America, LLC.
k. Patriot Aluminum Products, LLC.
l. Plasti-Bond; Robroy Industries.
m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
n. Spring City Electrical Manufacturing Company.
o. Topaz Lighting & Electric.
p. Wiremold; Legrand North America, LLC.

3. Options:

    a. Material: Sheet steel.
    b. Sheet Metal Depth: Minimum 2.8 inch (70 mm).

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    f. Pass & Seymour; Legrand North America, LLC.
    g. Patriot Aluminum Products, LLC.
    h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    i. Topaz Lighting & Electric.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Arlington Industries, Inc.
    d. Crouse-Hinds; brand of Eaton, Electrical Sector.
    e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    i. Patriot Aluminum Products, LLC.
    j. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    k. Topaz Lighting & Electric.

3. Options:

    a. Material: Sheet steel.

b. Sheet Metal Depth: minimum 2.8 inch (70 mm).

F. UL QCIT - Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
g. Pass & Seymour; Legrand North America, LLC.
h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
i. Topaz Lighting & Electric.

G. UL QCIT - Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Crouse-Hinds; brand of Eaton, Electrical Sector.
c. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
e. Topaz Lighting & Electric.
f. Wiremold; Legrand North America, LLC.

2.2 NONMETALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCMZ; including UL 514C.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Sustainable Design Submittals: Prepare and submit the following documentation for adhesive solvents:

C. UL QCMZ - Nonmetallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Appleton; Emerson Electric Co., Automation Solutions.
    d. Arlington Industries, Inc.
    e. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    f. Cantex Inc.
    g. Crouse-Hinds; brand of Eaton, Electrical Sector.
    h. Ericson Manufacturing Company.
    i. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    j. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    k. Intermatic, Inc.
    l. JM Eagle.
    m. Leviton Manufacturing Co., Inc.
    n. Panduit Corp.
    o. Pass & Seymour; Legrand North America, LLC.
    p. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    q. Topaz Lighting & Electric.
    r. Wiremold; Legrand North America, LLC.

D. UL QCMZ - Nonmetallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Cantex Inc.
    e. JM Eagle.
    f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Topaz Lighting & Electric.

E. UL QCMZ - Nonmetallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Cantex Inc.
    e. Crouse-Hinds; brand of Eaton, Electrical Sector.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Pass & Seymour; Legrand North America, LLC.
    h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

F. UL QCMZ - Nonmetallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    e. Cantex Inc.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2.3 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adalet.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Cooper B-line; brand of Eaton, Electrical Sector.
    d. FSR Inc.
    e. Hoffman; brand of nVent Electrical plc.
    f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    h. Milgard Manufacturing, LLC.
    i. N J Sullivan Company.
    j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    l. Spring City Electrical Manufacturing Company.
    m. Square D; Schneider Electric USA.

3. Options:

    a. Degree of Protection: Type 1.

D. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adalet.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Cooper B-line; brand of Eaton, Electrical Sector.
    d. FSR Inc.
    e. Hoffman; brand of nVent Electrical plc.
    f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    h. Milgard Manufacturing, LLC.
    i. N J Sullivan Company.
    j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    l. Spring City Electrical Manufacturing Company.
3. Options:

    a. Degree of Protection: Type 3R.

E. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adalet.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
3. Options:

    a. Degree of Protection: Type 3R.

F. UL BGUZ - Outdoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Cantex Inc.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. JM Eagle.
    f. Robroy Enclosures; Robroy Industries.
    g. Topaz Lighting & Electric.
3. Options:

    a. Degree of Protection: Type 3R.

2.4 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Intermatic, Inc.
h. Leviton Manufacturing Co., Inc.
i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
j. Panduit Corp.
k. Pass & Seymour; Legrand North America, LLC.
l. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
m. Topaz Lighting & Electric.
n. Wiremold; Legrand North America, LLC.

2. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.

D. UL QCIT or QCMZ - Nonmetallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arlington Industries, Inc.
d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
e. Crouse-Hinds; brand of Eaton, Electrical Sector.
f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Intermatic, Inc.
i. Leviton Manufacturing Co., Inc.
j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

k. Panduit Corp.
l. Pass & Seymour; Legrand North America, LLC.
m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
n. Topaz Lighting & Electric.
o. Wiremold; Legrand North America, LLC.

2. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.

PART 3 - EXECUTION

3.1 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

a. Type 3R unless otherwise indicated.
b. Locations Exposed to Hosedown: Type 6P.
c. Locations Subject to Potential Flooding: Type 6P.
d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.

2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: Type 12.

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:

1. Provide cast-metal boxes.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.2 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Set metal floor boxes level and flush with finished floor surface.
10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
11. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
12. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
13. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

    a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
    b. Provide gaskets for wallplates and covers.

14. Identification: Provide labels for boxes and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each box with engraved metal or laminated-plastic nameplate.

3.3 CLEANING

A. Remove construction dust and debris from boxes before installing wallplates, covers, and hoods.

3.4 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.16

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Wall Sleeves, Cast Iron:

1. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Pipe Sleeves, PVC:

1. Description: ASTM D1785, Schedule 40.

D. Molded Sleeves, PVC:

1. Description: With nailing flange for attaching to wooden forms.

E. Molded Sleeves, PE or PP:

1. Description: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch (0.6-mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Description:

a. Material: Galvanized sheet steel.
b. Minimum Metal Thickness:

1) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness must be 0.052 inch (1.3 mm).
2) For sleeve cross-section rectangle perimeter not less than 50 inches (1270 mm) or with one or more sides larger than 16 inches (400 mm), thickness must be 0.138 inch (3.5 mm).

2.3 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.5 POURABLE SEALANTS

A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.6 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

C. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Labels.
   2. Bands and tubes.
   3. Tapes and stencils.
   4. Tags.
   5. Signs.
   6. Cable ties.
   7. Miscellaneous identification products.

1.3 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 electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70, “National Electrical Code.”

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 1000 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Color for Neutral: White or gray.
5. Color for Equipment Grounds: Green.
6. Colors for Isolated Grounds: Green with two or more yellow stripes.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:
1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Equipment Identification Labels:
1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch (0.38 mm) thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

C. Write-on Tags:

1. Polyester Tags: 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 1000 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

K. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

M. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

R. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

S. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

T. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

U. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

V. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

W. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

X. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

Y. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

E. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

J. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

L. Operating Instruction Signs: Baked-enamel warning signs.

M. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
   a. Enclosures and electrical cabinets.
   b. Access doors and panels for concealed electrical items.
   c. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   d. Emergency system boxes and enclosures.
   e. Enclosed switches.

END OF SECTION 260553