MOUNT RAINIER NATIONAL PARK

PARADISE FIBER OPTIC CONDUIT & CABLE INSTALLATION

PROJECT STATEMENT OF WORK & SPECIFICATIONS *JUNE 2026*

Developed By:

Division of Administration & Business Services
Information Technology & Telecommunications Branch

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DIVISION, SECTION & PARAGRAPH NUMBERING

The numbering and lettering of sections and paragraphs in this Statement of Work (SOW) are merely for identification. Sections included are listed in this Table of Contents together with the number of pages in each section.

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DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 PROJECT LOCATION

This project is located within the Paradise area of Mount Rainier National Park, the most visited destination in the park. Paradise includes two large parking areas, picnic area, three housing dorm buildings, the Henry M. Jackson Visitor Center (JVC), historic Paradise Inn, historic Old Ranger Station, and the wastewater treatment plant facility (WWTP). Paradise is situated approximately 24 road miles from Ashford, Washington, and is accessed via State Route 706 and the Paradise Road. It is approximately 75 road miles from Tacoma, Washington. The project work area has a total estimated combined distance of 7,100 feet.

1.2 SCOPE OF WORK

This project involves constructing outside-plant telecommunication infrastructure. The Contractor will install fiber optic cabling and conduit, using both existing and new facilities, to create three low-count fiber cable routes from the Henry M. Jackson Visitor Center to the Wastewater Treatment Plant, Ski Dorm, and Glacier Dorm at Paradise. Cable terminations and electronics are excluded.

The term "vault" and "handhole" are used interchangeably in this document to describe underground enclosures where conduit segments intersect for the fiber cable to be pulled through.

A. Outside Plant - Conduit Paths & Construction (see Project Map in appendix)

1. See Section 27 12 23 Part 2.4 for conduit specifications.

2. SECTION A (JVC through Vault 2):
   a. The conduit path for this project starts inside the JVC basement IT cage where the building's telecom Building Entrance Terminal is located, which is the "project start" location. Two existing 3" conduits stub up out of the floor under the plywood telecom backboard.
   b. Both existing 3" conduits from the JVC run underground toward Vault 1 but stop approximately 12 to 18 inches short of this vault, located underneath the south edge of the roadway. Contractor shall make the necessary conduit extension and repairs to extend the vacant 3" conduit into Vault 1, which may require that the vault to be lifted out of place and re-seated after the conduit extension and repair has been made.
   c. The conduit segment between Vaults 1 and 2 has pull tape already in place.
   d. Distance from Project Start to Vault 2 is approximately 700 feet.

3. SECTION B (Vaults 2 through Vault 6 - WWTP cable path)
   a. Contractor to utilize existing sections of vacant 2" conduit between vaults. Pull tape is already in place.
   b. Distance between Vaults 2 and 6 is approximately 5,600 feet. The longest distance between vaults for the entire project is between Vaults 5 and 6 at approximately 1700 feet.

4. SECTION C (Vault 2 direct to Vault 7, then Vaults 7 through 12 – Ski Dorm & Glacier Dorm cable path)
   a. Contractor shall furnish, excavate, and install two Schedule 80 PVC conduits between

Vault 2 directly to Vault 7, then under the main road to Vault 8. These sections are under or next to the main road and must utilize Schedule 80 conduit to prevent crushing over time due to frequent heavy equipment traffic.

b. At the main road crossing next to the lower parking lot intersection, contractor to use either Horizontal Directional Boring or Pneumatic "Missile" Boring equipment and techniques to install two 2" Schedule 80 PVC conduits between Vaults 7 and 8 underneath the main road next to the lower part of the lower parking lot intersection. The bore path must be positioned accordingly to avoid coming in contact with existing high voltage primary power and fiber optic utility conduits under the road, which are installed horizontally flat, typically at a depth between either 34" and 40" below grade (standard depth), or between 18" and 22" below grade (in areas where competent rock was encountered during excavation). Because of proximity to existing utilities, obtaining accurate locate positions and depths for these existing utilities at the bore site will be crucial for this project.

c. Contractor shall furnish, excavate, and install Schedule 40 PVC conduit from Vault 8 through Vault 11 (next to Ski Dorm) by trenching along the bottom of the rock masonry wall in the lower parking lot area and moving several medium sized rocks to expose the ground. The trenching path is tight and/or on an incline in places, so a mini-trencher or other smaller sized trenching equipment may need to be used in lieu of a mini-excavator in areas to avoid equipment tipping or damage to large vegetation.

d. Contractor shall furnish, excavate, and install one 2" Schedule 40 PVC conduit between Vault 11 and Vault 12 (next to Glacier Dorm).

e. Contractor shall furnish and install a total of six new subsurface vaults (handholes) for Vaults 7 through 12. Vault 7 and Vault 12 must be heavy-duty and traffic-rated due to the proximity of the roadway. Handholes for Vaults 9 through 11 are away from road traffic and should be medium-duty and non-traffic-rated. See section 27 05 43 Part 2.5 for handhole specifications and requirements.

f. Distance from Vault 2 direct to Vault 7, then Vaults 7 through 12 is approximately 2,425 linear feet. This is the total estimated distance of excavation for this project.

5. BUILDING PENETRATIONS

a. Ski Dorm: Contractor shall install one 2" Schedule 40 PVC conduit from Vault 11, up the south face of the Ski Dorm building. Building has concrete siding from ground level to about 10 feet in height; penetration using a core drill may be required. Building shall be penetrated at a height that lines up with the ceiling in the basement. An LB fitting shall be used at the exterior building entry point. Conduit shall continue along the basement interior ceiling (parallel to existing conduits and pipes) to the Boiler Room where the conduit shall stub off above the IT cabinet (black wall-mount cabinet mounted next to north door of the boiler room).

b. Glacier Dorm: Contractor shall install one 2" Schedule 40 PVC conduit between Vault 12 and the southeast corner of the Glacier Dorm building. This is a concrete structure; core drilling will be required. Building penetration may be made at a suitable location where the conduit can enter the mechanical room at the southeast corner of this building. An LB fitting shall be used at the exterior building entry point. Conduit shall be stubbed off as it enters this room.

B. Outside Plant – Fiber Optic Cable & Sizing

1. See Section 27 13 23 Part 4.2 for fiber optic cable specifications.

2. Contractor shall furnish and install:

a. One 48-fiber cable for the path between the JVC and WWTP, estimated at 6,900 feet

(includes an extra 400 feet, see below).

b. One 12-fiber cable for the path between the JVC and Ski Dorm, estimated at 2,300 feet.

c. One 12-fiber cable for the path between the JVC and Glacier Dorm, estimated at 2,500 feet.

C. Outside Plant – Fiber Cable Installation (see Project Design Layout in appendix)

1. Project Start: All 3 cables shall originate from the JVC basement IT cage. Contractor to pull all 3 cables through the 3" conduit in the basement to Vault 1, then through the vacant 2" conduit to Vault 2. Each cable shall have 50 feet of slack coiled up at this location.

2. At Vault 2, the 48F cable shall route through the 2" conduit that continues down the main road to Vault 6. This cable will not run into any building. Contractor to leave an additional 400 feet coiled up at Vault 6 for a future ground-lay temporary install into the WWTP.

3. Also at Vault 2, the two 12F cables feeding the Ski Dorm and Glacier Dorm shall route together in a bundle through one of the two new 2" conduits that route to Vaults 7 through 11.

4. At Vault 11, one of the two 12F cables shall enter the adjacent Ski Dorm building, and the remaining 12F will route to Vault 12. At Vault 12 the cable will route into the Glacier Dorm building.

5. Splice Points & Inter-Vault Cable Pulls: Ideally, all fiber cables shall be run the entire distance without any splicing due to the relatively short distances involved and modern machine-assisted figure-8 techniques used in the industry. However if a cable inadvertently needs to be cut, that will be acceptable but only if absolutely necessary. If this occurs, contractor shall leave at least 60 feet (30 feet of cable in each direction) available in a vault for splicing.

6. Cable & Slack Loops: For Vaults 1 through 6 (all existing Oldcastle Precast model 25TA concrete/steel vaults along main roadway), each cable shall have a minimum of 30 feet (15 feet in each direction) for pass-through slack loops. The vacant 2" conduit to be used between Vaults 1 through 6 currently have a pull tape already in place. Vaults 7 through 12 shall utilize smaller handholes with slack loops having a minimum of 10 feet (5 feet in each direction) for each cable.

7. Traceable Pull Tape: When pulling fiber cables, contractor shall also install detectable/traceable pull tape in ALL conduits so the paths can be located in the future. See section 27 13 23 Part 2.4 for requirement and specifications.

D. Inside Plant (ISP) & Terminal Equipment

Inside plant and terminal equipment will be acquired and installed in-house in the future and will not be included in this project.

E. Testing and Acceptance

1. Link Loss Testing: The Contractor shall perform end-to-end Tier 1 (Optical Loss Test Set) and Tier 2 (Optical Time Domain Reflectometer - OTDR). Since none of these cables will not be terminated for this project, testing of 3 random fibers in each of the three newly installed fiber strands (using a temporary fusion splice on those fibers) shall be performed.
2. Documentation: Deliverables shall include As-Built drawings and OTDR trace reports for the random fibers chosen for testing.

F. Workmanship

All work shall be performed in a "neat and workmanlike manner" in compliance with NEC, BICSI, and local base telecommunications standards.

1.3 WORK RESTRICTIONS

A. Site Access: Contractor staff accessing the project site does not entail any special needs except for access to the communication cage of the JVC building and the mechanical rooms in the Ski Dorm, and the Glacier Dorm buildings. Per federal regulations, staff without sufficient physical security credentials shall require an escort by local IT staff within these buildings.

B. Period of Performance: Timing of work shall be coordinated with the Contracting Officer and follow the approved Contractor's work schedule. Anticipated contract award time frame is early to mid-September, 2026. Work is expected to start within ten (10) days after notice to proceed and be completed within 45 days of starting work.

C. Work Hours: Work hours are from 7:00 am to 5:30 pm Monday through Friday. Weekend and holiday work will normally not be allowed. Special requests may be made through the Contracting Officer / Contracting Officer's Representative (COR).

D. Staging and Storage of Materials: Confine storage of equipment and materials to the staging/lay-down/storage areas identified within the area designated by the Contracting Officer / COR or as established at the preconstruction meeting. The parking lot near the Ski Dorm Building may be considered if normal operations are not impacted. All staging and stockpiling areas shall be returned to pre-construction conditions following construction.

E. Vehicles & Equipment: Confine parking to areas designated for parking or staging materials and equipment throughout the non-public areas of the project site.

1. No unattended motors/engines are permitted. No idling of motors or engines for extended periods of time is permitted.
2. Fueling of any type, whether equipment or vehicles, must be done either on non-pervious surfaces such as concrete or asphalt, or deploy a spill containment pad.
3. Equipment must be free of any fluid leaks (fuel, oil, hydraulic fluid, etc.) upon arrival at the work site and will be inspected at the beginning of each shift for leaks. Leaking equipment will be removed off site for necessary repairs before the commencement of work.

F. Existing Utilities: Notify Contracting Officer / COR of proposed locations and times for excavation.

1. Pursuant to the Federal Enclave Doctrine, Washington State laws concerning utility locates (RCW 19.122) do not apply on lands within exclusive federal jurisdiction. Mount Rainier National Park falls under exclusive federal jurisdiction, as does land managed by most military installations such as Joint Base Lewis-McChord and Naval Subbase Bangor. OSHA and other applicable federal policies, regulations, and statutes still apply.
2. It is imperative for the safety of all personnel involved that the need for utility locates

be fully communicated ahead of time with both project and contracting staff, and requests fully signed off prior to any excavation taking place. The WA State "2 business days" locate completion requirement does not apply. Due to limitations in NPS staffing availability, locate requests must be submitted at least 5 workdays in advance to avoid project delays.

3. Utilities infrastructure within the boundaries of the park is owned by a combination of Mount Rainier National Park and other utility companies (primarily Puget Sound Energy, Lewis County PUD, and Lumen/CenturyLink). **An internal park-level utilities locate request form MUST be completed in full and submitted through the COR for ANY AND ALL underground utilities.** The Park will contact DigSafeWA OneCall ("811") on the contractor's behalf as needed for locates of contracted utilities. A copy of this form shall promptly be provided to the contractor by the COR upon request.
4. Contractor shall be responsible for identifying and preventing damage to known utilities. If damage occurs, repairs shall be made at no additional expense to the Government.
5. Contractor shall be responsible for periodically refreshing locate marks to ensure they can be seen clearly for the duration of the excavation portion of the project. Orange irrigation flags may be used in lieu of paint marks where necessary.
6. If damage occurs to an unknown utility, an equitable adjustment will be made for repairs in accordance with the Changes clause of the contract.

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

1. Notify Contracting Officer / COR not less than five (5) business days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Contracting Officer's written permission.

H. Preservation of Natural Features:

1. Before entering the park, all workers shall check vehicles, equipment, tools, boots, and backpacks for weed seeds, mud that could harbor weed seeds, and plant parts. All equipment shall be power-washed and inspected before work begins to ensure it is free of non-native weeds and/or seeds. The park requires and will perform inspections to ensure non-transport of non-native species BEFORE equipment is offloaded. Contact the COR at least (3) three days in advance of park entry to arrange for an inspection(s) at the loading dock or point of origin.
2. Re-use fill, rock, or topsoil from the project area, if possible. If not possible, or for utility bedding purposes, Contractor shall submit a list of proposed sources, end-use, and temporary storage requirements for imported material, 30 calendar days before delivery. The sources of imported rock, sand, gravel, and soil shall be inspected for invasive non-native plants, weeds, and/or seeds. The material must not be stockpiled at the quarry for more than 1 week after washing. If material comes from older stockpiles, the quarry must be certified weed-free by the County Noxious Weed Coordinator, or a qualified weed inspector designated by NPS. For details on obtaining pit inspections and topsoil specifications, contact Contracting Officer's Representative (COR) and provide at least 14 days' notice that an inspection is needed. Imported material shall be free of non-native weeds and/or seeds. Imported material shall be shipped directly from the source to the park without intermediary storage or staging. Shipping vessels shall be covered,

if necessary, to prevent spillage or blowing off their contents while in transit.

3. Prevent damage to natural surroundings. Restore damaged areas, repair or replace damaged trees and plants, at no additional expense to the Government.
4. Provide temporary barriers to protect existing trees and plants and root zones.
5. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer's Representative (COR) and remove agreed-on roots and branches that interfere with construction.
6. Do not fasten ropes, cables, or guys to existing trees.
7. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage. Where utility excavation or trenching intersects root systems of larger trees, cut roots greater than 3 inches in diameter cleanly with a sharp tool such as a saw (i.e. do not tear with the excavator).
8. Care shall be taken not to disturb any wildlife species (reptiles, migratory birds, raptors, or bats) found nesting, hibernating, estivating, or otherwise living in, or immediately nearby, worksites.
9. Remove all materials, including trash and food wastes, from project site daily to reduce the attraction of murrelet predators, such as crows and jays.
10. All disturbed ground shall be reclaimed using appropriate best management practices, which may include planting or seeding with native vegetation, or, in the case of small treatment areas, allowing native vegetation to reclaim the area naturally. Contractor shall consult with Contracting Officer's Representative to determine the best methods for restoration.

I. Archaeological Resources: Archaeological resources are physical pieces of evidence of past human activity, including evidence of the effects of that activity on the environment. Archaeological resources are found above and below the ground and underwater.

1. No archaeologically sensitive areas have been identified within the proposed project area. However, archaeological monitoring will be required during all ground-disturbing activity unless deemed otherwise by the NPS. Contractor shall provide a minimum of three weeks' notice before beginning trenching or excavation so that an archaeologist can be available.
2. If unknown archaeological resources are discovered during construction, the contractor shall stop work or relocate work to a non-sensitive area until resources can be properly recorded and evaluated and contact the Contracting Officer / COR immediately. Measures shall be taken to avoid further resource impacts or to mitigate their loss or disturbance.

I. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Government, Government employees, user groups, and emergency vehicles always. Do not use these areas for parking or storage of materials.

1. Schedule deliveries to minimize the use of driveways and entrances.
2. Schedule deliveries to minimize space and time requirements for the storage of materials and equipment on-site.

J. Construction Camp: The establishment of a camp within the park is not permitted.

K. Hauling Restrictions: Comply with legal load restrictions in hauling of materials. Load restrictions on park roads are identical to state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park

Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.

L. Restore all traffic/parking/security signs and markings, including space numbers, designations, and lines, to their original form if such signs/markings are defaced or deleted during construction/repair.

M. Control and provide security of Contractor-owned equipment and materials at the worksite. Report immediately missing/lost/stolen property to Park Dispatch at 360-569-6600.

1.4 PROJECT MEETINGS

A. Preconstruction Conference: Before the start of construction, the Contracting Officer will arrange an on-site or virtual meeting with the Contractor. The meeting agenda will include the following as a minimum:

1. Roles & Responsibilities/ Lines of Authority
2. Park rules and regulations
3. Jobsite Safety
4. Coordination of Subcontractors
5. Labor law application
6. Modifications
7. Payments to Contractor
8. Payroll reports
9. Contract time
10. Display of required posters
11. Notice to proceed
12. Correspondence procedures
13. Acceptance/rejection of work
14. Progress meetings
15. Submittal procedures
16. Environmental requirements
17. Saturday, Sunday, holiday, and night work
18. Schedule of Values

B. Progress Meetings: The Contracting Officer's Representative may schedule weekly or biweekly site meetings with the Contractor once onsite work commences. The Contractor shall be responsible for facilitating progress meetings and ensuring that the appropriate entities involved in planning, coordination, or performance of upcoming work activities are represented at these meetings.

1.5 SUBMITTALS

A. Division 01 documents: The following items shall be submitted a minimum of one (1) week after the Pre-Construction Conference. Contracting Officer will notify the Contractor of the tentative date for the Pre-Construction Conference.

1. Letter designating Project Superintendent
2. Construction Schedule
3. A comprehensive breakdown of the Schedule of Values
4. Accident Prevention Plan and/or SSSP

5. Safety Plan (SSSP) is a written plan that outlines the scope of work proposed, the safety practices and mitigations to be taken for identified hazards/risks, contractor roles and responsibilities, and any additional pertinent program element or requirements for a specific construction project that the provided scope of work is associated with.
6. A list of Subcontractors for this project
7. Written statements from subcontractors certifying compliance with applicable labor standard clauses, using SF1413
8. Satisfactory evidence of liability insurance coverage and worker's compensation for the Contactor and all subcontractors
9. Quality Control Plan

B. All items listed must be provided to the Contracting Officer after the Pre-Construction Conference is held. Failure to provide these documents within one (1) week of the Pre-Construction Conference will result in the Notice to Proceed not being issued, and the Contracting Officer will consider other contractual remedies. On-site work shall not commence until a written Notice to Proceed has been issued.

C. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Contracting Officer will return without review, submittals received from sources other than the Contractor.

1. CM-16 Transmittal Form: All material submittals shall be transmitted using National Park Service form CM-16. (This form can be downloaded from the Workflows website at http://www.nps.gov/dscw/con_subreview21.htm.) No action will be taken on a material submittal item unless accompanied by the transmittal form.
2. Documents required in Division 1 should be submitted with the CM-16 Transmittal form, as well, but may be submitted as a single Division 1 package.

1.6 ACCIDENT PREVENTION PROGRAM

A. The Contractor is responsible for establishing an effective accident prevention program and providing a safe environment for all personnel and visitors.

1. Ensure compliance with OSHA and project requirements.
2. Provide adequate first aid facilities for the number of employees and the type of construction at the site.

B. Accident Reporting:

1. Reportable Accidents: A reportable accident is defined as death, occupational disease, traumatic injury to employees or the public, property damage by accident more than $100, and fires. Notify Contracting Officer immediately in the event of a reportable accident. Within 7 days of a reportable accident, fill out and forward to the Contracting Officer an Accident/Property Damage Report (Form CM-22). This form may be obtained from the Contracting Officer.
2. All Other Accidents: The Contractor shall report all other accidents to the Contracting Officer as soon as possible and assist the Contracting Officer and other officials as required in the investigation of the accident.

1.7 QUALITY CONTROL PROGRAM

A. The Contractor is responsible for all testing and inspections required by the project Inspect

and test work as needed to ensure that the quality of materials, workmanship, construction, finish, and functional performance comply with applicable specifications, drawings, and codes.

1. Engage a qualified testing agency to perform these quality-control services.
2. Submit the appropriate report for each quality-control service.
3. Testing and inspecting requested by the Contractor and not required by the Contract Documents are the Contractor's responsibility.
4. The Contracting Officer / COR may designate test locations.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements. The quality of all work shall be the responsibility of the Contractor.

1.8 TEMPORARY FACILITIES

A. Sanitary Facilities: Public restrooms are available at both the JVC and the "Slate" winter entrance at the Guide House building across the parking lot from the JVC. Contractor may supply lighted and ventilated, weather-proof, and lockable, portable toilets with handwashing or sanitizing capability located in the designated material and equipment staging area. The contractor shall properly pump/empty these toilets regularly and keep the toilet clean so as not to attract insects/animals.

B. Water: Potable water is available at the site in small quantities. Note that there are no fire hydrants available for rapid filling. Coordinate any water use and connection with Contracting Officer / COR.

C. Telephone Service: No landline telephone service is available on site for the Contractor's use. The project site does, however, have reliable cellular phone coverage.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Recycling is encouraged.

E. Fire Prevention & Protection: A capable and qualified person shall be placed in charge of fire protection. The responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe work procedures.

1. Equip all gasoline or diesel-powered equipment used in potential forest or grass fire locations with spark arresters.
2. Locate internal combustion equipment so that exhausts are discharged well away from combustible materials.
3. Smoking: Smoking on the construction site is prohibited.
4. Vehicles & Equipment: Provide one extinguisher for each vehicle or piece of equipment.

F. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs following the Manual on Uniform Traffic Control Devices (MUTCD), the latest edition.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Adequately barricade and post open cuts in or adjacent to thoroughfares.
3. Protect pedestrian traffic by guardrails or fences.
4. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with

protection as required at ends.

5. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
6. Install Barrier Tape where directed by the Contracting Officer / COR. Keep a minimum of two (2) rolls on-site at all times.

1.9 PROJECT CLOSEOUT

A. Maintain one complete set of contract drawings and one full-size set of vendor-supplied drawings. Mark changes, deletions, and additions to show actual construction conditions. Show additions in red, deletions in green and special instructions in blue. On completion of the total project, submit complete record drawings. Include all shop drawings, sketches, and additional drawings that are to be included in the final set, with clear instructions showing the location of these drawings.

B. Complete the following closeout requirements before requesting a final inspection:

1. Submit electronic copies of any product operation and maintenance manuals, product cut sheets, specific warranties, guarantees, final certifications, and similar documents.
2. Submit performance testing reports.
3. Remove temporary facilities, construction tools, and similar elements from the project site.
4. Complete final cleaning and site restoration requirements.
5. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
6. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems.

1.10 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

A. Request final inspection in writing when project or designated portion of project is substantially complete. Contracting Officer will proceed with inspection within ten (10) days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.

B. If following final inspection, the work is determined to be substantially complete, the COR or Project Inspector will prepare a Punch List to be corrected before final acceptance and issue a Letter of Substantial Completion. The contractor shall complete the work described on the Punch List within seven (7) calendar days, as weather permits. If the Contractor fails to complete the work within this time frame, the Contracting Officer may either replace or correct the work with an appropriate reduction in the contract price or charge for re-inspection costs following the Inspection of Construction clause of the contract.

C. If, following final inspection, the work is not determined to be substantially complete; Contracting Officer will notify the Contractor in writing. Contractor shall request a new final inspection after completing work. All re-inspection costs may be charged against the Contractor following the Inspection of Construction clause of the contract.

D. After all Punch List items and deficiencies have been corrected, the Contracting Officer will issue a Letter of Final Acceptance.

PART 2 – PRODUCTS

1.1 ACTION SUBMITTALS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Mark each copy of each submittal to show which products and options are applicable.
2. Include the following information, as applicable:
   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions: When Contract Documents require compliance with manufacturer's printed instructions, provide one complete set of instructions to the Contracting Officer and keep another complete set of instructions at the project site until substantial completion.
   d. Manufacturer's catalog cuts: Submit only pertinent pages; mark each copy of standard printed data to identify specific products proposed for use.
   e. Wiring diagrams showing factory-installed wiring.
   f. Printed performance curves.
   g. Compliance with specified referenced standards.
   h. Testing by the recognized testing agency.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Notation of dimensions established by field measurement.
   g. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

C. Construction Materials: The Contractor is required to submit for approval a list of products and material. The National Park Service will review and approve these materials.

1.2 INFORMATIONAL SUBMITTALS

A. Contractor's Construction Schedule: The purpose of the Construction Schedule is to ensure adequate planning, coordination, scheduling, and reporting during the execution of the work by the Contractor. The Construction Schedule will assist the Contractor and Contracting Officer (CO) in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's monthly progress payment. It shall include the dates in the contract, phases, milestones, holidays, weather consideration, a critical path, and any other requirements of this contract.

B. Accident Prevention Plan: After the contract award and after the Pre-Construction conference, submit for review an Accident Prevention Plan. The Plan shall be written to comply with OSHA and project

requirements (a generic plan is not acceptable) including but not limited to the following:

1. Name and qualifications of the onsite representative (Site Safety Supervisor) responsible for carrying out the program. The designated Site Safety Supervisor shall be responsible for:
   a. Implementation and enforcement of the Accident Prevention Plan
   b. Daily safety inspections
   c. Conducting and documenting weekly and monthly safety meetings
   d. Review of safety requirements at progress meetings
   e. Compilation and maintenance of safety reference materials
   f. Tracking and resolution of safety violations
   g. Site personnel and visitor compliance with site safety and health requirements and the Accident Prevention Plan
   h. Investigation and reporting of accidents and injuries
2. Weekly and monthly safety meetings, documented with topics and attendees.
3. First aid and rescue procedures.
4. Traffic control plan.
5. Training, both initial and continuing.
6. Planning for possible emergency situations such as fires, floods, cave-ins, slides, explosions, power outages, and windstorms. Such planning shall take into consideration the nature of construction, site conditions, and the degree of exposure of persons and property.

C. Schedule of Values: Break down each lump-sum item into component work activities used in the schedule, for which progress payments may be requested. The work activities broken out within the schedule of values shall be integrated into and made a logical part of the construction baseline schedule submitted under this specification. The total costs for the component work activities shall equal the contract price for that lump-sum item. The Contracting Officer may request data to verify the accuracy of dollar values. Include general condition costs, overhead, and profit in the total dollar value of unit price items and the component work activities for each lump-sum item. The total cost of all items shall equal the contract price. An acceptable Schedule of Values shall be agreed upon by the Contractor and Contracting Officer before the first progress payment is processed

D. Quality Control Plan: The Quality Control Plan shall include:

1. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications, where appropriate.
2. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties and authorities designated by principal or owner.
3. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
4. Methods of performing, documenting, and enforcing quality control of all work, including Contractor report forms and acknowledgment of NPS forms.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.
6. Provisions for substantial completion(s) and final inspection(s) per Contract.
7. Quality Control Daily Reports and Daily Test Report Information Sheets (attached) of quality control activities and tests, which shall be maintained each day onsite work activities occur and submitted to the Contracting Officer no less than weekly.

E. Material Test Reports: Prepare reports written by a qualified testing agency, on the testing agency's standard form, indicating and interpreting test results of material for compliance with the requirements in the Contract Documents.

F. Product Test Reports: Prepare written reports indicating the current product produced by the manufacturer complies with the requirements in the Contract Documents. Base reports on the evaluation of tests performed by the manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

G. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during the installation of the product or after the product is installed in its final location, for compliance with the requirements in the Contract Documents.

H. Manufacturer's Instructions: Prepare written or published information that documents the manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include the name of the product and the name, address, and telephone number of the manufacturer.

PART 3 - EXECUTION (Not Used)

END OF SECTION

DIVISION 27

COMMUNICATIONS

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section specifies the basic requirements for communications installations as indicated or required and includes requirements common to more than one specification section of this division (such as related documents, related sections, definitions, governing requirements, contractor requirements, warranty requirements, submittal requirements/procedures, and project closeout requirements/procedures, as well as other requirements).

1.3 REFERENCES

A. Work shall be designed and installed per the following:

1. National Electrical Code (NEC)
2. National Electrical Safety Code (NESC)
3. OSHA Standards and Regulations
4. ANSI/TIA-758 Customer-Owned Outside Plant Telecommunications Infrastructure Standard
5. UL444 – Standard for Safety of Communications Cable

B. Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.

C. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.

1.4 SUBMITTALS

A. Product data

B. Wiring diagrams

C. Catalog cut sheets and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication, and material finish.

Clearly indicate on each sheet what is being submitted on.

D. Provide applicable portions of the following information within seven (7) days after receiving each reel and/or box of cable:

1. Manufacturer's product test data for fiber optic cable components.
2. On–reel OTDR testing of all fiber.

1.5 RESPONSIBILITIES AND COORDINATION

A. Contractor shall provide all materials, qualified labor and services required to ensure a complete and operational system, installed in accordance with the intent of the Contract Documents.

B. Contractor shall furnish and install all incidental items not actually shown or specified, but which are required by best practices to provide complete functional systems.

1.6 LABELING

A. Comply with TIA/EIA–606–A, TIA/EIA–606–A, Addendum 1 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging andbending.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 WORKMANSHIP

A. Manufactured products, materials, equipment, and components shall be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer's specifications and printed instructions.

B. The installation of all system components shall be carried out under the direction of qualified personnel. Appearance shall be considered as important as mechanical and electrical efficiency. Workmanship shall meet or exceed industry standards.

3.2 INTENT OF DRAWINGS

A. The drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc., unless specifically dimensioned.

B. Follow as closely as practicable the schematic design shown on the drawings. Make all

necessary measurements in the field to verify exact locations and ensure precise location and fit of specified items in accordance with the drawings. Make no substantial alterations without prior approval of the Contracting Officer.

C. Contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, and related components, according to the Contract Documents and subject to prior review by the Contracting Officer.

D. Contractor shall refer any conflicts with the Contract Documents to the Contracting Officer for resolution.

3.3 CABLE TERMINATION AND TEST PLANS

A. General

1. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.

2. Inspection Requirements:

   a. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.
   b. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.

3. Test Report Requirements – Each test report shall include the following sections:

   a. Scope of testing
   b. List of equipment used in the test
   c. List of technicians performing the test
   d. Summary of test results
   e. Individual test data sheets

4. Fiber Optic Cable Tests: Testing shall be performed using a level IIIe tester, with approved test–heads.

3.4 FINAL TEST AND ADJUST

A. Contractor shall be responsible for post–installation performance testing of all cabling systems specified elsewhere in the Contract Documents.

1. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber.
2. Any cable links or fiber strands, which fail to meet performance test criteria, shall be re–terminated, re–connectorized, or replaced by the contractor free of charge.
3. Submit final field test documentation to Contracting Officer.

3.5 DEFINITION OF ACCEPTANCE

A. System acceptance shall be defined as that point in time when the following requirements

1. All submittals and documentation have been submitted, reviewed, and approved.
2. The complete system has successfully completed all testing requirements.

B. All punch list items have been corrected and accepted.

END OF SECTION

SECTION 27 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1. RELATED DOCUMENTS

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

2. SUMMARY

   A. Provide all materials and labor for the installation of a pathway system for outside plant communications circuits. Work in this section includes excavation and trenching, conduit (raceway) construction, cutting and patching, concrete, plant-mixed hot mix asphalt paving, maintenance hole and handhole construction, and landscape restoration.

3. REFERENCES

   A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section:

      1. General:
         a. National Electrical Code (NEC)
         b. National Electrical Safety Code (NESC)
         c. Occupational Safety and Health Act (OSHA)

      2. Communications:
         a. ANSI/TIA/EIA - 758 : Customer-owned Outside Plant Telecommunications Cabling Standard
         b. ANSI/TIA/EIA - 568: Commercial Building Telecommunications Cabling Standard
         c. ANSI/TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
         d. ANSI/TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
         e. ANSI/TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
         f. ISO/IEC IS 11801: Generic Cabling for Customer Premises
         g. BICSI: BICSI Telecommunications Cabling Installation Manual (CIM)
         h. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)
         i. BICSI: BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)

      3. Concrete:
         a. Reinforcement:
            i. ACI 301: Structural Concrete for Buildings

ii. ACI SP-66: American Concrete Institute - Detailing Manual
iii. ANSI/ASTM A82: Cold Drawn Steel Wire for Concrete Reinforcement
iv. ANSI/AWS D1.4: Structural Welding Code for Reinforcing Steel
v. ANSI/AWS D12.1: Reinforcing Steel Welding Code
vi. ASTM A615: Deformed and Plain Billet Steel Bars for Concrete Reinforcement
vii. AWS D12: Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction

b. Cast-in-Place:
i. ACI 212.3R: Chemical Admixtures for Concrete
ii. ACI 301: Structural Concrete for Buildings
iii. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
iv. ACI 305R: Hot Weather Concreting
v. ACI 306R: Cold Weather Concreting
vi. ASTM C33: Concrete Aggregates
vii. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
viii. ASTM C94: Ready-Mixed Concrete
ix. ASTM C150: Portland Cement
x. ASTM C143: Standard Test Method for Slump of Hydraulic Cement Concrete
xi. ASTM C173: Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
xii. ASTM C231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
xiii. ASTM C260: Air Entraining Admixtures for Concrete
xiv. ASTM C309: Standard Specifications for Liquid Membrane Forming Compound for Curing Concrete
xv. ASTM C494: Chemical Admixtures for Concrete

c. Pre-Cast:
i. ASTM C478: Standard Specification for Precast Reinforced Concrete Manholes Sections
ii. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Utility Structures
iii. ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures
iv. ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
v. ASTM C1037: Standard Practice for Inspection of Underground Precast Concrete Utility Structures
vi. ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

4. Trenching and Backfill:
a. ASTM D1557: Test Method for Laboratory Compaction Characteristics Using Modified Effort

5. Asphalt Paving:

a. Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications for Road Bridge and Municipal Construction (most recent Edition)

4. DEFINITIONS

A. Aggregate: Mineral materials such as sand or stone used in making concrete.

B. Backfill: Earth material used specifically for filling and grading excavations back to a finished state. Backfill is placed on top of the bedding surrounding encased duct banks and direct-buried conduits.

C. Base: Earth material used specifically to level and grade an excavation's subgrade for the subsequent placement of encased duct banks, direct-buried conduit, maintenance holes and handholes. Base material is placed on top of the subgrade and beneath the bedding surrounding encased duct banks, conduits, maintenance holes or handholes.

D. Bedding: Earth material used specifically for filling excavations. Bedding is placed around encased duct bank, conduits, maintenance holes or handholes. Bedding is placed on top of the base and beneath the backfill.

E. Fill: The collective term for base, bedding, and backfill.

F. Handhole (HH): A structure like a small maintenance hole through which cable can be pulled, but not large enough for a person to fully enter to perform work. This term is used interchangeably with the term "Vault" in this document.

G. Maintenance Hole or Manhole (MH): A vault located in the ground or earth as part of an underground conduit system and used to facilitate placing, connectorization, and maintenance of cables as well as the placing of associated equipment, in which it is expected that a person will enter to perform work.

H. RNC: Rigid Non-Metallic Conduit (PVC or HDPE).

5. SUBMITTALS

A. Product Data: For each type of product indicated below. Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.
2. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Quality Assurance/Control:

1. Submit a copy of the delivery receipt for each concrete delivery. Include date, strength ordered, and location used.

C. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during construction, to the Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.
2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of fill, topsoil, concrete formwork, concrete, plant-mixed hot mix asphalt, raceway, maintenance holes, handholes and other incidentals and accessories as required.

2.2 BASE, BEDDING AND BACKFILL

A. Base: Readily compactable and meeting the following gradation requirements:

1. For Maintenance Holes and Handholes (provide gravel):

Sieve Size	PercentPassing 1”
Square	100
¼” Square	25 - 80
U.S. No. 200	15 max
Sand Equivalent	30 min

2. For Trenches (provide sand):

Sieve Size	Percent Passing
U.S. No. 10	35 - 100
U.S. No. 20	20 - 80
U.S. No. 40	10 - 55
U.S. No. 100	0 - 10
U.S. No. 200	0 - 3

B. Bedding: Same as Base – For Trenches, above.

C. Backfill:

1. For Maintenance Holes and Handholes – Same as Base (gravel).
2. For Trenches – re-use onsite soils, if acceptable.

2.3 CAST-IN-PLACE CONCRETE

A. Formwork:

1. Forms: Metal or plywood in good condition
   a. Form Release Agent: Burke Form Coating (or equal)

B. Reinforcement:

1. Reinforcing Steel: ASTM A615, Grade 40. Uncoated, free from rust, dirt, and loose scale.
2. Tie Wire: 18 gauge 40 or heavier black annealed wire.
3. Embedded Anchor Bolts: Mild galvanized steel, cold bent.

C. Concrete

1. Cement: Different types of cement, including the same type of cement provided by more than one manufacturer, are not acceptable. Cement shall conform to:
   a. ASTM C150-7, type 1.
   b. 2500 psi minimum compressive at 28 days per ASTM C39.
   c. 4 inches maximum slump per ASTM C-143.
2. Aggregate:
   a. Course: ASTM C33-71 with maximum size of 1 ¼".
   b. Fine: ASTM C33-71.
3. Water: Fresh, clean, potable and not detrimental to concrete.
4. Admixtures:
   a. Air Entrainment: Conform to ASTM C260 and ASTM C173 or C231 with 5% to 7% air entrainment.
   b. Other: Not allowed without prior approval from the Designer.
5. Curing Compound: Conform to ASTM C319. Free from petroleum resins or waxes. Formulated for sealing, surface hardening, and curing concrete.

2.4 CONDUIT

A. All conduit installed in-ground between handholes shall be PVC or approved equal, meeting or exceeding ASTM F512 and D1784, and D1785 standards.

1. Rigid Non-Metallic Conduit (RNC):
   a. Conduit installed under paved roadways must be Schedule 80 PVC to prevent crushing over time from heavy vehicles and equipment. All other conduit installed off-road shall be Schedule 40 PVC.
   b. Conduit must be gray or orange in color. Other colors will not be accepted.
2. Fittings:
   c. Sweeps: The minimum radius for all conduit between pulling points shall be ten times its diameter. HDPE elbows shall have a minimum radius of 36".
   d. End Caps (Plugs): Pre-manufactured and watertight. Tape is not an acceptable end cap or cover.
3. Traceable Pull Tape/Rope (e.g. "mule tape"): 3/4 inch, pre-lubricated, traceable/detectable, 100% polyester, with a minimum tensile strength of 1800 pounds. Tracer wire must be woven into the pull tape, have a minimum wire size of 22 AWG, and be coated to prevent corrosion. Smaller light-

duty polypropylene and/or nylon pull strings are not acceptable.

4. Warning Tape: 3" wide, detectable metallic warning tape labeled "Communications", or similar. Tape must have the industry standard color of AWPA Orange. Warning tape shall ideally be placed underground at an equal distance between the top of the conduit and grade level.

2.5 UNDERGROUND SPACES

A. Non-traffic-rated handholes:
   1. Cover and Body Material: FRP/Composite. Polypropylene or other light-duty material handholes are too susceptible to damage over time and will not be accepted.
   2. Spec: Oldcastle Fiberlyte FL30 or similar (13"L x 24"W x 18"D or similar size)
   3. Load Rating/Performance: Medium duty. Must meet or exceed SCTE Tier 8 load rating, able to withstand incidental traffic from light trucks or machinery.

B. Traffic-rated handholes:
   1. Cover and Body Material: FRP/Composite or Polymer Concrete. Steel lid optional.
   2. Spec: Oldcastle Duralite 1118 or equivalent (14"Wx21"Lx18"D or similar size)
   3. Load Rating/Performance: Heavy Duty, Traffic Rated, ANSI/SCTE-77, Tier 22. Must be able to withstand vehicles and heavy equipment traffic driving over, or parking on top of, the handhole.

2.6 LABELS

A. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

2.7 ASPHALT (applies only to projects allowing asphalt roadway cuts and repairs)

A. The HMA mix design must comply with Sections 9-03.8(2) and 9-03.8(6) of the Washington State Department of Transportation Standard Specifications (most recent edition).

B. All materials must comply with Sections 5-04.2 of the Washington State Department of Transportation Standard Specifications (most recent edition).

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

D. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Government.

E. Remove surplus materials and debris from the job site and dispose of legally.

3.2 EXCAVATION, TRENCHING AND FILL

A. Opening and Re-closing Pavement, Road Shoulders, Landscaped Areas and Lawns:

1. Size cuts only as large as required for Work to be accomplished.
2. Patch or replace using materials to match those removed.
3. Ensure that patches are level and thoroughly bonded with the original surfaces.

B. Excavation:

1. Do not excavate when the outside temperature is less than 35° F or when there is standing water or snow on the subgrade.
2. Where crossing of concrete or asphalt is required, saw cut and remove surface material prior to excavating. Remove concrete in complete sections from control joint to control joint regardless of the width of the excavation. Restore concrete and asphalt surfaces following excavation to match existing depth, strength, color and type of material.
3. Maintain adequate separation between the excavation and adjacent underground utilities.
4. Protect excavations at the end of the work shift. Cover with steel sheets and barricade prior to leaving the job site, in accordance with all applicable rules, regulations, building codes, and ordinances. Before resuming work, inspect trenches and remove/relocate any amphibians trapped in the trenches.
5. Install, operate and maintain pump or dewatering equipment as necessary to prevent water from accumulating in the excavation.
6. Excavation Depth/Width:
    a. For MH/HH: Excavate to a sufficient depth to install the overall assembled height of the vault plus the added height of any risers, covers, and bedding material consisting of a minimum 4”-12” of base. Excavate to a sufficient width to provide a minimum of 4” clearance around each side of the MH/HH.
    b. For trenches: Excavate to a sufficient depth to provide a minimum of 22” cover over the conduit and to allow for the proper alignment of conduit into the MN/HH. Excavate to a sufficient width to provide a minimum of 6” to each side of the conduit.
7. Over-excavate, fill, and compact any soft spots in the subgrade.
8. Run trench excavation true and as straight as possible. Clear trenches of stones and soft spots.

C. Fill:

1. Drain and/or pump groundwater and surface water from the recipient area prior to the

placement of fill.

2. Do not place frozen fill.
3. Base: Level the subgrade base using sand for trenches and gravel for MH/HH as necessary to form an even base.
4. Bedding: Do not exceed 4” depth of bedding lifts/layers before compacting.
5. Backfill: Do not exceed 6” depth of backfill lifts/layers before compacting.
6. Compaction: Compact using a vibratory plate or roller or other mechanical device. Compaction through jetting and/or pounding is not acceptable.
    a. Bedding: Compact material to a dense state equaling at least 95% of the maximum dry density per ASTM D1557.
    b. Backfill: Compact material up to two (2) feet below the finished grade with a minimum relative compaction of 90% of the maximum dry density per ASTM D1557.

D. Waste Disposal: Remove excavation materials and other construction debris from the site in a timely manner and dispose of legally.

3.3 CAST-IN-PLACE CONCRETE

A. Construct concrete in accordance with the appliable portions of the specifications, standards, codes and regulations (latest editions and/or amendments) listed in the References portion of this section.

B. Formwork:

1. Construction:
    a. Forms: Use the most advantageous panel sizes and panel joint locations. Neat patches and minor surface imperfections will be permitted. Form surfaces in true planes within ¼” in 10 feet. Clean forms and remove debris prior to pouring concrete. Make braces unyielding and tight to prevent leakage. Maintain formwork construction tolerances complying with ACI 347. Formwork shall be readily removable without impact, shock, or damage to concrete surfaces and adjacent materials. Use chamfer strips fabricated to produce uniform smooth lines and tight edge joints for exposed corners and edges.
    b. Reinforcement: Construct reinforcement in accordance with ACI SP-6. Weld reinforcement in accordance with ANSI/AWS D1.4 or ANSI/AWS D12.1. Accurately position, support, and secure reinforcement against displacement. Support reinforcement by metal/plastic chairs, runners, bolsters, spacers, hangers, or other incidental materials as required.
    c. Where metal or plywood forms are used, coat the forms with a form release agent prior to placement of concrete. Coat faces and edges of forms applied at a rate of 500 to 550 square feet per unit.
    d. Curved Surfaces: Use only curved forms for constructing curved structures and surfaces.
2. Slope: For flatwork, construct forms with a 1% side slope to both south and east sides.
3. Joints:
    a. Control: Build into form.
    b. Expansion: Build expansion joints into the form, pre-molded ½” thick, and conforming to ASTM D1751. Seal the top ½” of expansion joints with an approved joint sealer.
4. Removal: Remove forms after concrete has cured for 7 days or after concrete has attained a compressive strength of 4,000 psi.

C. Concrete:

1. Transport: Comply with ACI 304. Transport concrete from the mixer to the construction location via methods preventing separation of materials.
2. Application:
   a. Prior to placement, inspect and complete formwork construction, reinforcement, and items to be embedded or cast-in.
   b. Deposit concrete in forms in layers not deeper than 24" and in a manner to avoid inclined construction joints.
   c. Deposit concrete in a plastic condition and uniformly work around reinforcements.
   d. Consolidate concrete using internal machine vibration (stinger) during pouring.
   e. Once concrete work has commenced, work continuously until the work segment and/or section has been completed.
   f. Cold Weather: Protect concrete from damage caused by frost, freezing, or low temperatures in compliance with ACI 306R. When temperature is below 40° F, heat water and aggregates before mixing to obtain a concrete mixture of not less than 50° F and not more than 80° F.
3. Curing:
   a. Curing method and rate of application shall be according to manufacturer's recommendations.
   b. Protect concrete from premature drying, rain, excessive temperatures, and mechanical injury during the curing period.
   c. Cure concrete for 7 days in accordance with ACI 301 and keep continuously moist during this time. Maintain concrete temperature between 50° and 90° F during the curing period.
   d. Provide curing and sealing compound to exposed slabs, sidewalks, curbs, etc. as soon as final finishing operations are complete (within 2 hours). Re-coat areas subject to heavy rainfall within 3 hours of the initial application.
4. Finish:
   a. Consolidate, level and screen surfaces for evenness and uniformity. Remove excess concrete. Fill low spots. Float the surface after water sheen has disappeared from surface.
   b. Finish flatwork with a special tool to match patterned finish of adjacent existing concrete.
   c. Tool edges, control, and expansion joints to make finish work straight and even.
5. Protection for exposed concrete: Cover exposed concrete (i.e. sidewalk, driveway, etc.) with plywood, weighted with concrete blocks or similar heavy object in order to prevent surface damage.

3.4 CONDUITS

A. Sweeps:

1. Shallow curves comprised of continuous lengths of individual straight RNC conduit are permissible with a minimum sweep radius of 40 feet.
2. Where the conduit sweep radius is less than 40 feet, sweeps shall be factory-manufactured bends with a minimum of 48-inch radius.
3. Do not exceed 90 degrees for an individual sweep.
4. A conduit section shall have not more than the equivalent of two 90-degree sweeps (a total of 180 degrees) between pull points. The 180-degree maximum shall include kicks

and offsets. Where it is not possible to construct a section of conduit within the 180-degree sweep maximum, an intermediate MH/HH shall be installed.

5. Two 90-degree sweeps separated by less than 10 feet is not permissible.

B. Fittings:

1. Cut conduit ends square and ream to remove burrs and sharp ends. Extend conduits the maximum distance into fittings, couplings, and/or connectors. Tighten fittings securely and seal watertight.
2. End Caps (Plugs): Provide end caps on conduit ends throughout construction to prevent the intrusion of water or debris. Install end caps on conduit that is not directly being worked on during the workday and on conduits at night. Leave end caps in place upon final completion of the work.
3. End Bells: Provide end bells for terminating conduit in maintenance holes. Install protective end bells on conduits flush with maintenance holes.

C. Sealing: Apply solvent-type cement (for RNC) to make conduit connections waterproof. Seal and ground termination in maintenance holes to ensure that voids in the joints are filled. Seal conduit terminations in buildings until used for cable.

D. Warning Tape: Install magnetic detectable warning tape half the distance between the top of the conduit and finished grade.

E. Cleaning: After installation, and within five days prior to releasing conduit for cabling installation, clean each conduit with a wire brush and swab. Clean each conduit a minimum of two times in the same direction and swab with clean rags until the rag comes out of the conduit clean and dry.

F. Pull Tape/Ropes: Install in each conduit immediately after the conduit has been cleaned. Leave a minimum of 10 feet looped and tied off at each end of the conduit. The pull tape/rope used for the purpose of pulling the cable may be non-traceable/detectable, however the pull tape/rope that will be pulled in along with the cable (that will permanently remain in the conduit) must be traceable/detectable.

3.5 UNDERGROUND SPACES

A. Provide maintenance holes and handholes in the sizes and locations shown on the drawings.

B. Precast maintenance holes shall be free from damaged joint surfaces, cracks, or other damage that would permit infiltration. Repair of defects is not acceptable.

C. Install maintenance holes according to manufacturer's instructions.

D. Maintenance Hole Covers: Install maintenance holes to maintain top of cover 1" above the existing ground line or finished grade. Taper pavement surfaces up to the top of the maintenance cover. Covers and frames shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks and other defects. Mating surfaces between covers and frames shall be machine-finished to ensure a non-rocking fit.

E. Setting and Placement: Remove water from excavation and properly install bedding material prior to setting the maintenance hole.

1. Set maintenance hole in place by lowering each section into the excavation, ensuring that the section is level, plumb, and firmly positioned, and ensuring that the section gasket/seal is properly installed and watertight prior to setting the next section.
2. Carefully set the maintenance hole to ensure that the rim or lid elevation is set one inch above finished grade. For vaults located in paved areas, taper pavement up the maintenance hole rim.

F. Knockouts: Open conduit entry knockouts with care. Preserve intact the conduit entry knockouts that are not intended for current use.

G. Grouting: Apply grout in a manner to ensure filling of voids in the joints being sealed. Apply grouting to conduit entrances, risers, and covers in addition to any other voids.

H. Racking and Hardware: Install racking and hardware and incidental materials. Provide one (1) cable rack per maintenance hole. Provide additional incidental hardware for mounting racks and cable support arms.

I. Cleaning: Clean and dry the maintenance hole after construction activity is complete and prior to releasing the maintenance hole to the Government for Government's use.

3.6 ASPHALT

A. Examination:

1. Verify existing conditions before starting work.
2. Verify compacted subgrade is dry and ready to support paving and imposed loads.
3. Verify gradients and elevations of base are correct.

B. Subbase:

1. Prepare aggregate in accordance with Section 2-06 of the most recent edition of the Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications for Road Bridge and Municipal Construction.
2. In areas used for vehicular access during phased construction, maintain and restore aggregate base as required to meet specified requirements.

C. Preparation:

1. Protect surrounding areas and surfaces to preclude damage from work of this section.
2. Where new pavement is to abut existing pavement, sawcut existing pavement to provide a neat and straight edge at joint.
3. Level and compact subbase that may have been used for temporary driving surface. Provide and compact additional material as required to prepare subbase as required.

D. Compaction:

1. Crushed Surfacing: Immediately following spreading and final shaping, each layer or surfacing shall be compacted to at least 95% of maximum density as determined by the requirements of Section 2-03.3(14)D of the most recent edition of the Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications for Road Bridge and Municipal Construction
2. HMA: For general compaction the contractor shall comply with the General Compaction Requirements in Section 5-04.3(10)A of the most recent edition of the Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications for Road Bridge and Municipal Construction.

E. Construction:

1. Road cut must be a full grind to 3", clean and tack surface.
2. Apply 1/2" Hot-Mix Asphalt (HMA) in a three-inch lift. Must be field verified with Contracting Officer's Representative on-site prior to completion of asphalt work.
3. All hot mix asphalt shall be placed at temperatures between 215 and 325 degrees F with a self-propelled laydown machine.
4. Final surface applications shall be rolled or compacted with equipment sufficient to achieve compaction results in compliance with WSDOT standard construction specifications.
5. Crack sealing of the joint is required to prevent water and debris entry in the joints.
6. Longitudinal bituminous joints shall be vertical and properly tack coated if cold. Transverse joints shall always be tack coated.
7. For longitudinal/transverse Joints, keep elevation difference at joints less than 0.25 inches.
8.

F. Asphalt Application:

1. Work shall be completed in a manner to create a desired slope to follow drainage patterns.
2. Contractor shall be responsible for maintaining a smooth surface following the slope of the existing road after compacting the road base compaction fill material to 95%, then applying 3-inch compacted lift of Asphalt.
3. All work shall be in accordance with Standard Specifications for Construction, Washington State Department of Transportation (WSDOT) and as amended in this specification.
4. Contractor shall be responsible for containment and/or cleanup of any spilled materials.

G. Protection of Finished Work: Immediately after placement, protect pavement from mechanical injury and do not permit traffic until surface temperature is less than 140 degrees F, and in no case sooner than six hours after placing or per Washington State Department of Transportation Standard Specifications, whichever is more stringent.

3.7 RESTORATION REQUIREMENTS

A. Contractor shall repair all grounds and property to pre-construction condition using materials of same or better type or quality. This includes, but is not limited to, repaving, reseeding, walls, fences, landscaping, utilities, signs, painting, curbing, etc. All Bituminous materials should be used where necessary for roads, parking areas, and footpaths. Restoration shall follow the original construction drawings, documentation, and visual observation to match the existing conditions.

END OF SECTION

SECTION 27 13 23

OPTICAL FIBER CABLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work of this Section consists of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of horizontal optical fiber infrastructure as described on the drawings and/or required by these specifications.

1. Installation of fiber optic cable, conduit, and vaults per the description in Division 01, Part 1, and the maps and drawings included in the appendix of this document.
2. Contractor shall be responsible for providing and installing ground and bonding materials, duct plugs, and fire stopping materials as required completing the installation.
3. Other incidental hardware and appliances, necessary for the proper performance and operation of the communication cable system, which are consistent with the practices of cable installation, are to be provided by the Contractor as required to complete the installation.
4. Contractor is responsible for any damage to any known utilities caused during construction. In any area where a utility has been located, work activity must be verified through potholing.

1.2 REFERENCES

A. Design, install and test data distribution systems per manufacturer's requirements and in accordance with NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and industry standards and practices, including but not limited to the following:

1. ANSI/TIA/568-C.3, Optical Fiber Cabling Components Standard

1.3 QUALITY ASSURANCE

A. Provide electronic test results and a 20-year manufacturer's warranty upon completion of work.

1.4 SUBMITTALS

A. A. Submit Product Data:

1. Fiber optic cable (per required counts and specifications)

B. Submit Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Submit proof of optical fiber cable technician certification and record of experience.

1.5 OPTICAL FIBER OPTIC SYSTEM DESCRIPTION

A. This project is only for the installation of infrastructure and cable and does not include the termination of connectors or placement of ODF or other fiber patch panel hardware.

B. Refer to Division 01, Part 1, Section B for fiber optic cable count requirements. See Part 4 of this division for fiber optic cable specifications.

C. All cables shall be tested for defects in installation and to verify cable performance under installed conditions. Since none of the fibers will be terminated under this project, a total of 3 fibers of each installed cable shall be temporarily spliced and spot-verified as usable prior to system acceptance. Any detected defect in the cabling system installation shall be repaired or replaced at the contractor's expense to ensure usable fibers in all installed cables.

PART 4 – PRODUCTS

4.1 GENERAL

A. The following manufacturer's warranted systems are approved unless otherwise specified:

1. Corning, Inc.
2. Prysmian Group (General Cable)
3. CommScope
4. AFL Global (Fujikura)
5. OFS Optics (Furukawa Electric)
6. Superior Essex Communications
7. Eaton (Tripp-Lite)
8. Panduit

4.2 FIBER OPTIC CABLE

A. All fiber optic cable shall be single mode (OS2) optical fibers, 9/125 micron, dual window, water blocked, meeting the requirements of ITU-T G.652.D.

B. Single Mode Optical Fiber Specification

1. Loose tube, gel-free, all-dielectric design (no metallic component) requiring no grounding or bonding during installation or splicing
2. Attenuation (maximum): 0.35dB/km @ 1310 nm; 0.25dB/km @ 1550 nm
3. Short term tensile strength shall be a minimum of 2669N (600 lbf). Long term tensile strength shall be a minimum of 800N (180 lbf). Tensile strength shall be achieved using a fiberglass reinforced plastic (FRP) central member and / or aramid yarns.

B. Mechanical Construction: Jacketed fiber optic cable for duct/conduit installation shall include a central strength member (or approved equivalent), water-swellable tape, buffer tubes/fibers, ripcord, high tensile strength, all-dielectric cable, UV-stabilized polyethylene jacket, or equivalent.

C. The individual fibers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, "Optical Fiber Cable Color Coding." The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

D. Markings shall include the manufacturer's name, year of manufacture, the number of fibers, the words "OPTICAL CABLE", and sequential length marks.

PART 5 – EXECUTION

5.1 OPTICAL FIBER INSTALLATION

A. General

1. Contractor shall install all materials plumb, square, and in a workman-like manner.
2. Contractor shall supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc. as customary for the craft and necessary for the installation.
3. Contractor shall verify space requirements and locations with the Contracting Officer or COR before starting cable installations.
4. Contractor shall verify the cable type and jacket rating required for use before starting the fiber installation.
5. All fiber cables shall be installed by technicians trained and experienced in the installation and termination of fiber cables.

B. Field Conditions

1. Contractor shall conduct field inspection to coordinate, verify and/or determine the actual as-built locations of existing facilities and utilities that affect the installation, prior to commencing the installation in any area.
2. All underground structures including conduit, handholes, and related fixtures shall be kept as clean as possible during installation. Labor required for any cleaning work shall be included in the proposal and provided by the Contractor.

C. Pre-Cable Installation

1. Contractor shall verify part numbers and footages on cable reel shipping labels, bills of lading, invoices, etc., to compare to the original order upon receipt and before installation.
2. Contractor shall inspect fiber optic cable reels for damage upon receipt from the shipper and verify the receipt of the specified product before installation.
3. Contractor shall retain the manufacturer's test data and provide it, along with all other specified test documentation, as part of closeout documentation.
4. All cable that does not meet the project specifications or is not approved by the Contracting Officer shall be removed and replaced at the Contractor's expense.

D. Optical Fiber Installation

1. Install cables in accordance with manufacturer's approved installation methods, procedures and instructions to ensure warranty compliance.

5.2 FIBER OPTIC CABLE TESTING

A. General

1. Notify Contracting Officer / COR 48 hours in advance when work, technicians, and equipment are prepared for acceptance tests and inspections.
2. Provide technicians who are trained and certified in the use of the test equipment used for testing operations.
3. Maintain test equipment to manufacturer's requirements, and ensure that all equipment is calibrated according to the manufacturer's requirements.
4. Testing shall be in accordance with ANSI/ICEA S-87-640, Telcordia GR-20, RDUP PE- 90.

B. Testing

1. At a minimum, link attenuation measurements shall be made on all intra-building fiber backbone cables, and Optical Time Domain Reflectometer (OTDR) traces will be required where fiber cables have been terminated.
2. The single-mode fiber optic cables shall be tested in one direction at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A, Method A, One-cord reference method. Acceptable loss limits shall be based on the following link attenuation equation:
    1. Cable Attn (dB) = Attenuation Coefficient (dB/km) * Length (km)
    2. Attenuation Coefficient = 0.50 dB/km for single-mode indoor-outdoor cable
    3. Attenuation Coefficient = 0.40 dB/km for single mode outside plant cable
    4. Connector Loss (dB) = number of connector pairs * connector loss (dB)
2. The fiber optic cables shall be tested utilizing a power meter and stabilized light source capable of testing at 1310nm and 1550nm for single mode. Contractor shall complete a fiber optic post installation report at the time of testing containing meter readings at 1310nm and 1550nm for single-mode in one direction on each fiber, actual loss and other pertinent data regarding the cables tested, including model and serial number of test equipment, cable part #, installed fiber length, building span loss at 1310nm and 1550nm for single-mode, and date tested.
3. Acceptable attenuation shall be calculated based upon connector, type, and optical fiber length and shall comply with TIA/EIA 526. Attenuation shall not exceed the specified parameters established by the manufacturer and the requirements of this section.
4. The total optical fiber segment performance shall not exceed the summation of all the manufacturers components specified performance parameters (Loss Budget).
5. Test all inter-building optical fiber segments using an OTDR with launch and receiving cables on each end during each test operation.
6. All optical fiber testing shall utilize the manufacturers specified and approved test jumpers and adapters.
7. Optical fiber cable that is left un-terminated at both ends shall be tested using a launch cable and bare fiber adapter.
8. Fiber optic cable that is left un-terminated at one end shall be tested at the connector end using an OTDR.

5.3 SYSTEM WARRANTY

A. Contractor shall provide a 20-year minimum extended manufacturer's warranty in addition to the contractor's warranty provided to the project. The umbrella warranty provided for the optical fiber backbone cabling system shall be issued by the manufacturer of the cabling system.

END OF SECTION