E-RATE 470 FIBER OPTIC CABLE INFRASTRUCTURE

Hillsboro School District 1J

Request for Proposals (RFP) – RFP # - TS2018-01
Solicitation to provide a fiber optic network in support of Hillsboro School District facilities
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OVERVIEW

Hillsboro School District 1J (hereinafter referred to as (“HSD” or “District”)) is seeking proposals for the upcoming round of E-Rate funding. The E-Rate Year 2018 will commence July 1, 2018 and end June 30, 2019 (or beyond for multiyear contracts).

HSD seeks a quality vendor with experience in multi-site fiber optic installations, and capabilities to provide responsive service for the installed fiber optic cable. As such, HSD is soliciting proposals for purchasing and installation of fiber optic cabling to provide connectivity between and among all of their facilities. The intent of this RFP is to secure pricing for the purchase of a fiber optic Wide Area Network (WAN) as well as a maintenance contract with renewal every year in compliance with the requirements of the Universal Services Administrative Company (USAC), School and Library E-Rate program. Each facility designated in this RFP shall be provided a network connection capable of an entry level speed of 10Gbps with eventual connectivity speeds limited only by HSD installed edge device at each location.

Basic architecture and connection points are further defined later in this document as Attachment B and the associated project drawings are included with this RFP as Attachment C.

All work pursuant to this RFP shall be contingent upon funding from the Schools and Libraries Universal Service Administration (E-Rate). In the event of lack of funding, District may, or may not, accept all or parts of the bid proposal, at the discretion of HSD.

All bids must comply with all sections of this RFP and the products and services to be considered. All bidding vendors must be e-rate eligible and file an FCC Form 499A to provide the services requested and provide their SPIN number as part of this RFP.

Should your company wish to respond, please follow these directions:

All items are to be bid as shown on accompanying specifications but may exceed minimal specifications. Once bid, no substitutions will be allowed except in the case of updated editions.

Bids should be itemized and all inclusive with any delivery, installation and labor charges. Items that are not e-rate eligible must be clearly separated out from items that are E-Rate eligible.

All the sites listed in the appendix are identified as being eligible or ineligible for E-Rate funding.

Bids are expected to be firm quotations and should not be presented as estimates. Any deviations from the bid price accepted by HSD will take an approved change order.

All deliveries are to be made between the hours of 8:00am and 4:00pm, Monday through Friday, except on holidays. All items shall be properly crated or packaged by the supplier to ensure delivery in good condition. All freight and delivery charges shall be paid by the vendor and included in the bid price. The vendor shall, at his own expense, amend and make good any defective or unsatisfactory items.

A vendor meeting will be conducted Monday, February 12, 2018 at 1:00 PM (PST) for any vendors who wish to bid on this project. The meeting will be in the Technology Services Conference Room (TSCR) at the District Administration Center, 3083 Northeast 49th Place, Hillsboro, Oregon 97124.

Sign-in will be held at the reception desk in the lobby and will begin 15 minutes prior to start of meeting.

Vendors should be prepared to take photos, measure distances, and record any other data that may be required for their proposal at this time. Additional time for site visits will be February 19th – February 23rd, 2018 between the hours of 9:00 am and 3:00 pm. All such site visits will require check-in and check-out at the main office at each facility. Schools will be in session during these times and vendors are requested to be as unobtrusive as possible and refrain from any interaction whatsoever with students.

All vendors must meet or exceed the Vendor Qualifications and provide a Vendor Profile as indicated in this document.
OBTAINING SPECIFICATIONS
Specifications and bidding documents for this project are available online. The URL is:  
https://www.hsd.k12.or.us/Page/830

SUBMISSION TIME AND DATE
Proposals are due online by 2:00 p.m., local time on March 5th, 2018. Proposers are cautioned to allow sufficient time for transmission of their submittals.

OPENING OF PROPOSALS
Proposal opening to be 15 minutes after the close time. Only the names of firm submitting a response will be made public. All other information will remain sealed from the public until after evaluation. The opening will be held at the District Administration Center, 3083 Northeast 49th Place, Hillsboro, Oregon 97124.

QUESTIONS
Questions should be addressed, no later than 3:00 pm February 23rd, 2018 to:

Don Wolff,
Wolfdd@hsd.k12.or.us
Subject Line: RFP - #TS2018-01

Questions and Answers will be posted as an addendum on the web sited not later than 12:00 pm February 26th, 2018.

GOALS
- Provide 100% fiber optic based connectivity between District facilities.
- Provide a scalable network infrastructure capable of supporting HSD’s future needs.
- Determine the most cost-effective network infrastructure solution to meet the current and future needs of the school district.

E-RATE ELIGIBILITY AND FUNDING DISCLAIMER
Hillsboro School District has opted to pursue this effort under a new E-Rate criteria known as “Self-Construction of High Speed Broadband Networks” This is also known as self-provisioned fiber and is now eligible under Category 1 E-Rate funding. A RFP (this document) must be issued along with posting a Form 470, seeking proposals for both lit fiber and self-provisioned fiber service. If construction and ownership of dark fiber facilities is found to be most cost-effective, E-rate will fund the project beginning in July of 2018.

Solicitations for Leased Lit and Leased Dark fiber are being sought under a separate RFP.

If you are the successful Contractor, you will need to file a FCC Form 474 Service Provider Invoice (SPI) to be reimbursed by the Schools and Libraries Division (SLD) of the Universal Service Administrative Company (USAC) for the discounted portion of the costs of service. This must take place after USAC has committed to reimburse the discounted portion of the cost of eligible services provided to eligible entities pursuant to one or more FCC Forms 471, “Description of Services Ordered and Certification Form”, Hillsboro School District has filed a FCC Form 486, “Receipt of Service Confirmation and Children’s Internet Protection Act and Technology Plan Certification Form” and has paid the non-discounted portion of the cost for services. The successful contractor must also perform work in a manner that results in completed circuits. Per E-rate rules, self-provisioned fiber must be lit before funding for any work performed may be received from USAC.

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Except as noted in the bid documents, the District expects to receive E-Rate funding for this entire project. Funding is typically granted for a “Funding Year”, specifically, the next Funding Year begins July 1, 2018 and continues through June 30, 2019. While extensions may be granted, SLD may opt to satisfy their portion of the invoicing of this project only through the end of the current Funding Year. As such, E-Rate funding for this project may be terminated prior to completion pending extension or renewal efforts on behalf of Hillsboro School District. In the event an extension is not granted, the project will end in place.

Due to this potential cessation of E-Rate funding it is imperative that the successful contractor maintain exacting control of the project expenditures and invoice with precise amounts to make sure all current activities are covered. Work ahead with the expectation of payment beyond the current Funding Year may result in non-payment by SLD or Hillsboro School District.

**WAN MIGRATION STRATEGY**

The new fiber optic cable and all associated infrastructure as detailed in this RFP will be in addition to existing connections. System outages will not be required rather, each of the project sites will remain fully operational throughout the project duration. Only after complete installation and operational testing will HSD undertake the dismantling of the current network environment and cancel circuits providing connectivity.

**ASSUMPTIONS**

**Franchise Agreement**

The District will enter into negotiations with the City of Hillsboro to obtain an intergovernmental agreement that grants the District non-exclusive right to occupy and use of the City’s rights-of-way. The District realizes and understands that such agreement must be in place prior to Contractor soliciting permits (on behalf of the District) to begin work within the City limits of Hillsboro.

**Jurisdiction and management of other rights-of-way**

This project encompasses multiple jurisdictions. With the exception of the City of Hillsboro, where a franchise agreement will be negotiated, it is believed that construction permitting will suffice to allow placement of fiber for the sole purpose of connectivity to District facilities. This contract shall be responsible for all such permitting and necessary coordination. Language governing permits, construction standards and access to right-of-ways for the cities of Cornelius, Hillsboro, and North Plains are included as attachments to this document.
PGE Pole Permitting

Portland General Electric (PGE) retains ownership or attachment rights to the majority of the utility poles within the scope of this project. Their permitting process is time consuming. The successful contractor shall be responsible for acquiring permits from PGE for pole attachment. In the event such permitting is not forthcoming, the contractor shall have a contingency to employ directional boring to bypass certain poles to maintain project schedule to complete within the timeframe allocated by USAC for funding. Extension of USAC funding is not guaranteed on the basis of construction delays caused by PGE permitting process.

VENDOR QUALIFICATIONS AND CONTRACTOR REQUIREMENTS:

- It is understood that, except as otherwise specifically stated in this RFP, the Vendor shall provide and pay for all materials, labor, tools, equipment, transportation, temporary construction of every nature and all other services and facilities of every nature whatsoever, necessary to execute, complete and deliver the work within the specified time. Licenses necessary for the execution of the work shall be secured and paid for by the Vendor.
- Be a registered service provider with the Schools and Libraries Division (SLD) of the Federal Communications Commission (FCC), have a Service Provider Identification Number (SPIN) and comply with all SLD service provider requirements.
- In the event of questions during the E-Rate audit process, the selected bidder is expected to reply within three (3) days to questions associated with that bidder’s proposal.
- The vendor will be required to send copies of all forms and invoices to be submitted to SLD to HSD for its records prior to invoicing the SLD.
- Assist HSD in completing the Form 471 Item 21 data.
- The Form 471 Item 21 data will be constructed per the instructions on the SLD web page. The bidder shall include the appropriate information as shown on the web page, including the phrase "Form 471 item 21 Data," HSD name and address, BEN#, 144885, the assigned E-Rate FRN # for this RFP, and attachment #(s).
- Comply with the competitive bidding requirements of the SLD for Universal Service Fund services and support, along with state and local bid laws.
- Be able to provide at least five references from customers with similar projects.
- Have a minimum of five years of experience in the area of expertise of this RFP.
- Have highly-qualified network engineers and technicians on staff.
- Provide information regarding availability of (on-site) technical support. Vendors must have a maximum travel time of 3 hours to Hillsboro School District and must be available upon request.

Note: Failure to comply with all the above may result in disqualification of the bidder

PROPRIETARY MATERIAL

HSD will attempt to protect legitimate trade secrets of any vendor. Examples of such information would be unpublished descriptions of proprietary aspects of the systems proposed. Any proprietary information contained in the proposal must be designated clearly and should be separately bound and labeled with the words "Proprietary Information." Marking the entire proposal proprietary may result in the rejection of the proposal.
Vendors should be aware that HSD is required by law to make its records available for public inspection, with certain exceptions. It is HSD's belief that this legal obligation would not require the disclosure of proprietary, descriptive literature that contains valuable designs, drawings, or documentation. However, the vendor, by submission of materials marked "Proprietary Information," acknowledges and agrees that HSD will have no obligation or liability to the vendor in the event that either must disclose these materials.

**PROPOSAL DISPOSITION**

All materials submitted in response to this RFP shall become the property of HSD.

**SCHEDULE OF EVENTS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue RFP</td>
<td></td>
<td>February 5, 2018</td>
</tr>
<tr>
<td>Pre-Bid visit of 3 Facilities</td>
<td>1:00 PM, TS Conference Room AC</td>
<td>February 12, 2018</td>
</tr>
<tr>
<td>- Site visits continue - Contractors must check in with Main Office and receive visitor’s pass</td>
<td>9:00 AM - 3:00 PM</td>
<td>February 13 - 23rd, 2018</td>
</tr>
<tr>
<td>Questions due to District</td>
<td>3:00 PM</td>
<td>February 23, 2018</td>
</tr>
<tr>
<td>Question response(s) to bidders</td>
<td>12:00 PM</td>
<td>February 26, 2018</td>
</tr>
<tr>
<td>RFP due</td>
<td>2:00 PM</td>
<td>March 5, 2018</td>
</tr>
<tr>
<td>RFP Opening</td>
<td>2:15 PM</td>
<td>March 5, 2018</td>
</tr>
<tr>
<td>Board approval of RFP Award</td>
<td>7:00 PM</td>
<td>March 13, 2018</td>
</tr>
<tr>
<td>Award (on or about)</td>
<td>5:00 PM</td>
<td>March 14, 2018</td>
</tr>
<tr>
<td>Last day of school (K-11)</td>
<td>3:00 PM</td>
<td>June 15, 2018</td>
</tr>
</tbody>
</table>
| School starts, 2018-19 school year                        |                           | September 04, 2018
CONTRACTOR RESPONSIBILITY
The selected contractor shall be responsible for:

- Determining the most cost-effective and reliable route for the fiber from termination point A to termination point B. If possible, routes should stay within the public right-of-way. If a longer or more expensive route is chosen for reasons of reliability, the Contractor should document the rationale. The Contractor must describe the route of the fiber, by segment, in detail. Every known impediment to construction or use of the fiber must be clearly documented. In general, fiber must be installed using the most obvious method (aerial, direct buried, underground, etc.). However, if, in the Contractor’s judgment, HSD would be better served by using a different method in a specific segment of the route, the Contractor should specify that method and provide a rationale. The Contractor should also take advantage of value engineering opportunities, e.g., “share the trench” or “share the duct” opportunities for part or all of a fiber’s route, future risk mitigation to the fiber cable facility, permit or right-of-way issue mitigations, or more efficient approaches to HSD’s network design. Any and all engineering fees and make-ready fees must be included in the fixed-price bid.

- While HSD realizes it may be difficult for a prospective Contractor to estimate these cost-effective methods, E-rate filing time constraints do not permit a serial approach (i.e., an initial RFP for route engineering, then a second RFP for installation).

- Final design of pathways and optical fiber routing – while every effort has been made to accurately portray the conditions of each facility, this contract shall be responsible for vetting and verification of all conditions that will impact this project. The Drawings accompanying this bid package are diagrammatic. They do not show every component of a complete fiber optic distribution system which may be required to accommodate unique building construction features or materials installed by other trades. The Drawings are to be followed as closely as practical while making necessary adjustments in the placement of cable to facilitate the overall construction of the fiber optic pathway without additional cost to HSD. The right is reserved to make any reasonable changes in prior to roughing-in pathways if such is in the best interest of HSD.

- Installation of optical fiber cabling to existing facilities – all facilities so noted in Attachment A require fiber optic connectivity. Where existing pathway is not useable, this contract shall be responsible for all construction required to place fiber between existing utility right-of-way and the existing point of demarcation within each facility. Such construction shall be permitted and completed in a manner that satisfies the Authority Having Jurisdiction. All HSD as-built drawings will be updated.

- Shared or contiguous properties may allow economies-of-scale as well as potential joint use with existing pathway where inter-governmental agreements are in place facilitating such use.

- Negotiate on behalf of HSD – Contractor shall be responsible securing all necessary right-of-way and access permits and agreements required to complete this project to include:
  - space and use agreements with public utilities to secure perpetual and uninterrupted use of necessary poles with no reoccurring cost to District
  - crossings to include roads, highways, railroads, and bodies of water
  - duct and conduit systems
  - All other such pathway required to place fiber optic cable to each of the facilities referenced in these documents. All such agreements are subject to District approval.
Coordination responsibility of this contract covers multiple entities acting as AHJ, including but not limited to:

- City of Cornelius
- City of Hillsboro
- City of North Plains
- Washington County
- Oregon Department of Transportation (ODOT)

- **Facility coordination** – Contractor shall be responsible for coordinating access with HSD manager of construction and maintenance services to the project facilities for all construction activities to take place at the project sites. Contractor shall be responsible for the performance and conduct of all sub-contractors and will assume all fiduciary responsibility for the entire project through closeout and completion activities.

- **Safety, security and traffic control** – Contractor is responsible for providing necessary construction barriers and safety measures to ensure the safety of all project stakeholders including but not limited to contractor staff, District staff, students, vendors, parents and any other individuals and property that is located on or near project sites.

- **Restoration of site** – Contractor shall restore all landscape, roadways, and hard surfaces with like materials and match the adjacent surface style and texture. Temporary patching of hard surfaces subject to pedestrian or vehicle traffic shall be completed within 24 hours of surface being cut or such area shall be barricaded in a manner that precludes accidental contact with opening.

- **Telecommunications rooms and other impacted areas** shall be restored in the same manner, so that each of the surfaces shall be as if it had been prior to construction activities subject to HSD approval.

- **District and public access** – every effort shall be made to provide unfettered access for HSD staff and general public to each location identified in this RFP. This includes access to each of the buildings and access to each of the vehicle roadways where trenching and other barriers may occur. Provide cones, caution tape, and other safety barriers as required.

- **Construction update meetings** – Contractor’s Project Manager shall schedule and attend regular coordination and construction meetings with the Owner and Owner’s representatives.

- **Background check and badging requirements** – All District facilities are to be considered secure and controlled environments. Each of the contractor’s field staff assigned to this project that will be present on any District properties or facilities, during which time as the facility is occupied, shall complete background check information and be fingerprinted as required by HSD. The cost associated with this background check will be the responsibility of the contractor. Each of the contractor’s field staff shall be approved and issued a Contractor’s Badge by HSD prior to starting any work for HSD. If, during the course of this project, previously badged individuals are identified as ineligible for any reason whatsoever their access will be curtailed and their badge is to be surrendered immediately.

### E-RATE REQUIREMENTS

Prior to submitting a response to this RFP, the Request for Proposal is necessary to file appropriate application forms administered by the Universal Services Administration Company (USAC) under the direction of Federal Communications Commission (FCC).
Bidders shall obtain a Service Provider Identification Number (SPIN) assigned by Schools and Libraries prior to submitting a proposal. Proposals without a SPIN will be rejected. If awarded, contractor shall coordinate with District to complete all required E-Rate documentation and forms including but not limited to Form 471.

Any and all USF E-rate “ineligible” products and/or services must be listed separately in the proposal.

**“OR APPROVED EQUAL” CLAUSE**

In order to establish a basis of quality, certain processes, types of equipment, or kinds of materials may be specified, either by description of process or by designating a manufacturer by name and referring to his brand or product designation, or by specifying a kind of material. It is not the intent of these specifications to exclude other processes, equipment, or materials of equal value, utility or merit.

Whenever a process is designated or a manufacturer’s name, brand, or product is described, it shall be understood that the words, “or approved equal” follow such name, designation, or description, whether in fact they do so or not.

If a Bidder proposes to furnish an item, process or material which it claims to be of equal utility to the one designated, then:

- Bidder shall deliver a substitution request to: Don Wolff wolffd@hsd.k12.or.us, referencing RFP - TS2018-01, at least seven (7) business days prior to the Bid due date and time, accompanied by a written statement describing it together with supporting data and details sufficient to permit HSD to evaluate the same.
- HSD may require demonstration, additional tests, and additional data, all to be supplied at the expense of the Bidder.
- HSD shall in its sole discretion determine if an item submitted as an alternate or approved equal is “equal” or “equivalent”.
- HSD shall issue an addendum at least five (5) business days prior to the Bid due date and time for approved equal determinations.

**PRICING AND PAYMENT STRUCTURE**

Vendors are required to breakdown the purchases by building as outlined in the Bid Pricing Schedule. Vendors are required to complete Appendix B as part of their proposal. Contracts will be awarded only after receiving a funding commitment and decision letter from SLD or agreed upon by HSD. This RFP will automatically become part of any contract awarded to a vendor.

Once a contract is awarded, the total dollar amount is the responsibility of HSD.

- Contractor shall use District supplied application and certification for payment form. HSD will provide initial template in an Excel format with base information filled in and instructions for use to allow contractor to accurately account for time and materials expended in this effort. This form will require notarized signature on behalf of the contractor prior to submission to HSD for approval and payment.
- The District expects the vendor to invoice the District for the non-discount amount (the applicant’s share of the cost) and file E-rate form 474 (SPI or Service Provider Invoice) for reimbursement of the discount amount.
- USAC will review the SPI Form and process a payment to you if payment is approved.
- The applicant (HSD) is always required to pay the non-discount portion of the cost of the services.

Note that final acceptance will not occur unless and until all fiber links have been tested and shown to have satisfactory results.
MAINTENANCE

- A Maintenance and Service contract is required for the on-going maintenance of the installed fiber. The agreement shall outline the expected response time maintenance windows as expected by HSD to address outages resulting from damage(s) to the installed fiber optic cable infrastructure. The following are response time requirements:
  - Four hour response time Monday – Friday between 7:00 am and 5:00 pm – exclusive of District holidays.
  - The SLA shall cover any and all outages resulting from damage to the fiber optic infrastructure, regardless of the cause. Further detail is provided in MAINTENANCE AND SERVICE SCHEDULE below.

DISCREPANCIES AND OMISSIONS

Any potential respondent to this RFP finding discrepancies or omissions in these documents or having any doubts as to the meaning or intent of any part thereof shall submit such questions or concerns to Don Wolff, Wolffd@hsd.k12.or.us Subject Line: RFP - #TS2018-01. Addenda issued to this RFP shall be considered a part of this RFP and shall become part of any final Contract that may be derived from this RFP. This RFP and its addenda will be part of any possible future contract with successful vendor(s).

ERRORS/OMISSIONS

Any Bid may be deemed non-responsive by HSD if it;
  - is not on the Bid forms provided;
  - contains errors or omissions, erasures, alterations, or additions of any kind;
  - proposes prices which are unsolicited or obviously unbalanced;
  - or not in complete conformance with any and all conditions of the bidding documents.

CONTINGENCIES

Proposers must submit responses online by the due date and time. Proposers are reminded to allow sufficient time for response submission. Completion of this RFP form and its associated Appendices are a requirement. Failure to do so will disqualify your RFP response submittal.

BID SECURITY

All bids must be accompanied by bid security in the form of a bid bond issued by a surety authorized to conduct such business in Oregon. Security shall be in the amount of five percent (5%) of the total bid price. The bid security shall serve as a guarantee that the bidder will not withdraw the bid for a period of sixty (60) days after bid opening, and if awarded the contract, will execute the contract and furnish all required bonds and insurance within the time frame specified. Proposers shall attach both a copy of the bond document and the Power of Attorney to their online response.

The Attorney-in-Fact who executes any bond on behalf of the surety must attach a notarized copy of his or her Power of Attorney as evidence of authority to bind the surety on the date of bond execution.
RESIDENT/NON-RESIDENT BIDDER

Oregon law requires that HSD, in determining the lowest responsive Bidder, add a percent increase on the Bid of a non-resident Bidder equal to the percent, if any, of the preference given to that Bidder in the state in which that Bidder resides. Therefore, each Bidder must indicate whether it is a resident or non-resident Bidder. A resident Bidder is a Bidder that has paid unemployment taxes or income taxes in the state of Oregon during the last twelve (12) months immediately preceding submission of this Bid, has a business address in Oregon, and has stated in its Bid that it is a “resident Bidder.”

EXPERIENCE AND ABILITY TO PERFORM THE WORK

Upon request, Bidders must present all necessary information indicating that the Bidder has met the standards of responsibility set forth in ORS 279B.110. HSD will make the final determination as to whether or not the Bidder is qualified to perform the work.

The Contractor and/or First Tier sub-contractor shall provide a list of three (3) different project references with their Bid submission as per the criteria listed in these documents. These references will be contacted regarding the quality of workmanship and service that the Bidder or sub-contractors have provided on projects of comparable size and scope. The Bidder shall submit this information using the Contractor Qualification Statement.

BASIS OF AWARD

In accordance with the guidelines of USAC, this contract will be awarded to the most cost effective provider. Price will be the primary factor, but not the sole factor, in evaluating the bids. As stated in the Vendor Qualifications, other factors of consideration will be prior experience, including past performance; personnel qualifications, technical excellence; and management capability, including schedule compliance. Award will be made to the responsive and responsible bidder offering a proposal that is deemed the most acceptable and advantageous to Hillsboro School District.

Any determination of bidder’s responsibility or responsiveness is subject to review and determination by HSD’s attorney as to legal sufficiency. HSD reserves the right to accept or reject any and all bids in whole or in part and to waive any irregularities in the best interest of the Hillsboro School District. Only those bidders that, in the sole opinion of HSD, meet the minimum experience requirements shall be considered to be responsible bidders.

In the event all Bids exceed HSD’s estimate, HSD reserves the right to negotiate with the selected low Bidder in an effort to meet the project budget.
EVALUATION CRITERIA
District shall select the qualified bidder whose proposal is most advantageous to Hillsboro School District with price and other factors considered as allowed by E-rate and ORS 279A.
District reserves the right to reject any and all proposals for good cause pursuant to E-rate and ORS 279C.
In reviewing the responses, HSD shall consider the following factors;
- Bidders Service Provider Identification Number (SPIN) assigned by Schools and Libraries.
- Installation Cost.
- Re-Occurring Maintenance Cost.
- Demonstrated Qualifications.
- Demonstrated Relevant Experience in K-12 Environment.
- Service plan for responses to problems.
- Project or Services performance based on references.
- Price of eligible services will be the primary factor.

The following table will be used to evaluate all proposals:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price - Price of eligible services will be the primary factor</td>
<td>30%</td>
</tr>
<tr>
<td>References</td>
<td>20%</td>
</tr>
<tr>
<td>Maintenance Plan Proposed</td>
<td>20%</td>
</tr>
<tr>
<td>Personnel Qualifications\Experience</td>
<td>20%</td>
</tr>
<tr>
<td>Flexibility of Services and\or Plan</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

No consideration will be given to any claims based on a lack of knowledge of existing conditions.
GENERAL REQUIREMENTS

NOTICE TO BIDDERS: For purposes of these instructions and all other contract documents herein, the name Hillsboro School District 1J may be abbreviated to “HSD” and both names signify the same municipal corporate body.

DURATION OF PROPOSALS

Each bid shall be irrevocable for a period of 60 days from date of bid opening.

An award of a contract to any bidder shall not constitute a rejection of any other bid.

RESERVATIONS:

Hillsboro School District expressly reserves the following rights:

- To reject all bids.
- To reject any bid or bids not in compliance with all prescribed public bidding procedures and requirements.
- To reject any bid or bids not meeting the specifications set forth herein.
- To waive any or all irregularities in bids submitted.
- To consider the competency and responsibility of bidders in making any award.
- To award the contract by lot or by individual item as HSD deems appropriate, unless otherwise specified.
- In the event any bidder or bidders to whom a contract is awarded shall default in executing said formal contract or in furnishing a satisfactory performance bond within the time and in the manner hereinbefore specified, to re-award the contract to another bidder or bidders.
- To increase or decrease specified quantities by 20%.
- To make the award based on their best judgment as to which merchandise or services comply with the specifications.

REQUEST FOR CHANGE OR PROTEST OF SOLICITATION SPECIFICATIONS OR CONTRACT PROVISIONS

Time for Submission of Request for Change or Protest. Requests for change or protests of solicitation specifications or contract provisions shall be presented to HSD’s Purchasing Department, in writing, five (5) calendar days prior to bid or proposal closing.

Such request for change or protest shall include the reasons for the request or protest, and any proposed changes to specifications or provisions. No request for change or protest of the content of solicitation specifications or contractor provisions shall be considered after the deadline established for submitting such request or protest.

Extension of Closing Date. If any request for change or protest is received in accordance with section (1) above, the bid or proposal closing date may be extended if HSD determines an extension is necessary to allow consideration of the request or protest and issuance of any addenda to the solicitation documents.

Identification of Request for Change or Protest. Envelopes containing requests for change or protests of solicitation specifications or contract provisions shall be marked as follows:

- Solicitation Specifications (or Contract Provisions)
- Request for Change (or Protest)
- Solicitation Document (or Other Identification)
PROTEST OF CONTRACTOR SELECTION, CONTRACT

Notice of Award.

HSD’s written notice of contract award shall constitute a final decision of HSD to award the contract or proceed with the purchase if no written protest of the contractor selection or contract award is filed with HSD’s Purchasing Department within seven (7) calendar days following issuance of the award documents. If a protest of contractor selection or contract award is timely filed by an actual aggrieved bidder or proposer, the award documents shall constitute a final decision of HSD only upon issuance to the protesting bidder or proposer of a written decision denying the protest and affirming the selection or the award. Unsuccessful bidders or proposers will generally not be notified that a contract has been awarded.

Right to Protest.

Any actual bidder or proposer who is adversely affected or aggrieved by HSD’s grounds upon which the protest is based may file a written protest. In order to be an adversely affected or aggrieved bidder or proposer with a right to submit a written protest, a bidder or proposer must itself claim to be eligible for award of the contract as the lowest responsive, responsible bidder or best proposer and must be next in line for award, i.e., the protestor must claim that all lower bidders or better proposers are ineligible for award because their bids or proposals were non-responsive or as a result of HSD committing a material violation of a solicitation provision or of an applicable procurement statute or administrative rule, the protestor was unfairly evaluated and would have, but for such material violation, been the lowest bidder or the highest-ranked proposer. HSD shall not entertain a protest submitted after the time period provided in HSD’s solicitation.

Authority to Resolve Protests.

The superintendent or the superintendent’s designee shall have the authority to settle or resolve a written protest submitted.

Decision.

After the superintendent or the superintendent’s designee issues a response to a written protest, an aggrieved proposer may seek judicial review in the manner provided in ORS 279B.415.

ACCEPTANCE OF CONDITIONS

Each bidder by the submission of a bid assents to each and every term and condition set forth anywhere in these specifications and agrees to be bound thereby.

INTERPRETATION OF SPECIFICATION

Any interpretation upon the foregoing or annexed specifications, either verbal or written, attempted to be placed thereon by any person other than the purchasing supervisor or his/her designee will not be binding upon HSD.

WARRANTY AND GUARANTEE

Unless otherwise specified herein, all goods, materials and workmanship shall be guaranteed and warranted for a period of twelve months from date of delivery, including parts, labor, transportation, technician mileage, service calls, etc., except for damage caused by misuse, vandalism or acts(s) of God.

TAX EXEMPTION

Prices quoted should not include Federal Excise or Transportation taxes, nor State or sales tax as HSD is exempt from such taxes. Federal Excise Tax exemption certificate will be furnished, if required.
NOTIFICATION OF AWARD

Upon award and successful contract negotiation, the District will enter into a service contract with the successful Proposer(s). District purchase orders are required for all work performed. Successful bidder should expect a legally-binding agreement (contract, etc.) to be entered before March 22, 2018.

SAMPLES

When required, samples must be delivered to the designated location prior to the stated bid opening time, or as noted on the bid. All samples submitted that are not consumed in testing must be picked up within ten (10) days after notification by HSD Purchasing Department or they become the property of HSD.

DEFINITIONS

As used in the Contract Documents, unless the context requires otherwise:


“Contract” or “Contract Documents” include the Agreement, the Bond, the Proposal, the Instructions to Bidders, the General Conditions of the Contract and Detailed Specifications, the Addenda, if any, incorporated in the Documents before their execution.

“Contractor” means the person or persons with whom a contract is entered into by HSD for the performance of work or the providing of goods and/or services.

“Person” means a person, partnership, corporation, and other association.

“Responsible Bidder or Proposer” means an individual, firm or corporation who has the capability in all respects to perform fully the contract requirements, the integrity and reliability which will assure good faith performance, and who has not been disqualified under ORS 279C.440.

“Specifications” means the directions, requirements, explanations, terms and provisions pertaining to the various features of the work, the manner and method of bidding for the work, the manner and method of performance of the work, and the manner and method of payment all as they appear in the contract documents.

ANNUAL AHERA NOTIFICATION

The Hillsboro School District reports the annual submittals and updates of its yearly asbestos management plans for all schools.

In 1986, Congress passed the Asbestos Hazard Emergency Response Act (AHERA) requiring schools to be inspected to identify any asbestos containing building materials (ACBM). Suspected ACBM was located, sampled (or assumed), and rated according to its condition and potential hazard.

Every three years, the Hillsboro School District conducts a re-inspection of each building’s ACBM to determine whether its condition has changed and to make recommendations on managing or removing the ACBM. Every six months, a surveillance of all ACBM takes place to monitor any change in its condition.

The law required an asbestos management plan for each school to be in place by July 1989. Hillsboro School District developed these plans and delivered them to the Oregon Department of Education. A school’s particular management plan is available for review on site during regular business hours. Any school’s management plan may also be reviewed at the Construction Services office during regular business hours.

Hillsboro School District complies with all federal and state regulations controlling asbestos and takes the necessary steps to ensure students and employees a healthy and safe environment in which to learn and work.
ADDITIONAL REQUIREMENTS
Drop-Shipment will not be accepted by HSD and will be refused unless:
A. Shipment is prepaid FOB destination.
B. Shipping label shows vendor to whom District purchase order was issued.
C. Shipping label clearly shows District purchase order number.
Successful bidders will be required to supply appropriate labels and packing slips to their suppliers if they intend to drop-ship. HSD will not be liable for storage or second delivery charges necessitated by non-compliance with the above items.
Bidders must include catalogue information, specifications, etc., on each item bid unless HSD has specified a brand name and model for reference and the item being bid is that exact brand and model.
Brand names and/or model numbers, where used herein, are for reference purposes only. Products of like quality meeting District specifications will be equally considered. If bidding other than as specified, a product sample is to be provided along with this bid.
Bidders are encouraged to bid various alternates, if such alternates essentially meet specifications. Bidders may describe such alternates on other than the proposal forms provided herein, but are cautioned to make their submittals complete and self-explanatory. HSD is not required to seek details or information not initially included with bid proposals.
All equipment shall be new and of the latest model, unless otherwise specified by HSD, and warranted by the successful bidder(s) for a period of one year from date of delivery to HSD. Warranty is to include all parts, labor, mileage, etc., except for the costs of repairs to equipment damaged by misuse or abuse by HSD. In addition, vendors are required to provide complete manufacturer warranty information on all equipment bid.
All electrical items must have 3-wire grounded power cords unless otherwise specified and must meet State of Oregon and Washington County electrical codes. All equipment shall comply with OSHA standards.
All items offered must be labeled in accordance with the chronic hazard labeling standard (ASTM D-4236, and Federal Law PL 100-695) and shall be ACMl certified.
HSD reserves the right to award the contract by lot or individual item, whichever is deemed appropriate.
TERMS AND CONDITIONS APPLICABLE TO AWARD
INDEMNITY/HOLD HARMLESS: To the fullest extent permitted by law, the undersigned contractor agrees to indemnify and hold the Hillsboro School District 1J, its employees, agents, representatives, volunteers, and others harmless for any incidents, accidents, losses, expenses, and/or liabilities for which negligence can be attributed directly or indirectly in whole or in part to the contractor’s organization which may arise during the course of this agreement. Also, the Hillsboro School District 1J agrees to indemnify and hold the contractor, its employees, agents, representatives, volunteers, and others harmless for any incidents, accidents, losses, expenses and/or liabilities for which negligence can be attributed directly or indirectly in whole or in part to HSD during the course of this agreement.
PAYMENT FOR SERVICES: The contractor must submit an invoice to Hillsboro School District, 3083 NE 49th Place, Hillsboro, Oregon 97124. All invoices must reference HSD purchase order issued to the contractor. All materials furnished must be accepted by HSD before payment will be approved. Payments will usually be made within 30 days of completion of service or delivery, or receipt of invoice, whichever is later.
For E-rate eligible services, the contractor must separately invoice the District for the non-discounted portion of the invoice and submit an E-rate Form 474 to request payment for eligible services.
NON-ASSIGNABILITY: The successful bidder shall not assign any portion of the Contract. The successful bidder may not confer an assignment on any third person by any other means without prior written consent of HSD. This provision shall apply to all transfers by operation of law, and transfers to and by trustees in bankruptcy, receivers, personal representatives, and legatees.

TERMINATION FOR DEFAULT OF CONTRACTOR: Time and the strict and literal performance on the part of the contractor of every term and condition of the contract as specified in the contract documents are of the essence. Upon the willful failure or refusal on the part of the contractor to perform on such term or condition, HSD at its election, without prejudice to any other right or remedy, may cause the same to be performed by others, and any additional cost on account thereof shall be reimbursed forthwith by the contractor.

TERMINATION OF CONTRACT FOR CAUSE: If, the Contractor fails to fulfill in timely and proper manner his obligations under this contract or if the Contractor violates any of the covenants, agreements, or stipulations of the contract, HSD shall thereupon have the right to terminate this contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least five (5) days before the effective date of such termination.

Notwithstanding the above, the Contractor shall not be relieved of liability to HSD for damages sustained by HSD by virtue of any breach of the contract by the Contractor, and HSD may withhold any payments to the Contractor until such time as the exact amount of damages due HSD from the Contractor is determined. In addition HSD may terminate this agreement, in whole or in part, for its convenience by giving vendor sixty (60) days written notice of intent to terminate.

DEPARTURES FROM TERMS OF CONTRACT: No direction or approval given by HSD or any representative of HSD which deviates in any respect from the specifications or other contract documents shall be valid or recognized unless and until the same is reduced to writing and issued in the form of a written order over the signature of an authorized representative of HSD so as to become a contract document as herein before defined.

INSPECTION: All articles supplied shall be subject to inspection and rejection by the purchaser or any department official charged with such duty.

CHANGES IN SPECIFICATIONS AND QUANTITIES: HSD reserves the right to make such changes or corrections in specifications or quantities as it may deem necessary or desirable prior to the bid opening. Bidders will be notified of such changes in writing mailed to the address on file in HSD Purchasing Department. HSD will not be responsible for the failure of bidders to receive notice of changes as stated. All proposals, when opened, will be understood to be based on the changed or corrected specifications or quantities and all bidders will be bound thereby. Prices quoted must be firm except as otherwise specified in this bid. Any vendor’s bid requiring receipt of initial order in less than sixty (60) days will be unacceptable unless otherwise specified by the Purchaser herein.

DELIVERY AND COMPLETION: Unless otherwise specified herein, goods ordered or services contracted in response to bids must be delivered or completed within 45 days after receipt of order. Vendors not completing contracts within the period specified shall be considered in breach of contract, and HSD shall be entitled to just legal and financial remedies.

PURCHASE ORDER CONTRACTS: Purchase order contracts, when issued, will be subject to all terms and conditions of these specifications and the laws of the State of Oregon. Time of delivery is of the essence. No exception to delivery dates shall be allowed without written approval form the Purchasing Department. All goods or materials purchased are subject to the approval of HSD. Any rejections of goods or materials, whether held by HSD or returned will be at the vendor’s risk and expense.
All invoices, packing lists, packages, shipping notices, and any other written document affecting the contract shall contain the applicable purchase order number. Packing list(s) shall be enclosed with each and every shipment pursuant to the contract, indicating the content therein. Each container (box, bag, etc.) shall show the purchase order number.

In the event of a breach by the vendor of any of the provisions of the contract including delivery, HSD reserves the right to cancel and terminate the contract forthwith upon giving oral or written notice to the vendor.

Vendor agrees to accept for credit, repair, or replacement, at no charge, any items received defective by HSD or proven defective during the specified warranty period and to be responsible for ALL transportation costs for return thereof to the vendor and when repaired or replaced the return thereof to HSD.

AFFIRMATIVE EMPLOYMENT PRACTICES: Bidders certify conformance to the applicable Federal Acts, Executive Orders and Oregon Statutes and Administrative Rules concerning Affirmative Action toward equal employment opportunities. Furthermore, bidders agree to include a similar Affirmative Action Provision in every sub-contract negotiated pursuant to their contracts with HSD.

All information and reports required by Federal or state agencies, having responsibility for enforcement of such laws, shall be supplied to HSD upon request for the purpose of investigation to ascertain compliance with such acts, regulations and orders. In the event of the determination of non-compliance with the Affirmative Action Provision, HSD may cancel, terminate or suspend the contract in whole or in part, and declare the contractor ineligible for further District contracts; or take such other action as it deems appropriate to bring about compliance.

CONTRACTOR QUALIFICATIONS

Submit the following information as part of the response to this RFP:

Company profile: - Describe the Contractor facilities and local office that will support and deliver services on this project. Indicate any out-of-state offices that will be utilized to bring additional resources to support this project. Indicate any Sub-Contractor facilities that you will utilize to support this project.

Personnel: - Identify the project team who will be responsible for participating on this project. Please respond to the following for each of your project personnel:

- Project Manager
- Lead Technician
- Installer Technicians
- Title and names of other field staff
- Qualifications - Describe each of their qualifications, industry experience in the contractor field, certifications, and training

Licensing: - Provide any licensing information for; City, State, and Federal that shall have a bearing on this RFP.

Affiliation/Bonds: - List the union affiliation, if any, for each classification of your employees, including:

- Project Manager.
- Lead Technicians.
- Installer Technicians.
- Title and names of other field staff.
**District Certificate of Insurance Requirements:**
- a. Contractor will be required to submit and maintain, at all times and at its sole expense, the following insurance in connection with its obligations. All such insurance shall be written through insurance carriers acceptable to Agent and Owner, and licensed in the state that these services are to be performed.

  A. Worker’s Compensation Insurance with statutory limits and employers liability coverage of not less than $1,000,000 each for bodily injury, disease, each employee; and disease, policy limit.

  B. Commercial General Liability insurance with limits of at least $2,000,000 per occurrence and a general aggregate of not less than $3,000,000. The foregoing insurance shall cover, but not be limited to, the following:
    1) Premises and Operations Liability
    2) Products/Completed Operations
    3) Broad Form Property Damage
    4) Broad Form Contractual Liability
    5) Personal Injury
    6) Independent Contractors Liability

  C. Owned, Hired and Non-Owned Automobile with a combined single limit per occurrence of not less than $1,000,000

  D. The liability insurance policy or policies required hereunder shall name “Hillsboro School District 1J” as “Additional Insured.” Each policy shall also be endorsed to provide that a written notice of cancellation, lapse or change of Vendor’s insurance will be sent to Owner by Vendor’s insurance carrier at least thirty (30) days prior to the effective date of such cancellation, lapse, or change.
    1) Vendor agrees to provide replacement cost property insurance to cover all equipment and supplies that it owns and brings onto the property.
    2) Certificate should be sent to as well as Certificate Holder should be listed as:
      Hillsboro School District 1J
      3083 NE 49th Place
      Hillsboro, OR 97124

**Capabilities:**
- Describe if your company intends on performing all work, utilizing its own internal resources and personnel, or shall be subcontracting installation requirements. If subcontracting shall be utilized, describe how these resources will be implemented within the project and the types of tasks that these resources shall perform.
- List the professional accreditations or certifications held by key stakeholders responsible for the design and implementation of this project.

**Approach:**
- Describe your organization’s approach on how you will successfully provide the requested services described within this RFP based upon the project schedule and milestones.
- Describe your approach for coordination and communication with the building occupants and District’s staff during the installation activities.
Experience:

- Provide a description of (3) similar projects, successfully completed within the past (5) years.
- Provide documentation denoting the length of time the company has been in business providing similar services.
- Describe the support infrastructure for responding to and resolving connectivity issues with installed cable plant including response time to a reported major outage.
- Describe experience coordinating easements and access to right-of-ways with municipalities and utility districts. Cite specific examples including Portland General Electric, Frontier Communications (formerly Verizon), or CenturyTel.

VENDOR RESPONSIBILITIES

It shall be the responsibility of the selected vendor/contractor to provide the configuration and system quantities to all locations stated herein. The intentional or accidental omission of necessary component(s) or system(s) shall require the selected vendor/contractor to supply said missing component(s) or system(s) at no cost to HSD. HSD and any Consultants associated with this RFP are not responsible for any omission, failure to detect any requirement, or any other condition required to complete the Scope of Work.

The Awarded Bidder shall:

- Meet jointly with representatives of HSD to exchange information and agree on details of equipment arrangements and installation interfaces for the cabling project.
- Have sufficient resources in order to complete the SOW within the allotted timeframe.
- Furnish all labor, supervision, tooling, and miscellaneous mounting hardware and consumables for the cabling system installed at HSD.
- Furnish, install, and terminate all fiber strands at each location according to the Specifications.
- Install all cable in accordance with the Specifications and/or manufacturer’s recommendations and best industry practices.
- Develop and submit for approval a labeling system for the cable installation. At a minimum, the labeling system shall clearly identify all components of the system. Sample labels must be approved by HSD.
- Test (100%) all cables and termination hardware for defects in installation and to verify cable performance under installed conditions. Testing procedures should be included in proposal documentation.
- Supply documentation of testing and footage of each cabling run in proposal documentation.
- Abide by and responsible for compliance with and satisfaction of the Authority Having Jurisdiction (AHJ) in accordance with all local, State and Federal codes and regulations.
- Procure all permits required for the complete installation of specified product at each location so identified in these documents.
BID FORMS

NOTE TO BIDDER: Bidders must provide all of the information requested in this Bid. Bidder should type or use ink for completing this Bid.

To: Hillsboro School District 1J
    RE: RFP #XXX

Bidder: 
Address: 
Bidder’s Contact: Telephone: Date:

BIDDER’S DECLARATION AND UNDERSTANDING

The undersigned, hereinafter called the Bidder, declares that the only persons or parties interested in this Bid are those named herein, that this Bid is, in all respects, fair and without fraud, that it is made without collusion with any official of Hillsboro School District, and that the Bid is made without any connection or collusion with any person submitting another Bid on this Contract.

The Bidder further declares that it has carefully examined the Contract Documents for the completion of the Work, has personally inspected the Site, has satisfied itself as to the Work involved, and that this Bid is made in accordance with the provisions and under the terms of the Contract Documents, which are hereby made a part of this Bid.

Any printed matter on any letter or paper enclosed herewith which is not part of the Bidding Documents or which was not requested by Hillsboro School District is not to be considered a part of this Bid, and the undersigned agrees that such printed matter shall be entirely disregarded and, notwithstanding such printed matter, that the Bid is a bid to do the Work and furnish the labor and materials and all other things required by the Contract Documents strictly within the time and in accordance with such Specifications. This Bid is irrevocable for sixty- (60) days following the date of the opening of Bids.

BID SECURITY

Bid security in the form of a certified check, cashier’s check, irrevocable letter of credit or bid bond as further described in the Instructions for Bidders and in the amount of five percent (5%) of the total bid price is enclosed herewith and is subject to all the conditions stated in the Instructions for Bidders.

CONTRACT EXECUTION, BONDS AND INSURANCE

The Bidder agrees that if this Bid is accepted, it will, within seven (7) days after award of the Contract by Hillsboro School District, sign the Construction Agreement in the form annexed hereto, and will at that time deliver to Hillsboro School District the Performance Bond and the Labor and Materials Payment Bond required herein and in the form annexed hereto, along with all certificates of insurance and certified copies of insurance policies specified and required in these Contract Documents, and will, to the extent of its Bid, furnish all machinery, tools, apparatus, and other means of operation and construction and do the Work and furnish all the materials necessary to complete all Work as specified or indicated in the Contract Documents.

COMMENCEMENT OF WORK AND CONTRACT COMPLETION TIME

The time frame for the award and execution of this Contract shall be as described in the Instructions for Bidders and other Contract Documents. The Successful Bidder further agrees to commence the Work within five (5) days of issuance of the Notice to Proceed and to diligently prosecute the Work to its final completion in accordance with the Contract Documents.

ADJUSTED PAYMENTS

In the event the Bidder is awarded the Contract and fails to complete the Work in compliance with the time required by the Contract Documents, adjusted payments shall be paid to Hillsboro School District as described in the General Conditions.

SALES AND USE TAXES

The Bidder agrees that all applicable federal, state and local sales and use taxes are included in the stated bid prices for the Work.

LUMP SUM AND UNIT PRICE WORK

The Bidder further proposes to accept as full payment for the Work proposed herein the amounts computed under the provisions of the Contract Documents and based on the listed lump sum and unit price amounts. The amounts shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.

PREVAILING WAGES FOR PUBLIC WORK

Bidder hereby certifies that the provisions of ORS 279C.800 - 279C.870, regarding prevailing wages, shall be complied with on this project.
### SCHEDULE OF BID PRICES

The Bidder, whose legal signature binding the Bidder to the bid process indicated on these pages is found on the signature page, hereby bids as follows:

<table>
<thead>
<tr>
<th>Identifier</th>
<th>From - Site</th>
<th>To – Site(s)</th>
<th>Total Lump Sum Amount</th>
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<tbody>
<tr>
<td><strong>RING-1</strong></td>
<td>Glencoe High School</td>
<td><em>Clockwise Route</em></td>
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<td></td>
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<td>Peter Boscow Conference Center</td>
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<td>Miller Education East</td>
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<td>Miller Education West</td>
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<td><em>Counter-Clockwise Route</em></td>
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<td>Mckinney Elementary</td>
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<td>Transportation Services</td>
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<td><strong>SPUR 1-1</strong></td>
<td>Glencoe High School</td>
<td>Free Orchards Elementary</td>
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<td><em>Lump sum for all required construction related components, fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.</em></td>
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<tr>
<td><strong>RING-2</strong></td>
<td>Glencoe High School</td>
<td><em>Clockwise Route</em></td>
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<td>Patterson Elementary</td>
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<td></td>
<td>Evergreen Middle</td>
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<td></td>
<td>Jackson School Elementary</td>
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<td>Mooberry Elementary</td>
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<td><em>Counter-Clockwise Route</em></td>
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<td>Lincoln Street Elementary</td>
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<td>Eastwood Elementary</td>
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<td></td>
<td>Poynter Middle</td>
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<td></td>
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<td>Mooberry Elementary</td>
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<td><strong>SPUR 2-1</strong></td>
<td>Evergreen Middle</td>
<td>North Plains Elementary</td>
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<td><strong>SPUR 2-2</strong></td>
<td>Poynter Middle</td>
<td>Hare Field</td>
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<td><em>Lump sum for all required construction related components, fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.</em></td>
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<td>RING-3</td>
<td>Hillsboro High School (HilHi)</td>
<td><strong>Clockwise Route</strong> W. L. Henry Elementary</td>
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<td>Brookwood Elementary</td>
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<td>Facilities</td>
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<td><strong>Counter-Clockwise Route</strong> South Meadows Middle</td>
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<td>Witch Hazel Elementary</td>
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<td>Facilities</td>
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<td>SPUR 3-1</td>
<td>HilHi</td>
<td>Minter Bridge Elementary</td>
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<td>SPUR 3-2</td>
<td>HilHi</td>
<td>Farmington View Elementary</td>
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<td>SPUR 3-3</td>
<td>South Meadows Middle</td>
<td>Groner Elementary</td>
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Lump sum for all required construction related components, fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.

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<td>Ring-4</td>
<td>Century High School</td>
<td><strong>Clockwise Route</strong> Imlay Elementary</td>
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<td>Brown Middle</td>
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<td>Tobias Elementary</td>
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<td><strong>Counter-Clockwise Route</strong> Ladd Acres Elementary</td>
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<td>Rosedale Elementary</td>
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<td>Butternut Creek Elementary</td>
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<td>Reedville Elementary</td>
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</tr>
<tr>
<td>TIE</td>
<td>Reedville Elementary</td>
<td>Indian Hills Elementary</td>
<td></td>
</tr>
</tbody>
</table>

Lump sum for all required construction related components, fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.
## RING-5

<table>
<thead>
<tr>
<th>Identifier</th>
<th>From - Site</th>
<th>To – Site(s)</th>
<th>Total Lump Sum Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING-5</td>
<td>Liberty High School</td>
<td>Clockwise Route West Union Elementary Orenco Elementary Quatama Elementary</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Counter-Clockwise Route Lenox Elementary Quatama Elementary Hillsboro Stadium</td>
<td></td>
</tr>
</tbody>
</table>

Lump sum for all required construction related components, fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.

### MAIN NORTH RING

- Administration Center to Liberty High School
- Liberty High School to Century High School
- Century High School to Administration Center

### MAIN SOUTH RING

- Administration Center to Century High School
- Century High School to HilHi
- HilHi to Glencoe High School
- Glencoe High School to Administration Center

### SPUR

- Administration Center to NWRESD

Lump sum for all required construction related components, 48 strand fiber optic cable and related materials, labor, permits and testing to provide completely functional system as detailed in the bid package.

$
<table>
<thead>
<tr>
<th>Identifier</th>
<th>Total Lump Sum Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING-1</td>
<td>$</td>
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<tr>
<td>RING-2</td>
<td>$</td>
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<tr>
<td>RING-3</td>
<td>$</td>
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<tr>
<td>RING-4</td>
<td>$</td>
</tr>
<tr>
<td>RING-5</td>
<td>$</td>
</tr>
<tr>
<td>MAIN RINGS</td>
<td>$</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>$</td>
</tr>
</tbody>
</table>
MAINTENANCE AND SERVICE SCHEDULE

HSD requires that the entire installed system be covered by a maintenance and service contract that covers all aspects of the installed fiber optic cable plant up to the point of demarcation into each and every District facility. Maintenance contract shall be priced as a lump sum, per year, for five years following the installation and acceptance of the fiber optic network. There shall be two components of the maintenance contract:

A. ROUTINE/PREVENTATIVE MAINTENANCE

This will entail the routine activities necessary to keep the fiber optic plant functional. Included will be:

- Trimming foliage to maintain minimum acceptable clearance between aerial fiber optic cable and all vegetation. This may be contracted to a third party; however, responsibility for this activity to be done shall rest solely with this maintenance contract. All aerial runs installed by this contract are included and shall be inspected not less than quarterly. In the event District personnel discover areas where trimming is necessary, contractor shall be responsible for trimming within 72 hours of written notification by HSD. Acceptable clearance is defined as no vegetation within 24 inches of the installed cable plant.

- Vault and conduit inspection shall be conducted and documented not less than annually to verify proper drainage within the system. In addition, this contract shall be responsible for inspection of vault and conduit system after storms in which the measured rainfall is more than the average as recorded in a 24 hour period. In addition, this contract shall respond to request for inspection on behalf of HSD if such request is made by any city, county, or state official responsible for roads or utility right-of-way.

- Replacement of any initially installed components (for whatever reason so necessary) normally associated with the proper installation of fiber optic cable shall be accomplished as no charge to HSD. This includes but is not limited to:
  - Messenger cable and all pole and building cable attachment hardware to include lashing, splicing, and slack loop management components.
  - Weather heads, fasteners and weatherproofing components
  - Conduits, boxes and ducts
  - Bonding and grounding components

- Requests for coordination or locate(s) shall be responded to within 24 hours.

- Requests to relocate installed fiber optic cable shall be addressed by HSD; however, District will rely on this maintenance contract to perform any such activities, (e.g. relocate pole attachment to accommodate other utility or service requests). Reasonable costs associated with such activities are expected to be forwarded to the entity requesting the relocation services.

B. REMEDIAL MAINTENANCE OR EMERGENCY SERVICE.

These services will result from unplanned activities that impact the operation of the installed fiber optic network. Covered are:
• Outages due to breaks in aerial fiber. This covers breakage in any aerial fiber that may occur within the entire fiber network regardless of the cause. District shall require a 4 hour response time to determine the cause of the outage and will then work with the contractor to determine restoration.
  o In the event the outage is due to damage of a utility pole, District will require restoration of the affected fiber optic segment(s) within 24 hours of such time as the owning utility replaces the broken pole.
  o In the event the outage is due to damage within a span caused by other than pole damage, District will require restoration of the affected segment(s) within 24 hours of such time as the cause of the outage was identified.

• Outages in underground fiber. This covers all outages in the conduit and vault system that may occur within the entire fiber network regardless of the cause. District shall require a 4 hour response time to determine the cause of the outage and will then work with the contractor to determine restoration.
  o If the outage is determined to have been caused by excavation, District will require restoration of the affected fiber optic segment(s) within 24 hours of such time as the cause of the outage was identified.
  o If the outage requires replacement of a vault, District will require restoration of the affected segment(s) within 24 hours of when the new vault was placed.

MAINTENANCE AND SERVICE PRICING

<table>
<thead>
<tr>
<th>Year incurred</th>
<th>Contract cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>$</td>
</tr>
<tr>
<td>2020</td>
<td>$</td>
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<tr>
<td>2021</td>
<td>$</td>
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<tr>
<td>2022</td>
<td>$</td>
</tr>
<tr>
<td>2023</td>
<td>$</td>
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</tbody>
</table>

ADDITIONAL WORK IF NEEDED

Hourly rates and material mark ups will be established for additional work required at District’s request.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Price</th>
</tr>
</thead>
</table>

NOTE: Pricing to include all labor, materials and any related shipping costs
PREVAILING WAGES FOR PUBLIC WORK
Bidder hereby certifies that the provisions of ORS 279C.800 - 279C.870, regarding prevailing wages, shall be complied with on this project.

Bidder signature

Print Name of Company

_______________________________________________________________

Print Name of Authorized Signor/Title

_____________________________________________________

Signature

___________________________________________________________________________
BID BOND

BOND NO. ____________________
AMOUNT: $__________________

NOTE: Bidders must use this form, not a surety company form

KNOW ALL MEN BY THESE PRESENT, that _____________________________ hereinafter called the PRINCIPAL, and _____________________________ a corporation duly organized under the laws of the State of _____________ having its principal place of business at _____________ in the state of _____________, and authorized to do business in the state of Oregon, as SURETY, are held and firmly bound unto _____________ hereinafter called the OBLIGEE, in the penal sum of _____________________________ DOLLARS ($__________________), for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these present.

THE CONDITION OF THIS PRINCIPAL IS SUCH THAT:
WHEREAS the PRINCIPAL is herewith submitting a BID FOR:

E-RATE 470 FIBER OPTIC CABLE INFRASTRUCTURE, RFP - #TS2018-01

Said Bid, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if the Bid submitted by the PRINCIPAL is accepted, and the Contract awarded to the PRINCIPAL, and if the PRINCIPAL shall execute the proposed Contract and shall furnish any bond(s) required by the Contract Documents within the time fixed by the Documents, then this obligation shall be void; if the PRINCIPAL shall fail to execute the proposed Contract and furnish the bond(s), the SURETY hereby agrees to pay to the OBLIGEE the penal sum as liquidated damages, within ten (10) days of such failure.

Signed and sealed this ______ day of ________________________, 2018

By: ________________________________
PRINCIPAL

By: ________________________________
Attorney-in-Fact
SURETY

If the Bidder is awarded a Contract on this Bid, the surety or sureties who provide(s) the Performance Bond and Labor and Materials Payment Bond will be:

<table>
<thead>
<tr>
<th>SURETY</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ______________________________</td>
<td>__________________________________________</td>
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<tr>
<td>2. ______________________________</td>
<td>__________________________________________</td>
</tr>
</tbody>
</table>

Bidder signature

Print Name of Company

_______________________________________________________________

Print Name of Authorized Signor/Title

_______________________________________________________________

Signature

___________________________________________________________________________
CONTRACTOR QUALIFICATION STATEMENT

NOTE: The prime contractor and all first tier subcontractors proposed to complete cabling, infrastructure or any other significant portion of work must each complete a separate Contractor Qualifications Statement. (List type of work applicable)

The undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading:

Contractor Name
Address
Telephone Fax E-Mail

ORGANIZATION
How many years has your organization been in business as a Contractor?
Under what former names has your organization operated?

Licensing and Bonding
Oregon CCB# Public Works Bond #
Other licenses

Experience
List the type of work your organization normally performs with its own forces and the number of full time employees to be assigned to the project?

Does your firm own or able to obtain the necessary equipment for this job? Please indicate equipment available to conduct the work.
CONTRACTOR QUALIFICATION STATEMENT continued

CLAIMS AND SUITS
Has your organization ever failed to complete any work awarded to it?

Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or officers?

Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years? Provide information

Have any officers or employees been convicted of any crimes relative to a project such as this?

REFERENCES
List the major fiber optic cabling and infrastructure projects your organization has in progress

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Owner</th>
<th>Architect/Engineer</th>
<th>Amount</th>
<th>% Complete</th>
<th>Completion Date</th>
<th>Contact Person</th>
<th>Phone #</th>
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</table>

List the major fiber optic cabling and infrastructure projects your organization has completed in last 5 years

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Owner</th>
<th>Architect/Engineer</th>
<th>Amount</th>
<th>% Complete</th>
<th>Completion Date</th>
<th>Contact Person</th>
<th>Phone #</th>
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</tbody>
</table>

Page 34 of 111
CONTRACTOR QUALIFICATION STATEMENT continued

List 3 subcontractors HSD can contact for a reference.

<table>
<thead>
<tr>
<th>Name</th>
<th>Specialty</th>
<th>Contact Name</th>
<th>Phone #</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

List 3 suppliers HSD can contact for a reference.

<table>
<thead>
<tr>
<th>Name</th>
<th>Specialty</th>
<th>Contact Name</th>
<th>Phone #</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Bank Reference
Name: ____________________________________________
Address: ________________________________________
Contact Name: ___________________________ Phone number: ___________________________

**Bidder signature**
This information provided is true and complete.

Print Name of Company
______________________________________________
Print Name of Authorized Signor/Title
______________________________________________
Signature ______________________________________
SIGNATURE PAGE
The name of the Bidder submitting this Bid is ______________________________________
______________________________
doing business at
______________________________
Street________________________ City_____________ State_______ Zip________
Which is the full business address to which all communications concerned with this Bid and with the Contract shall be sent.
The names of the principal officers of the corporation submitting this Bid, or of all of the partners, if the Bidder is a partnership or joint venture, or of all persons interested in this Bid as individuals are as follows:
__________________________________________________________________________
If Individual
IN WITNESS hereto the undersigned has set his/her hand this _____ day of March, 2018
Signature of Bidder ____________________________________________________________
Printed Name of Bidder _______________________________________________________
Title _________________________________________________________________
If Partnership or Joint Venture
IN WITNESS hereto the undersigned has set his/her hand this _____ day of March, 2018
______________________________
Name of Partnership or Joint Venture
By: ______________________________
______________________________
Printed Name of Person Signing
Title: ______________________________
If Corporation
IN WITNESS WHEREOF the undersigned corporation has caused this instrument to be executed and its seal affixed by its duly authorized officers this _____ day of March, 2018.
______________________________
Name of Corporation
State of Incorporation
By: ______________________________
______________________________
Printed Name of Person Signing
Title: ______________________________
<table>
<thead>
<tr>
<th>Specification Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 00 00</td>
<td>COMMUNICATIONS</td>
</tr>
<tr>
<td>27 05 00</td>
<td>COMMON RESULTS FOR COMMUNICATIONS</td>
</tr>
<tr>
<td>27 05 13</td>
<td>COMMUNICATIONS SERVICES</td>
</tr>
<tr>
<td>27 05 26</td>
<td>GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 05 28</td>
<td>PATHWAYS FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 05 28.29</td>
<td>HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 05 28.33</td>
<td>CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 05 28.39</td>
<td>SURFACE RACEWAY FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 05 43</td>
<td>UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS</td>
</tr>
<tr>
<td>27 05 53</td>
<td>IDENTIFICATION FOR COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 08 00</td>
<td>COMMISSIONING OF COMMUNICATIONS SYSTEMS</td>
</tr>
<tr>
<td>27 11 00</td>
<td>COMMUNICATIONS EQUIPMENT ROOM FITTINGS</td>
</tr>
<tr>
<td>27 13 23</td>
<td>COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING</td>
</tr>
<tr>
<td>27 17 00</td>
<td>TESTING, IDENTIFICATION AND ADMINISTRATION OF FIBER</td>
</tr>
</tbody>
</table>
SECTION 27 00 00 - COMMUNICATIONS

PART 1  GENERAL
1.01  OVERVIEW
A. Division 27 – Communications governs the infrastructure for the low-voltage information transport systems, which include voice and data and their pathways.
B. The Scope of Work covered by this document is to furnish and install single mode fiber to all HSD facilities as outlined in these specifications and accompanying drawings.
C. Description of Work:
D. Furnish and install materials for the fiber optic infrastructure systems as specified herein and as shown on the Drawings. Upon completion, the systems shall be functioning in compliance with performance requirements specified.
E. The fiber optic cabling specified and shown on the Drawings is for complete, performance based, workable systems. Deviations from the systems shown due to a particular manufacturer’s requirements shall be made only with the written approval of HSD, and at no additional cost to HSD.
F. Structured Cabling Designer:
Darren Herrick, LEA, RCDD
Company: Northwest Information Services
Address: 4900 SW Griffith Drive #250, Beaverton OR 97005
Phone: 503.246.8585, ext. 230 (C) 503.830.6305
E-Mail: darren.herrick@nis.consulting
G. System shall include the following:
1. All fiber optic cabling
2. Pathways for the fiber optic cabling
3. Right-of-way and pole attachment permitting and lease for perpetual use by HSD
4. All permits and inspections to satisfy AHJ(s)
5. All traffic control and coordination with Oregon Department of Transportation and local city and county law and traffic enforcement entities
6. Grounding and Bonding System (GBS) as required
7. Firestopping as required

1.02  SECTION INCLUDES
A. Related Documents and Codes, and Standards
B. Related Sections
C. Abbreviations, Acronyms and Definitions
D. Project Drawings
E. Quality Assurance
F. Warranty
G. Substitutions
H. Submittal Requirements
I. Additional Requirements
J. Delivery and Storage
K. Permits and Inspections
L. Additional Costs
1.03 RELATED DOCUMENTS AND CODES

A. Comply with the referenced codes and standards and with the Contract Documents. Where conflicts occur, the more stringent shall apply.

B. The latest versions, including addenda, as enforced by the local authority having jurisdiction of the following codes, associations, acts and agencies:
   1. Federal Communications Commission (FCC)
   2. National Fire Protection Association (NFPA), specifically:
      a. NFPA 70, National Electrical Code® (NEC®)
      b. NFPA 72, National Fire Alarm Code®
      c. NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
      e. NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
      f. NFPA 780, Standard for the Installation of Lightning Protection Systems,
      g. NFPA 5000™, Building Construction and Safety Code
   4. Occupational Safety and Health Administration (OSHA)

C. The latest versions, including addenda, of the following standards:
   1. American National Standards Institute (ANSI)
   2. National Electrical Manufacturers Association (NEMA)
   3. Telecommunications Industries Association (TIA), specifically:
      h. TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity through Reverse-Pair Positioning
      i. TIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
      k. ANSI/TIA-568-0-D - Generic Telecommunications Cabling for Customer Premises
      l. ANSI/TIA-568.1-D,-2015 Commercial Building Telecommunications Infrastructure Standard
      m. ANSI/TIA-569-D-2015, Telecommunications Pathways and Spaces
      n. ANSI/TIA-598-C, Optical Fiber Cable Color Coding
      o. ANSI/TIA-604.2-A, FOCIS 2—Fiber Optic Connector Intermateability Standard
      p. ANSI/TIA-606-B, Administration Standard for Commercial Telecommunications Infrastructures
      q. ANSI/TIA/607-C, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
      r. ANSI/TIA-758-A, Customer-owned Outside Plant Telecommunications Infrastructure Standard
      s. ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems
4. Other Reference Materials
   a. ANSI/NECA/GICSI-568-2006, Standard, Installing Commercial Building
      Telecommunications Cabling
   b. BICSI Outside Plant Design Reference Manual (COOSP)
   c. BICSI Electronic Safety and Security Reference Manual (ESSDRM)
   d. BICSI Information Transport Systems Installation Methods Manual
      (ITSIM)
   e. BICSI Network Design Reference Manual (NDRM)
   f. BICSI Telecommunications Distribution Methods Manual (TDMM)
   g. BICSI Wireless Design Reference Manual (WDRM)
   h. Institute of Electrical and Electronic Engineers (IEEE)
   i. National Electrical Manufacturers Association (NEMA)
   j. Underwriters Laboratories (UL®) Cable Certification and Follow up
      Program
   k. American Standards Association (ASA)

1.04 RELATED SECTIONS
   A. Section 27 05 13 – Communications Services
   B. Section 27 05 26 – Grounding and Bonding for Communications Systems
   C. Section 27 05 28 – Pathways for Communications Systems
   D. Section 27 05 28.29 – Hangers and Supports for Communications Systems
   E. Section 27 05 28.33 – Conduits and Backboxes for Communications Systems
   F. Section 27 05 28.39 – Surface Raceways for Communications Systems
   G. Section 27 05 43 – Underground Ducts and Raceways for Communications Systems
   H. Section 27 05 53 – Identification for Communication Systems
   I. Section 27 08 00 – Commissioning of Communications
   J. Section 27 11 00 – Communications Equipment Room Fittings
   K. Section 27 13 23 – Communications Optical Fiber Backbone Cabling
   L. Section 27 17 00 – Testing, Identification and Administration of Fiber

1.05 ABBREVIATIONS and ACRONYMS
   AFF Above Finished Floor
   AWG American Wire Gauge
   BICSI Building Industry Consulting Services International
   Gbps Gigabits per second
   Mbps Megabits per second
   MDF Main Distribution Frame, consisting of carrier entrance rooms and head-end
   OSHA Occupational Safety and Health Act
   RUS Rural Utilities Service
   SCS Structured Cabling System
   SFF Small Form Factor
   TE Telecommunications Enclosure
   TIA Telecommunications Industry Association
   TR Telecommunications Room
   UL® Underwriters Laboratory
   WAN Wide Area Network
1.06 DEFINITIONS

Conduit - A raceway of circular cross-section.

Conveniently Accessible - being capable of being reached from floor or use of 8’ step ladder without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point and interconnection point to the network.

Entrance Room – A space in which the joining of campus and building telecommunications backbone facilities takes place.

Equipment Room – An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate crossconnect, as well as video surveillance and security equipment

Lead Telecommunications Installer – the project manager for the Contractor for all telecommunications work in the construction documents (Power & Signal Drawings and specification Section 27), who shall be on-site at all times while Division 27 work is being performed. This individual shall attend all construction project meetings.

Listed Communications Cable – A cable listed by the Underwriters Laboratory (UL®) and accepted by the local authority having jurisdiction as having met appropriate designated standards or has been tested and found suitable for installation in specific spaces. Refer to NEC® Section 800 for listing types and additional requirements.

MDF – Main Distribution Frame, also known as the Main Equipment Room.

Owner – Hillsboro School District

Owner's Representative – An entity assigned to represent HSD in all matters pertaining to this project. Used synonymously with “Owner”.

Plenum - A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

Plenum-rated – listed by the Underwriters Laboratory as being suitable for installation into a plenum space. Communications cabling routed through plenum-rated space shall be plenum-rated and identified as Type CMP.

Point of Entrance (Building Entrance) - The point within a building at which the Outside Plant (OSP) communications wire or cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit (Type RMC) or an intermediate metal conduit (Type IMC) connected by a grounding conductor to an electrode in accordance with the NEC®.

Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

Subcontractor, Telecommunications – entity responsible for all telecommunications work in the construction documents (Power & Signal Drawings and specification sections 27 0000 through 27 5313).

Telecommunications – in general, telecommunications refers to infrastructure/equipment needed for the voice, data, and video communications and transport systems.

Telecommunications Room - An environmentally enclosed architectural space designed to contain telecommunications equipment, cable terminations, or crossconnect cabling. The Main Equipment Room may also be known as the MDF, and may be co-located with the building’s Entrance Room and Equipment Room. Telecommunications Rooms will also house equipment for additional systems, such as security, cable television, and audio/video.
1.07 QUALITY ASSURANCE

A. Contractor Qualifications
   1. Company Requirements
      a. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the drawings and Specifications.
      b. Fiber optic systems specified shall be assembled and installed under the direction of a qualified Contractor. Qualification requirements shall include submittal to HSD of the following:
         1. List of previous projects of this scope and nature, including names and sizes of projects, description of work, times of completion, and names of contact persons for reference.
         2. Installers shall certify that they are manufacturer-authorized or trained for work to be performed.
   B. When articles, materials, operations or methods related to execution of communications work are noted, specified, or described in the specifications or are indicated or reasonably implied on drawings and schedules, execute work as required or appropriate to provide complete and proper function, operation and installation.
   C. The drawings utilize symbols and schematic diagrams to indicate items of work. These symbols and diagrams will not typically identify dimensions nor will they identify inclusion of specific accessories, appurtenances and related items necessary and appropriate for a complete and proper installation and operation. The Contractor shall install work complete and ready for proper operation, including related items not specifically identified, shown, indicated or specified. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on drawings and on shop drawings approved by HSD.
   D. The drawings include details for various items, which are specific with regard to the dimensions and positioning of the work. These details are intended only for the purpose of establishing general feasibility; they do not obviate field coordination for the indicated work. Work shall not proceed until actual field conditions and requirements are verified by the Contractor.
   E. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions.

1.08 WARRANTY

A. Warranty Requirements: Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other Division 27 sections for specific additional warranty requirements that exceed or are in addition to those of this section.

B. Contractor warranty: Provide all services, materials and equipment necessary for successful operation of entire system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, cable, accessories, installation, and configuration required to maintain a complete and operable system. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by HSD and shall not institute warranty period.

The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to HSD’s satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty.
C. Project Warranty
   1. Equipment and materials required for installation under these specifications shall be the current model and new (less than one year from date of manufacture), unused and without blemish or defect, and are to be guaranteed to be free from defect.
   2. When a defect or problem is observed within the first year after substantial completion, HSD will notify the governing subcontractor through the proper channels. The appropriate Subcontractor then has 48 hours to fix the defect or furnish and install a replacement part/system, all at no cost to the project or HSD.

D. Advanced System Warranty for Fiber Systems
   1. Beyond the initial one year project warranty, the fiber optic cabling systems shall be warranted for a minimum of 20 years by a national and reputable connectivity or cabling manufacturer.
      a. This warranty shall cover any material defect, as well as the performance of the cabling system.
      b. This warranty shall cover both material and labor for the full length of the warranty period.
   2. The Contract shall be certified by this manufacturer.

E. Owner’s rights: This section shall not be interpreted to limit Owner’s rights under applicable codes and under this Contract.

1.09 SUBSTITUTIONS
A. Substitution requests: Substitution requests will be considered only if submitted to Owner’s Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner’s Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner’s Representative.

B. Rejection: For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, HSD does not expect nor desire requests for substitutions and alternate products other than those specified. HSD reserves right for HSD's Representative to reject proposed substitution requests and submissions of alternates without review or justification.

1.10 SUBMITTALS
A. General Requirements
   1. HSD is to review all submittals related to Division 27 work. This includes, but is not limited to, relevant:
      a. Pre-bid questions
      b. Contractor and personnel qualifications with bid
      c. Voluntary alternates and unit pricings with bid
      d. Pre-construction product submittals and shop Drawings
      e. Change order requests, requests for information (RFIs), design change directives (DCDs), and any other changes as directed by the architect/engineer.
   2. Allow a minimum of one week (five working days) for HSD to review.
   3. The following submittals are due at the Pre-Bid deadline for questions:
      a. Requests for product substitution shall be in accordance with this document.
b. All products seeking approval either as “approved equivalent” or otherwise, shall be submitted as a product substitution request prior to bid. Failure to submit product substitution request in a timely manner (before pre-bid questions are due) may preclude product from being utilized on the project. Requests made with bid or post-bid will not be considered without a significant cost savings realized to HSD.

c. The burden of proof is on the contractor to provide documentation that equivalent product meets the specifications and project requirements. Include in substitution request:
   1) Product being replaced
   2) Reason for product substitution
   3) Full manufacturer specification sheet clearly indicating that all requirements in project documents have been met

d. Failure to meet these requirements will result in the product substitution request being returned without review.

e. All product substitution requests are to be reviewed and approved by HSD. Not all requests will be approved, and all decisions are final, without recourse.

B. The following submittals are due with the Bid:
   1. Proof of Contractor and personnel qualifications
      a. Provide a typed list with the following information:
         1) Company name of Contractor
      b. List of previous projects (minimum of 3) of this scope and nature, including:
         1) Project name and date of completion
         2) Project size
         3) Name and contact information

   2. Voluntary alternatives (that realize substantial cost savings)

C. The following submittals are due at the Pre-Construction Phase (to be delivered to HSD):
   1. General Requirements:
      a. Follow submission guidelines as outlined in this section.
         1) Strictly electronic submission to HSD is acceptable.
      b. Ensure a cover page with Project Title, Telecommunication Subcontractor Company, and point of contact is included for all physical submittals.
      c. Updated Personnel Qualifications
   2. Product Information, divided by Specification Section and in order as listed in specification. Identify the start of each specification section.
      a. Provide manufacturer's product information cutsheet or specifications sheet with the specific product number identified or filled out.
         1) Submitted cutsheets without specific product identified will result in the whole submittal being returned without review.
2) No product substitutions will be considered post bid without a significant cost savings to the project to be realized by HSD – a minimum of $1000, either in material or labor savings. For any product substitution requests post-bid, Contractor shall submit an RFI through the proper channels with the requested documentation from the Pre-bid requirements above. Also, include realized cost savings. The project team may issue a change order (or its equivalent) for the product change at their discretion.

b. Refer to individual sections for additional requirements.

c. Communications pathways – internal to buildings:
   1) Hangers and Supports – indicate proposed routing of all cabling supported by J-hooks.
   2) Firestopping – indicate manufacturer, product/assembly, and UL system for all firestop penetrations required for communications cabling.

D. The following submittals are due during Construction (project closeout), in accordance with the requirements of this Section:

1. 3 weeks prior to Substantial Completion:
   a. Record Drawings
      1) Modify reviewed and accepted AutoCAD® shop Drawings to include revisions based upon completion of work.
      2) Provide (1) printed set of record Drawings to scale (not less than 1/8" = 1'-0").
      3) This set is to include system function diagrams and details not on original construction documents.
   b. Test Results, in accordance with Sections 27 08 00 and 27 17 00.
   c. With the exception of the (1) printed set of record Drawings, submit these files electronically either on disk (CD or DVD) or USB Flash Drive, with project name and number clearly indicated.

2. Within two weeks after Substantial Completion:
   a. Warranty Certificates for the Advanced Telecommunications System Warranty for the copper and fiber systems with point of contact for any warranty claims.

1.11 ADDITIONAL REQUIREMENTS

A. Integration: Responsibility for overall telecommunications system integration and coordination of work among subcontractors, and suppliers shall rest with Contractor named in this contract. Work covered by this division of specifications shall be coordinated with related work indicated on drawings or specified elsewhere under project specifications. All work related to telecommunications system and required for complete and operational systems as detailed in these specifications or the accompanying drawings shall be performed under direct supervision of telecommunications system installer in a manner approved by product manufacturer.
B. General compliance requirements: Provide a complete and operable system in compliance with project drawings, specifications, referenced standards, applicable building codes, and Authority Having Jurisdiction (AHJ) requirements. Scope of this contract includes planning, design, materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on drawings or contained in specifications. Comply with all contract documents, specifications, drawings, manufacturer’s instructions, and HSD and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify HSD’s representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from HSD’s representative.

1.12 DELIVERY STORAGE AND HANDLING
A. General: HSD will, at Contractor’s request, provide appropriate space on site for Contractor trailer or job box; however, Contractor shall be responsible for the deliveries, storing and handling of all materials relative to the systems, including materials supplied by others that are part of the installation contract. Material shall be stored and protected according to manufacturer’s instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

1.13 PERMITS AND INSPECTIONS
A. General: All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.

B. Contractor shall obtain and pay for all licenses, permits, and inspection fees required by local agencies and/or other agencies having jurisdiction (AHJ). Copies of all permits shall be delivered electronically to HSD.

C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.

D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to HSD prior to request for Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations.

E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.

F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the National Electrical Code and other applicable sections of the National Fire Code, as published by the National Fire Protection Association (NFPA).

G. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).

H. All work shall comply with the TIA Standards listed in this document.

1.14 EXAMINATION
A. General: Prior to submitting a proposal, Contractor shall examine sites, review drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor’s proposal, even if not indicated or specified.

B. Bidders’ questions: Should bidders have questions as to intent of drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to HSD in manner dictated by HSD. All answers and clarifications to drawings and specifications will be issued in writing.
C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.15 ADDITIONAL COSTS
A. General: Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.
B. Inspections and testing: For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by HSD to verify Project compliance for same material or equipment, HSD reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions. HSD will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. HSD reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.
C. Exclusions: Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

PART 2 PRODUCTS
2.01 GENERAL
Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer and part number.

All products and materials shall be new and unused prior to their installation as part of this project. Refurbished items are not allowed.

PART 3 EXECUTION
3.01 GENERAL
A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where Division 27 work may properly commence. Start of work indicates acceptance of conditions.
B. Coordinate location of equipment and conduit with HSD prior to execution.
1. Holes through concrete and masonry structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base building.
2. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by HSD as required by limited working space.
3. Holes shall be located so as not to affect structural sections such as ribs or beams.
4. Holes shall be laid out in advance. The HSD shall be advised prior to drilling through structural sections, for determination of proper layout.
5. Structural Penetrate: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors, provide an effective barrier against the spread of fire, smoke and gases.
C. Follow all manufacturers’ instructions and install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

1. In the event of discrepancy, immediately notify HSD through the proper channels. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

D. Protection of Systems and Equipment

1. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

2. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on sides with securely fastened protective rigid or flexible waterproof coverings.

3. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum-cleaned both inside (as appropriate) and outside before testing, operating or painting.

E. As determined by HSD, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of HSD shall be final.

F. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

G. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

H. Access to Equipment

1. Equipment shall be installed as per the detail on the drawings.

2. Working spaces shall be not less than specified in the National Electrical Code® for voltages specified.

3. Where HSD determines that the Contractor has installed equipment not “conveniently accessible” for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by HSD, at no additional cost to HSD.

I. Cleaning

1. During construction, and prior to HSD acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

2. Remove dust and debris from interiors and exteriors of telecommunications equipment (including rough-in).

J. Completion

1. General:
   a. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

2. Results Expected:
   b. Systems shall be complete and operational.
   c. Cleaning work shall be complete.

3. Testing and Verification – General Requirements
   a. Refer to individual sections for additional testing and verification requirements.
b. The Contractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

c. Verification by Inspection: Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the specifications.

d. Verification by Test and Demonstration: The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the communications systems components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test".

e. System Operation Tests Conducted Upon Completion of Work: Upon completion of the Telecommunications Subcontractor's Work, subject the system to functional and operational tests. When required corrections determined by initial test results have been completed, fully retest the system. HSD shall be notified in writing not less than seven days in advance of date of proposed final testing and inspection. The advance notice shall include certification that the installation is complete and operable and that the Contractor has satisfactorily performed the final tests specified herein.

f. The acceptance testing and final inspection shall be accomplished in the presence of HSD. At least 10 days prior to scheduled system completion, the Contractor shall submit, for approval by HSD, a test plan to completely test the telecommunications system. The Contractor shall include in test plan, for acceptance by HSD, a complete and detailed final acceptance test check-off list ("punch list"). The list shall be a complete representation of specified functions and conditions.

END OF SECTION
SECTION 27 05 00 - COMMON WORK FOR COMMUNICATIONS

PART 1 - GENERAL

SECTION 27 17 00

1.01 SUMMARY

A. Drawings and general provision of the Contract, including General and other Conditions, apply to the work specified in this section.

1.02 SECTION INCLUDES

A. Summary
B. General Requirements
C. Environmental Considerations
D. Site Specific Requirements

1.03 RELATED SECTIONS

A. Section 27 05 13 – Communications Services
B. Section 27 05 26 – Grounding and Bonding for Communications Systems
C. Section 27 05 28 – Pathways for Communications Systems
D. Section 27 05 28.29 - Hangers and Backboxes for Communications Systems
E. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems
F. Section 27 05 28.39 - Surface Raceways for Communications Systems
G. Section 27 05 43 - Underground Ducts And Raceways For Communications Systems
H. Section 27 05 53 – Identification for Communication Systems
I. Section 27 08 00 – Commissioning of Communications
J. Section 27 11 00 – Communications Equipment Room Fittings
K. Section 27 13 23 – Communications Optical Fiber Backbone Cabling
L. Section 27 17 00 – testing, Identification and Administration of Fiber

1.05 GENERAL REQUIREMENTS

A. Hillsboro School District is providing new single mode fiber optic cable and infrastructure to support District-wide communications. This contract will be responsible for all aspects of cabling and supporting infrastructure required for functional systems, specifically:

1. Pathways as per Section 27 05 28 and as called out on Drawings.
2. Outside plant conduit and vault system and related components as called out in Section 27 05 43, site narrative(s) or as noted on Drawings
3. Installation of fiber backbone between the demarcation points within each of HSD’s facilities as identified in these specifications and as depicted on Drawings. Testing of fiber cabling systems in accordance with ANSI/TIA-568 and as outlined in Section 27 08 00.
4. Creation of as-built documentation, both electronically and printed, as specified in these documents.

B. All work outlined in these documents and on the accompanying Drawings must be prior to the substantial completion date called out in this bid package, specifically:

1. All construction from utility right-of-way to the point of demarcation.
2. All raceway (including requisite surface mounted raceway), conduits, and junction boxes required for telecommunications pathways.
3. Installation and testing of all fiber optic cabling to allow District to install active electronics and bring complete systems live.
4. Test results and as-build documentation as per Section 27 05 13.
1.06 SUMMARY

A. The intent of the Division 27 Specifications and the accompanying Drawings is to provide a complete and workable system as shown, specified and required by applicable codes and the Authority Having Jurisdiction (AHJ). Include all work as specified in Division 27 and shown on the accompanying Drawings, including appurtenances, to provide a complete and functional system.

B. The Division 27 Specifications and accompanying Drawings are complementary and what is called for in one shall be as binding as if called for in both. Items shown on the Drawings are not necessarily included in or called out in the Specifications and vice versa. Specifications shall supersede Drawings in the case of a conflict.

C. Imperative language is frequently used in the Division 27 Specifications. Except as otherwise noted, such requirements are to be performed by the Contractor or a Sub-contractor directly responsible to the Prime Contractor performing the Division 27 work.

D. The Drawings accompanying Division 27 (T series) are diagrammatic. They do not show every component of a complete telecommunications premises distribution system which may be required to accommodate unique building construction features or materials installed by other trades. The Drawings are to be followed as closely as practical while making necessary adjustments in the placement of cable to facilitate the overall construction of the building without additional cost to the Owner. The right is reserved to make any reasonable changes in Telecommunications Outlet locations prior to roughing-in.

1.07 ENVIRONMENTAL CONSIDERATION

A. Except as noted for purposes of recycling, all construction related debris; packaging and waste materials will be removed from the job site each day and disposed of by the Contractor.

1.08 SITE SPECIFIC REQUIREMENTS

A. Site details are shown on the accompanying drawings.

1.09 DEVICE LOCATIONS

A. Demarcation locations as per the accompanying Drawings.

PART 2 (NOT USED)

PART 3 (NOT USED)

END OF SECTION
SECTION 27 05 13 - COMMUNICATIONS SERVICES

PART 1 - GENERAL REQUIREMENT

1.01 SECTION INCLUDES

A. Basic Communication Requirements
B. Administrative Requirements
   1. Contract Documents, Quality Assurance, and Manufacturer’s Warranty
   2. Technical Qualifications
   3. Certificates and Reference Standards
   4. Laws and Regulations, Permits
   5. Submittal and Substitution Information
   6. Environmental Requirements
   7. Progress Drawings and Schedules

1.02 RELATED SECTIONS

A. Section 27 0000 - Communications
B. Section 27 0005 – Common Work Results for Communications
C. Section 27 0526 – Grounding and Bonding for Communications Systems
D. Section 27 0528 – Pathways for Communications Systems
E. Section 27 0528.29 - Hangers and Supports for Communications Systems
F. Section 27 0528.39 - Surface Raceways for Communications Systems
G. Section 27 0553 – Identification for Communication Systems
H. Section 27 0800 – Commissioning of Communications
I. Section 27 1100 – Communications Equipment Room Fittings
J. Section 27 1323 – Communications Optical Fiber Backbone Cabling
K. Section 27 17 00 – testing, Identification and Administration of Fiber

1.03 BASIC COMMUNICATION REQUIREMENTS

A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture.
B. The Contractor shall field-investigate all District facilities to ascertain the exact physical conditions at the point of demarcation (typically in the main Equipment Room [MDF]) to become familiar with the physical environment of the building.
C. The Contractor shall provide, install, and test the entire fiber optic cable infrastructure as described under this contract.
D. The Contractor shall call attention to the Owner any error, conflict, or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until a resolution or clarification has been made. Supplemental Plans and Specifications may be supplied as required and shall become part of the Contract Documents.

1.04 CONTRACT DOCUMENTS

A. The contract documents, such as drawings, schedules and specifications are used to describe the required work.
B. The work to be performed under the contract documents includes furnishing all labor, materials, equipment and services necessary, whether listed in the specifications or not, to construct and install the complete communications infrastructure as shown on contract drawings and specifications.
C. The drawings and schedules depict, in general, application-dependent data while the narrative/specifications, in general, define broader requirements, such as overall quality.
D. The Contractor shall follow all specifications herein. In case of conflict between drawings and specifications, the latter shall prevail unless authorized in writing by the Owner.

F. Supplementary Details and Plans may be supplied as required. They shall be issued as addendum and shall become a part of the Contract Documents.

1.05 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all Telecommunications Industry Association (TIA) and BICSI recommended installation practices and manufacturer’s guidelines when installing communications components.

1.06 TECHNICAL QUALIFICATIONS

A. A minimum of three references demonstrating Contractor’s past installation experience in similar projects. The Contractor must supply a one year warranty upon completion of the job.

B. All Journeymen are to possess a current Oregon License.

C. All Apprentices are to be actively enrolled in an Oregon State approved electrical apprenticeship program.

D. All Equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of training courses, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.

E. Verification of the above requirements must be submitted in writing with bid.

1.07 REFERENCE STANDARDS

A. This section references the latest revisions of the following documents. In case of conflict between the requirements of this section and those of the listed documents, the more stringent shall prevail.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>ANSI/TIA-568x</td>
<td>Building Telecommunications Wiring Standards</td>
</tr>
<tr>
<td>ANSI/TIA-569</td>
<td>Commercial Building Standard for Telecommunications Pathways and Spaces</td>
</tr>
<tr>
<td>EIA RS-310-C</td>
<td>Racks, Panels, and Associated Equipment</td>
</tr>
<tr>
<td>UL 94</td>
<td>Tests for Flammability of Plastic Materials and Parts in Devices and Appliances</td>
</tr>
<tr>
<td>ANSI/ICEA S-80-576-1988</td>
<td>Communications Wire and Cable for Wiring of Premises</td>
</tr>
<tr>
<td>ANSI-TIA-607-C</td>
<td>Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises</td>
</tr>
<tr>
<td>UL1863</td>
<td>Standard for Communication Circuit</td>
</tr>
</tbody>
</table>
1.08 LAWS AND REGULATIONS

A. This section references the latest revisions of the following documents. In case of conflict between the requirements of this section and those listed documents, the requirements of the listed documents shall prevail.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA-70</td>
<td>National Electric Code® (NEC®) plus all Oregon State Electrical Code plus local County and City Amendments</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
</tr>
<tr>
<td>UL®</td>
<td>Underwriters Laboratories Inc.</td>
</tr>
</tbody>
</table>

Oregon Fire Code

1.09 UNDERWRITERS LABORATORIES LISTING

A. Unless otherwise specified, electrical equipment and material shall be listed and labeled by Underwriters Laboratories (UL®) for the purpose for which it is used. This requirement may be waived only if a UL® listing is not available for this type of product. Telecommunications cables are acceptable if UL® recognized.

1.10 PERMITS, LICENSES AND TAXES

A. Contractor shall obtain and pay for permits, inspections, licenses and taxes applicable to this work. Copies of all permits and inspections are to be prominently displayed at each site. Copies of all inspection reports are to be presented to Owner upon closeout of project.

B. Contractor is required to adhere to standard specification as detailed by the latest version of ODOT Standard Specifications. District will absorb the costs for railroad and DOT permits.

C. Before any construction may occur, the contractor shall have plans which have been signed and approved by ODOT, all required permits obtained, and all required bonds posted. A pre-construction conference shall be held prior to the start of construction.

D. All work and materials within the ODOT Right-of-Way shall be in accordance with the "Oregon Standard Specifications for Construction" Oregon State Department of Transportation, 2018 Edition, http://www.oregon.gov/ODOT/HWY/SPECS and the project specifications. This may specifically impact work on or around:

1. State Highway 8 (TV Highway)
2. State Highway 10 (SW Farmington Road)
3. US Highway 26 (Sunset Highway)
4. State Highway 219

E. A copy of the approved plans must be on the job site whenever construction is in progress.

F. If mailboxes need to be moved or rearranged, the contractor shall coordinate with the U.S. Postal Service for the new location of the mailbox structure.

G. Any roadway signage or stripping removed or temporarily moved by the contractor shall be restored so as to meet the current ODOT standards unless shown otherwise.

H. It is the responsibility of the contractor to provide adequate temporary traffic control to ensure traffic safety during construction activities. Therefore, the contractor shall submit a traffic control plan to the appropriate public works department at least 48 hours prior to starting any work in the right-of-way.
I. All traffic control devices shall conform to the “Manual on Uniform Traffic Control Devices” (MUTCD) or as modified by the traffic engineer so authorized by the Authority Having Jurisdiction (AHJ). All work requiring lane closures must be pre-approved. Fire, pedestrian, and vehicular access shall be maintained at all times, except when contractor has permission to close and access. Pedestrian access must be maintained in accordance with ADA requirements during any sidewalk closure.

J. Allowable work hours will be daylight hours only. No work days will be allowed Saturday, Sunday or holidays unless authorized by Hillsboro School District, State of Oregon, County or City. In no case will work commence before 7:00 am nor continue beyond 6:00 pm.

K. Contractor shall provide a weekly look-ahead schedule not later than 2:00 pm the preceding Friday detailing the projected areas where work will be occurring. In addition, a daily schedule shall be provided not later than 2:00 pm each day that covers the specific locations for work activities.

1.11 OTHER CONSTRUCTION REQUIREMENTS AND RESTRICTIONS

A. Trucks shall remain on paved surfaces and the construction at all times. All excavated material shall be disposed at an approved and permitted disposal site. Stockpiling on site will not be permitted.

B. Wherein at all possible, directional boring equipment shall be placed on District owned property or in the utility right-of-way. In the event it is necessary to cross private property a minimum of 24 hours advance coordination is required with the property owner.

C. Contractor shall provide bore logs prior to project final approval

D. Any existing public or private property and improvements damaged during construction shall be replaced at no additional cost prior to final inspection. The road pavement removal shown is the minimum amount of pavement removal needed. The contractor shall protect the existing pavement edge to remain. If the existing pavement and pavement edges adjacent to the saw cut is damaged in any way, the contractor shall saw cut and remove the damaged pavement at no additional cost. The new saw cut line will be as directed by the inspector from the AHJ.

E. Any existing sidewalk damaged during construction shall be replaced at no additional cost prior to final inspection. Concrete shall be finished to match existing.

F. Contractor must provide steel plating to cover open trenches in order to maintain traffic and vehicle access.

1.12 SUBMITTALS

A. General: Owner must approve all submittals before the start of fabrication (or shipment, for stock items) of any equipment requiring submittals.

B. Drawings
   1. The Contractor shall submit shop drawings for any modification or new product installation not previously identified in bid documents.
   2. The drawing must be submitted not less than five (5) days (weekends and national holidays excluded) before the scheduled work begins.
   3. The Contractor shall proceed with the installation only after approval from the Owner.

C. Materials List: The Contractor shall submit a list of all materials for the proposed work.

D. Firestopping: The Contractor shall comply with all requirements of Authority Having Jurisdiction
E. **Sound Deadening Materials**: The Contractor shall submit a list of acoustic separation products and procedures. The submittal shall include the manufacturer's technical data for each product including product description, specifications (including labeling or listing by an agency acceptable to the Owner), and storage requirements.

F. **Material Safety Data Sheets**: Supply Material Safety Data Sheets (MSDS) to Owner for all material accompanied by such.

G. **Test Plans**
   1. The Contractor shall submit a plan for the testing the installed network.
   2. The test plan shall include test equipment to be used, procedure and report structure.

H. **Certificates**
   1. Construction Permits
   2. The Contractor shall post a copy of the all permits at the respective site (or possess such in their field office) and email a copy to the Owner.
   3. The Contractor shall provide copy of approved permits to the Owner certifying that the work has been inspected and that the work conforms to the requirements of the Authority Having Jurisdiction.

1.13 **REQUESTS FOR SUBSTITUTION**

A. Substitution of items shown in the contract documents must be requested in writing.

B. Approval shall be by written addendum or change order. Substitutions made without prior written approval will be reversed and all costs related to reversal will be the responsibility of the Contractor.

C. Contractor shall be responsible for any design changes and costs related to substitution approval.

D. The functions and features specified are vital to the operation of these facilities; therefore the acceptance of alternate manufacturers does not release Contractor from strict compliance with the requirements of the specification.

1.14 **ENVIRONMENTAL SAFETY REQUIREMENTS**

A. Parking spaces for installer’s trucks shall be provided by HSD at each site; however, spaces are very limited and must be coordinated with the designated District project manager. In no case will handicap access be compromised at any time.

B. Job site trailer, if required, shall be coordinated with HSD prior to placement. Secured storage is the responsibility of the Contractor.

C. Construction of dewatering (groundwater) systems shall be in accordance with the ODOT standard specifications. During excavation, at bore pits and trenches, excavations shall be kept free of water. The contractor shall control surface run-off so as to prevent entry or collection or water in excavations. The static water level within the excavation shall be drawn down a minimum of 1 foot below the bottom of the excavation so as to maintain the undisturbed state of the foundation soils and allow acceptable placement of any bedding or backfill to the required density.
D. The contractor shall furnish, install, and operate all necessary equipment to keep excavations free from water during construction. Dewatering systems shall be contractor designed and operated so as to prevent any removal or flowing of native soils. Disposal of the water shall not cause injury to public or private property or nuisance to the public and shall be approved by ODOT. Discharge to the ODOT storm drain system shall meet state ecology turbidity requirements. Sufficient pumping and power equipment in good working condition shall be available at all times.

E. All bore pits shall be compacted to 95 percent density in roadways, roadway shoulders, roadway prism and driveways and 85 percent density in unpaved areas. Excavation, trenching and shoring for all utility work existing and new shall be in accordance with Oregon Administrative Rules, Chapter 437 DIVISION 3 (29 CFR 1926) CONSTRUCTION as well as Oregon Occupational Safety and Health Division and Federal Occupational Safety and Health Administration requirements.

F. The contractor’s trench safety system shall be a protective system designed and maintained by a competent person and shall meet accepted engineering requirements or practices. This trench safety system may require the use of a support system in locations not designated in the contract as requiring a support system.

G. The contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, confined space protections, flaggers, and any other needed actions to protect the life, health, and safety of the public and to protect property in connection with the performance of work covered by the contract. Any work within the traveled right-of-way that may interrupt normal traffic flow shall require a traffic control plan approved by ODOT, and the County or City public works. All sections of the ODOT Standard Specifications, Traffic Control, and the Manual of Uniform Traffic Control Devices (MUTCD) shall apply.

1.15 PROGRESS DRAWINGS AND SCHEDULES
A. All drawings shall be revised as necessary during the course of the work.
B. The Contractor shall maintain one neatly and legibly marked (redlined) set of full-size Drawings accurately depicting as-built locations, changes, and repairs made during the work.
   1. Marking of the Drawings shall be kept current.
   2. Drawings shall be delivered to the Owner prior to final progress payments.

PART 2 - PRODUCTS
2.01 GENERAL
A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.
B. Quantities are to be determined by Contractor unless specified.
C. Products shall be UL® listed for the purpose they are to be used.

2.02 PRE-APPROVED PRODUCT SETS
A. The following product sets are pre-approved for this project. Except as noted, all others will require a substitution request to be completed and approved as per these documents. HSD will not consider product sets that have not been pre-approved or accepted as per the substitution request process.
   1. Fiber optic cable and connection/termination products shall be manufactured by one of the following:
      a. Optical Cable Corporation
      b. Corning
SECTION 27 05 13
COMMUNICATIONS SERVICES

HILLSBORO SCHOOL DISTRICT
FIBER OPTIC CABLE INFRASTRUCTURE UPGRADE

RFP # - TS2018-01

2. All ancillary components, attachment hardware, support structures shall be at the contractor’s discretion; however, District will have final approval of material list submittal.

2.03 FIRESTOPPING
A. Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.
B. Firestopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits and cables.
C. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be performed by installer of fireproofing and paid for by section responsible for damage and shall not constitute grounds for an extra to Owner.

2.04 ACOUSTIC SEPARATION
A. Acceptable products for 2” through 4” penetrations are as follows
1. STI EasyPath™
2. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
3. Or approved substitution
B. Acceptable products for less than 2” penetrations are as follows
1. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
2. Or approved substitution

PART 3 - EXECUTION

3.01 GENERAL
A. Manufacturer's installation instructions and requirements shall be strictly adhered to in the telecommunications equipment installation, fabrication and testing process.
B. Where conflicts arise between the requirements of this Specification and the manufacturer's installation instructions, the Owner shall be consulted for resolution.
C. All fiber optic cabling shall be installed according to manufacturers’ installation guidelines, and according to related ANSI/TIA-568-C standards.
D. All installed cables shall be kept free from nicking, abrading, or cutting during storage and during the installation process.
E. Cable shall be installed into conduits after conduit installation is complete and appropriate bushings or couplers have been installed. Manufacturers’ recommendations for maximum pulling tensions and minimum bend radii for all cables must not be exceeded.
F. Care shall be exercised in wiring to avoid damage to wiring and equipment.
G. All support equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads.
H. Open areas requiring suspension for cables will employ properly rated support mechanisms and devices to accommodate future addition of cable.
I. The installation must conform to OSHA standards and comply with state and local safety codes.
J. Installation shall be neat, well organized, and professional.
K. Any discrepancies, conflicts or issues must be brought to the attention of the Owner before installation or as soon as possible thereafter.

L. The Contractor shall clean up any work area exposed to traffic at the end of each day. At the end of the project all material removed or left over, and/or not being used shall be removed from the project site unless other arrangements have been made. A final clean up shall be made before final payment is made.

M. All wall and floor penetrations shall be fire stopped at or before substantial completion.

3.02 BURIED FIBER OPTIC CABLE

A. All buried cables or wires, and accessory materials used in the construction of the Project must be handled with care. Each reel of buried cable or wire must be inspected for damage. All damage must be repaired to the satisfaction of the Owner and in accordance with the methods or other instructions described herein. If reel wrap is present, the reel wrap must remain intact on the reel until the cable or wire is ready to be placed.

B. The construction equipment must be subject to the approval of the Owner and the AHJ(s) over highway and road rights-of-way.

C. The design of the plowshare must be such that the buried fiber cable, conduit or wire passing through the plow must not bind. The plowshare must have a removable gate for the purpose of inspection, and a hinged fairlead, which must be equipped with smooth, freewheeling rollers or low friction surfaces to prevent damage to the cable, conduit or wire. The equipment shall be capable of extending the plow a minimum of 6 inches below the specified depths under all terrain conditions.

D. Care is to be exercised during the plowing operation, to feed the cable, conduit or wire into the ground through the plow loosely and at no tension. Equipment and construction methods must be such as to assure compliance with this requirement. The Contractor must furnish competent supervision at all times at the site of plowing operations to assure compliance with this requirement.

E. If, during the plowing operation, the plow should strike a buried object or rock that stops the equipment which necessitates removal of the plow from the ground, the plow must be removed from the ground carefully, and if practicable without backing the plow, to avoid damage to the cable, conduit or wire. Should it be necessary to back the plow to remove it from the ground, the cable or wire must be uncovered a sufficient distance back for inspection by the Contractor’s project engineer to determine whether the cable or wire has been damaged.

F. Every instance of damaged cable, conduit or wire observed at any time whether prior to installation, occurring during construction, or discovered by test or observation subsequent to installation in plant, must be immediately called to the attention of the Contractor’s project engineer. The method of repair or correction of such damage must be in accordance with the written instructions of the Contractor’s project engineer. The Contractor must promptly repair such damage or make such corrections in accordance with such written instructions of the Contractor’s project engineer. Minor damage to the outer jacket of the cable or wire observed prior to or occurring during construction must be repaired in accordance with RUS Splicing Standard Bulletin 1753F-401(PC-2).
G. Major damage to cable or wire observed prior to or during construction must be corrected by enclosing the damaged section of cable or wire in (1) a buried plant housing located as specified by the Contractor’s project engineer or (2) a buried splice closure if approved by the Contractor’s project engineer, which are buried to the same depth as that required for the cable or wire. If the shield has been broken or the conductor insulation damaged, the cable or wire must be restored to the equivalent of new condition. This may require cutting out the damaged section of cable or wire if required by the Contractor’s project engineer.

H. Major damage to cable, conduit or wire discovered after placement either through test or observation must be repaired as approved by the Contractor’s project engineer. This may require cutting out the damaged section and replacing it with a short section of new cable, conduit or wire with splices made in (1) buried plant housing or (2) buried splice closures, if approved by the Contractor’s project engineer, which are buried to the same depth as that required for the cable or wire. It may also require the replacement of an entire section between housings already installed.

I. Warning Tape shall be required for all buried cable installation process except when directional boring operation are used and shall be as follows:
   1. Extra Stretch terra tape
   2. Minimum of six inches (6") wide
   3. Orange in color with black lettering which reads “Caution Buried Fiber Optic Cable Below”
   4. Placed in the Trench a minimum of twelve inches (12") above all conduit/fiber.

J. The Contractor’s Project Engineer should periodically inspect the cable, conduit or wire as well as the installation equipment and procedures during installation to guard against damage to the cable, conduit or wire when it is being placed in the ground, and to see that proper depth is maintained.

K. The Contractor must promptly repair any damage to fences, lawns, shrubbery, drives and any other property damaged during construction.

L. A rock excavating unit (BM71) must be applied where a plow train cannot maintain specified depth under the buried cable, conduit or wire unit (including ripping). To assist in determining the ability of any plowing equipment to place the cable/conduit at a specified depth, the table below must be used only to compare the capability of this equipment with standard minimum drawbar pull ratings.

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Minimum Drawbar Pull pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>55,000</td>
</tr>
<tr>
<td>30</td>
<td>75,000</td>
</tr>
<tr>
<td>36</td>
<td>95,000</td>
</tr>
<tr>
<td>48</td>
<td>135,000</td>
</tr>
<tr>
<td>60</td>
<td>175,000</td>
</tr>
</tbody>
</table>

M. The equipment and construction methods used by the Contractor must be such as to cause minimum displacement of the soil. The slot made in the soil by the cable plow must be immediately closed.

N. Damage to banks, ditches, driveways and roads caused by the equipment must be immediately repaired to the satisfaction of the AHJ(s) over highway and road rights-of-way where involved.

O. Where cables, conduit or wires are buried near the edge of pavements, the Contractor must take particular care to avoid damaging the pavement. If such damage does occur repairs must be made immediately to meet the requirements of state or local authorities having jurisdiction over the pavement involved.
P. The stub pole or stake portion of stake mounted housings must be installed in accordance with the manufacturer’s instruction sheets in a manner not to damage the cable or wire placed in the trench.

Q. To avoid possible damage to buried cable or wire from exposure to traffic, livestock and other hazards, trenching of laterals, trenching around culverts, construction of aerial inserts and similar operations must be completed as soon as practicable behind the plowing operation.

R. Trenches must be promptly backfilled with earth and tamped at 6” lifts so that the earth is restored to original grade to assure no hazard to vehicular, animal or pedestrian traffic. No trenches will be left open overnight.

S. When placing cable, conduit or wire in a trench in rock, the cable or wire must be cushioned by a fill of sand or selected soil at least 2” thick on the floor of the trench. The backfill for at least 4” above the cable or wire must be free from stones, rock or other hard or sharp materials, which might damage the cable. Alternate methods are permissible subject to approval of the AHJ.

3.03 BURIED CABLE DEPTH

A. Unless otherwise specified by the Contractor’s project engineer above the depth of buried cable or wire placed, measured from the top of the cable or wire to the surface of ground or rock must be as listed below:

1. Minimum depth in soil (Mainline) - 36 inch
2. Minimum depth at ditch crossings 36 inch
3. Minimum depth in rock 24 inch (152 mm) Rock to surface.

Note: ODOT requires contractor to place at a depth of 48” and 60” below culverts, for portions on ODOT right-of-way. If such occurs in solid rock in, 24’ is permitted with a concrete cap over the conduit.

B. In the case of a layer of soil over rock, either the minimum depth in rock, measured to the surface of the rock, or the minimum depth in soil, measured to the surface of the soil, may be used at the Contractor’s Project Engineer’s option.

C. When rock excavating is required, width and depth requirements of the trench must be:

<table>
<thead>
<tr>
<th>Trench Width</th>
<th>Trench Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>10” (or greater)</td>
<td>24”</td>
</tr>
</tbody>
</table>

Either the minimum depth in rock must be achieved or some other method may be employed by the Contractor to provide adequate protection to the cable or wire as agreed to by the AHJ, e.g. concrete cap.

3.04 BURIED CABLE SPLICES

A. Buried fiber optic cables or wires may be spliced directly but such must be accomplished in a re-enterable splice case that is accessible from above ground such as a pedestal or fiber hand hole. Splicing must be performed in a manner that leaves a minimum of 10’ of coiled slack fiber for future access.

3.05 AERIAL FIBER OPTIC CABLE

A. This contract shall be responsible for the identification of all poles required for aerial routing. Contractor shall complete all pole permit applications required for use and forward approved forms to District for payment processing.

B. The contractor shall supply all the labor and material associated with installation of slack storage devices for aerial cable. The contractor shall use the Preformed FIBERLIGN® CLAS (Center-Lock Aerial Slack) storage system for All Dielectric Self Supporting (ADSS) cables and lashed messenger cable.

C. Class A galvanized steel utility grade strand or Extra High Strength (EHS) galvanized steel strand shall be used.
D. All construction and installation work shall be done in a thorough and workmanlike manner in accordance with the specifications and drawings and shall be subject to acceptance by the Owner.

E. All aerial cables, and accessory materials used in the construction of the Project shall be handled with care. Each reel of aerial cable shall be inspected for damage. Any damage shall be repaired to the satisfaction of the Owner. If reel wrap is present, the reel wrap shall remain intact on the reel until the cable is ready to be placed.

F. The latest revision of the National Electrical Safety Code (NESC) and the National Electrical Code (NEC®) shall be followed in every case except where local regulations are more stringent, in which case local regulations shall govern.

G. All bolts employed for the mounting of hardware items on poles shall be long enough to fully engage the nut (including locknut, where applicable) but shall not extend more than 2” beyond the nut after the nut is tightened. The ends of bolts shall not be cut.

H. Where physical obstructions make it necessary to pull cable along the line from a stationary reel, cable stringing blocks shall be used to support the cable during all placing and tensioning operations. Ladders, cable cars and other equipment shall not be placed on or against the cable.

I. During installation, maximum pulling tension and minimum bending radius of the aerial fiber optic cable shall not exceed the cable manufacturer’s recommendations.

J. Initial stringing tension, maximum permissible span length, and sagging shall be in accordance with the cable manufacturer’s recommendations.

K. The support messenger of fiber optic cable shall be grounded in a manner that satisfies the AHJ.

L. Cable guards shall be applied over the cable at points of potential abrasion such as at supports, and in locations where tree trimming is not permitted.

M. During the placing operation, precautions shall be taken to prevent slippage of the cable sheath or jacket over the core. Splicing of the optical fibers shall be performed in accordance with RUS Splicing Standard Bulletin 1753F-401 (PC-2). Splicing of the support member shall be performed in accordance with the method specified by the manufacturer.

N. The cable shall be installed within a reasonable time after the strand is installed and tensioned. If a delay in installing cable in excess of 24 hours is encountered, temporary dampers shall be installed on the strand.

O. When tensioning strand the cable suspension clamps shall be loose enough to allow free movement of the strand.

P. Suspension strand shall be placed in accordance with the manufacturer’s instructions and shall be tensioned in accordance with same.

Q. The suspension strand shall be placed on the roadside of the pole line.

R. In tangent construction, the lip of the suspension strand clamp shall point toward the pole. At angles in the line, the suspension strand clamp lip shall point away from the load.

S. In level construction the suspension strand clamp shall be placed in such a manner that it shall hold the strand below the through-bolt. At points where there is an up-pull on the strand, the clamp shall be so placed that it shall support the strand above the through-bolt.

T. When a thimble-eye bolt is used both to mount the suspension strand clamp and to make the guy attachment, the size of the suspension strand clamp shall be governed by the size of the thimble-eye bolt required for the guy.
U. Tensioning the strand shall be in accordance with air temperature as per manufacturer’s instructions.

V. The suspension strand shall be made electrically continuous throughout its entire length.

W. Suspension strands shall be bonded to other bare cable suspension strands, and guys on the same pole and grounded by connection to ground leads. The lashing wire shall be terminated at each pole and the cable shall be supported and protected at the suspension clamp. Where the strand is to be grounded to a multi-grounded neutral on a pole which does not carry a vertical pole ground wire, a #6 AWG bare copper wire shall be left coiled and taped to permit it to be extended up the pole and connected to the multi-ground neutral by a representative of the servicing power company. This contract shall coordinate such bonding and grounding activities.

X. Cable shall be lashed with lashing wire to the suspension strand by means of a suitable lashing machine. The pitch of the lashing wire may be from 10” – 15” but must be constant for any section of cable of the same size and gauge. For cables of ¾” or larger in diameter, the lashing wire shall be placed with a tension of 35 to 40 lbs. Cables having a diameter less than ¾” shall be lashed with a lashing wire tension of 18 to 25 lbs.

Y. During the placing operation, precautions shall be taken to prevent slippage of the cable sheath or jacket over the core. The cable shall be snug against the suspension strand throughout the span. It shall be supported in a position directly below the strand insofar as possible, except where spiraling has been specified. Where more than one cable is placed on a strand, the cables shall be symmetrically arranged so that the cables are snug against the suspension strand and against each other. At lashing wire terminating points, the tension placed in the lashing wire by the lashing machine shall be maintained. No slack in the lashing wire shall be permitted to run into the span. Splicing of lashing wire is not allowed.

Z. Where suspension strand attachments such as suspension strand cross-over, suspension strand pull-offs, etc., are encountered in the span, a positive separation shall be provided between the suspension strand attachment and the cable, and the cable shall be supported and protected in accordance with the manufacturer’s instructions. Spiraling of the cable shall be performed within 48 hours of the tensioning operation.

3.06 SPLICING OF AERIAL FIBER

A. All closures shall be PLP Coyote® closure, or equivalent, consisting of an aerial splice closure and the closure manufacturer’s provided encapsulating material if required. It also includes all necessary hardware items to support the cable adjacent to the closure and to terminate the lashing wire. The fiber organizer trays shall be supplied as part of the Splice Case Closure.

B. Cable closures shall be installed in accordance with the manufacturer’s instructions. Splicing shall be performed in accordance with RUS Splicing Standard Bulletin 1753F-401 (PC-2).

C. Splice closures shall be individually inspected during installation for proper encapsulation and/or flash tested when applicable.

D. An optical time domain reflectometer (OTDR) shall be used for testing splices. The OTDR shall be stationed at the launch point for testing individual splices as they are made and for end-to-end signature tests for the fiber optic link. An optical power meter shall be used for end-to-end cable acceptance tests.
E. The OTDR tests will be as per Section 27 08 00 for 100% of the cable strands including continuity test to ensure entire span is being tested. Continuity test will be completed by exposing inside end during test and then capping strand end to create a reflective event.

F. The following specifications and expectations are to be met or exceeded:
1. All Feeder fibers shall be tested loss and strand attenuation, both 1310nm and 1550nm light frequencies shall be tested.
2. Launch cables will be used to give better resolution to events at the near end and far end terminations.
3. Each strand shall be tested in bi-directional end to end.

G. An electronic copy of the test results that summarizes the splice loss and fiber strand attenuation for each span, as well as an OTDR trace for all spans shall be provided to the Owner in a Windows viewable format.
1. Average span splice loss to be .15db or better. The maximum splice loss per individual strand will be .20 db.
2. Raw fiber adapters will be used to test any un-terminated Feeder Fibers.

3.07 USE OF PREMISES
A. **General:** Use of premises shall be restricted as directed below:
1. **Cleaning and rubbish removal:** Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. When working in a facility, put premises in neat and clean condition to provide acceptable appearance and operation of equipment, to satisfaction of District.
2. **Rubbish Removal:** Provide for the removal from the site of all spoils, debris, boxes, packaging, crates, and trash generated from the work.
3. **Storage:** Store materials maintaining an orderly, clean appearance. If stored on site in open or unprotected areas, all equipment and material shall be kept off ground and covered with tarpaulins.

3.08 PREPARATION
A. Before installation of cabling and/or equipment in telecommunications spaces, the Contractor shall field-investigate each facility and ascertain if the physical conditions within the facility shall permit commencement of the Contractor’s work.
B. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of the Owner.

3.09 DOCUMENTATION
A. **Test Reports**
1. The Contractor shall compile test results into the forms that contain all applicable test data. Hard copy output indicating successful testing of every location is not required.
2. A USB flash drive containing all test data and a Windows-based viewer shall be provided.

3.10 AS BUILTS
A. Contractor will be provided the T series AutoCAD® drawings electronically. These drawings shall be the base drawings for the as built documentation with the following being provided by the Contractor as a separate AutoCAD® layer:
1. Cable routing
2. Cable ID.

END OF SECTION
SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 SUMMARY
A. This section includes the grounding and bonding requirements for the metallic components located in the Telecommunications Rooms.

1.02 SCOPE
A. Provide all labor, materials, tools, and equipment required for the bonding and grounding of all metallic components associated with the installation of fiber optic termination equipment in the telecommunications rooms.
B. Included in this section are the minimum composition requirements and installation methods for the following:
   1. Busbars
   2. Bonding accessories

1.03 QUALITY ASSURANCE
A. See Section 27 05 13
B. All grounding and bonding cables shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
C. Grounding shall meet applicable ANSI/TIA-607-B, NEC Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice. All racks and cable trays shall be bonded to a ground bar with #6 AWG cable. All termination equipment shall be grounded according to the specifications of the manufacturer.
D. Impedance shall not exceed 5 Ω between any two metallic points within a Telecommunications Room.

PART 2 - PRODUCTS

2.01 GROUND BUS BAR – TELECOMMUNICATIONS ROOM
A. Telecommunications Grounding Busbar (TGB) shall be constructed of .25” thick solid copper bar.
B. The busbar shall be 2” high and 12” long and shall have 9 attachment points (one row) for two-hole grounding lugs.
C. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI/TIA/607-B and shall accept lugs with 5/8” and 1” hole centers.
D. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” standoff from the wall.
E. The busbar shall be UL® Listed as grounding and bonding equipment.

2.02 CABLE RUNWAY BONDING STRAPS
A. Continuous #6 AWG with two hole compression lugs, Chatsworth 40164-001 or approved alternate.
B. #6 AWG from bench stock is acceptable with machine compression or exothermically applied lugs.
2.03 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block
   1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
   2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
   3. The conductors shall be held in place by two stainless steel set screws.
   4. Ground terminal block shall have two .25” holes spaced on 5/8” centers to allow secure two-bolt attachment to the rack or cabinet.
   5. Ground terminal block shall be UL® Listed as a wire connector.

B. Compression Lugs
   1. Compression lugs shall be manufactured from electroplated tinned copper.
   2. Compression lugs shall have two holes spaced on 5/8” or 1” centers, as stated below, to allow secure two bolt connections to busbars.
   3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
   4. Compression lugs shall be UL® Listed as wire connectors.

C. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

D. C-Type, Compression Taps
   1. Compression taps shall be manufactured from copper alloy.
   2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
   3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
   4. Compression taps shall be UL® Listed.

PART 3 - EXECUTION

3.01 GENERAL

A. The following applies only to telecommunications spaces where a recognized grounding busbar is not already in place. In the event the telecommunications room is already properly equipped with a telecommunications busbar, this contract shall only be responsible for insuring that all components placed in the telecommunications rack are properly bonded to the grounding system.

B. A copper bonding and grounding system shall be installed which places a properly sized (as per Table 250-122 of National Electrical Code) copper cable in the immediate vicinity of the telecommunications backboard. Contractor shall be responsible for placement of the above referenced ground busbars and terminal(s) as well as their connection to the building system grounding cable using an exothermic-welded type connector or appropriate compression applied connector to satisfy the Authority Having Jurisdiction.

C. Bonding and grounding shall meet applicable ANSI/TIA-607-B, NEC® Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice. All racks and cable trays shall be bonded to a ground busbar with #6 AWG cable. All termination equipment shall be bonded to a known source of building system ground according to the specifications of the manufacturer.
3.02 TELECOMMUNICATIONS BONDING AND GROUNDING SYSTEM USING STRUCTURAL METAL (The following two paragraphs are as per directives in ANSI/TIA/607-C)

A. When structural metal is bonded to the building’s grounding electrode system it may be used in place of a TBB or a GE. Before utilizing structural metal in place of a TBB or a GE, building plans (including as-builts as applicable) and specifications shall be reviewed to ensure the structural metal is electrically continuous or can be made so. Additionally, the two-point continuity test described in ANSI/TIA-607-C should be performed from floor-to-floor on the structural metal, thereby ensuring electrical continuity through the entire structure. Concrete reinforcing steel shall not be used as a TBB or a GE.

B. Connections to the TMGB/TGB: The bonding conductor from the structural metal to the TMGB or TGB shall be sized according to table 1 of ANSI/TIA-607-B. Bonds to structural metal shall be made by listed exothermic welding, listed compression or listed mechanical connectors and shall be accessible. Bonds to the TMGB or TGB shall be made as specified in ANSI/TIA-607-C. Components to be connected to the TMGB or TGB shall be as specified in ANSI/TIA-607-C.

3.02 PREPARATION

A. Preparation of surfaces: Clean contacting surfaces of ground connections to bright metal before connecting

B. When making bolted connection to aluminum or galvanized structures, apply a corrosion-inhibitor such as Penetrox A to contact surfaces between connector, and surface of structure.

3.03 INSTALLATION

A. Outdoor Grounding and Bonding Connections: All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.

B. Wall-Mount Busbars

1. Attach busbars to the wall with appropriate hardware according to the manufacturer’s installation instructions.
2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

C. Rack-Mount Busbars and Ground Bars

1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.
2. Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer’s installation instructions.
3. Bond the rack-mount busbar or ground bar to the room’s TMGB or TGB with appropriately sized hardware and conductor.
D. Ground Terminal Block
1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

E. Cable Runway Bonding Straps
1. Bond equipment to a vertical rack-mount busbar using bonding jumper according to the manufacturer’s recommendations.
2. Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar to help prevent corrosion at the bond.

3.03 INSTALLATION
A. All metallic components that make up the equipment racks and ladder rack shall be bonded together in a manner that provides continuous continuity between the components. Attention must be given to the removal of paint of powder coating to present bare metal where bonding straps are fastened to the metallic component.

END OF SECTION
SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.02 DESCRIPTION OF WORK

A. This Section pertains only to pathways in interior spaces. All exterior pathway and construction requirements are detailed in Section 27 05 43.

B. This contract shall be responsible for all hangers and support mechanisms required to properly support all fiber optic cables installed as a part of this project in a manner that completely satisfies the local Authority Having Jurisdiction.

C. This contract shall be responsible for all pathways as called out on Drawings, specifically:

1. Various conduits, sleeves or supporting mechanisms required to transition the fiber optic cable from outside the facility to the point of demarcation within the building. Any necessary penetrations shall accommodate a minimum of a Trade Size 1 EMT conduit.

2. Surface mounted raceway, as per Section 27 05 28.39 and as shown on “T” series Drawings

D. The Contractor shall coordinate with HSD (if applicable) prior to final placement of telecommunications pathways. Placement shall be such that pathway will be accessible for future additions requiring placement of telecommunications cable.

E. The Contractor shall provide all labor, equipment and supplies to furnish and install the communications pathway, hangers and supports.

F. Installation shall include the actual physical installation of the hardware and/or support structure, firestoping, testing and documentation.

1.03 RELATED SECTIONS

A. Section 27 05 28.29 - Hangers and Supports for Communications Systems

B. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems

C. Section 27 05 28.39 - Surface Raceways for Communications Systems

D. Section 27 05 43 – Underground Ducts and Raceways for Communications Systems

1.04 REFERENCES

A. ANSI/NFPA 70/250 - National Electric Code – Ground and Bonding

B. ANSI/NFPA 70/318 – National Electric Code – Cable Trays


E. ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

F. ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3

G. ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process

H. ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
I. ANSI/TIA-68-D.0-x Series - Commercial Building Telecommunications Cabling Standard

J. ANSI/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces

K. ANSI/TIA-607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

L. NEMA VE 2-2006 Cable Tray Installation Guidelines

M. NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems

N. UL® E209183

O. ANSI C80.1 Rigid Steel Conduit - Zinc Coated

P. ANSI C80.4 Fittings for Rigid Metal Conduit

Q. BICSI Electronic Safety and Security Reference Manual (ESSDRM)

R. BICSI Information Transport Systems Installation Methods Manual (ITSIM)

S. BICSI Network Design Reference Manual (NDRM)

T. BICSI Telecommunications Distribution Methods Manual (TDMM)

U. BICSI Wireless Design Reference Manual (WDRM)

1.05 QUALITY ASSURANCE

A. All fiber optic cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing fiber optic cabling.

C. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

1.06 SUBMITTALS

A. The following information shall be provided:

1. Manufacturer's literature and catalog cuts indicating:
   a) Physical dimensions, including dimensions (if appropriate)
   b) Materials of construction

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and material shall carry Underwriters Laboratory certification if required by local, state or national codes. Products are to be from the acceptable manufacturer listed below or an approved alternate. In no case will field fabrication or "shop built" cable support products be acceptable.

2.02 NON-CONTINUOUS CABLE SUPPORT SYSTEMS (J-HOOKS)

A. Shall be constructed of galvanized steel, stainless steel, or hot dipped zinc.

B. Fastener is to be installed using dedicated wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments. Product is to be UL® Listed for the application.
1. Non-Continuous Cable Supports
   a) Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL® Listed.
   b) Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
   c) Non-continuous cable supports sized 1 - 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
   d) Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
   e) Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
   f) Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal.
   g) Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal.

2. Adjustable non-continuous cable support sling
   a) Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support optical fiber cable; UL® Listed.
   b) Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
   c) Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
   d) If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
   e) Acceptable products: ERICO CADDY CableCat™ CAT425; or approved equal.

3. Multi-tiered non-continuous cable support assemblies
   a) Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; UL® Listed.
   b) If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
c) The multi-tiered support bracket shall consist of ERICO CADDY CATHBA and CableCat™ J-Hooks with screws; or approved equal.

4. Non-continuous cable support assemblies from tee bar
   a) Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
   b) Acceptable products: ERICO CADDY CAT12TS, CAT21528, CAT32528; or approved equal.

5. Non-continuous cable support assemblies from drop wire/ceiling
   a) Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
   b) Acceptable products: ERICO CADDY CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34, CAT326Z34; or approved equal.

6. Non-continuous cable support assemblies from beam, flange
   a) Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
   b) Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY beam clamps and CADDY flange clips; or approved equal.

7. Non-continuous cable support assemblies from C & Z Purlin
   a) Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
   b) Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY Purlin hangers; or approved equal.

8. Non-continuous cable support assemblies from wall, concrete, or joist
   a) Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
   b) Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY angle bracket; or approved equal.

9. Non-continuous cable support assemblies from threaded rod
   a) Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, UL® Listed.
   b) The multi-tiered support bracket shall have a static load limit of 300 lbs.
   c) U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
   d) Acceptable products: ERICO CableCat™ J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY CATHBA series; CAT-CM™ Double J-hook CAT100CM, CAT-CM™ Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series; or approved equal.
10. Cantilever-Mounted cable supports
   a) U-hook shall be able to be assembled to a wide variety of wall mount brackets.
   b) Spacing of individual U-hooks as needed, max of 4’ to 5’ apart.
   c) U-hooks may have the optional attachment of a cable roller for ease in pulling cables.
   d) Acceptable products: ERICO CAT-CM™ U-hooks CAT200CMLN, CAT300CMLN; CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket; or approved equal.

2.03 SURFACE MOUNTED RACEWAY
   A. Surface Mounted Raceway (SMR) shall be provided as per Section 27 0528.39 with all fittings including but not limited to mounting clips and straps, couplings, flat, bend limiting internal and external elbows, cover clips, bushings, device boxes and other incidental and miscellaneous hardware required for a complete SMR system.

2.04 ADJUSTABLE CABLE SUPPORT SYSTEM
   A. Cable support system shall be a factory produced assembly and sized to accommodate 100 percent expansion, i.e., rated to hold double the number of initially installed cables.
   B. Acceptable product is: CADDY® CABLECAT Adjustable Cable Support

2.05 ROD MOUNTED CABLE SUPPORT SYSTEMS
   A. Acceptable product is: CADDY® CAT-CM Cable Support System

2.06 FIRESTOPPING SYSTEMS FOR TELECOM RACEWAYS
   A. Acceptable products for 2” through 4” penetrations are as follows
      1. STI EasyPath™
      2. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
   B. Acceptable products for less than 2” penetrations are as follows
      1. Resilient elastomeric caulk and re-enterable putty manufactured by 3M, Specified Technologies or Hilti.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Install per manufacturer’s instruction per weight loading.
   B. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8” rod attached to building structure utilizing UniStrut® channel to form a trapeze. Double nut the top and bottom at the UniStrut®. Utilize conduit clamp to secure conduits to UniStrut®.
   C. Install in accordance with directions given in Section 27 0528.39
   D. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.
   E. Do not exceed load ratings specified by manufacturer.
   F. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
   G. SMR shall be securely supported using mechanical fasteners at intervals not exceeding 10 feet or in accordance with manufacturer’s installation instructions.
   H. Metal components shall be bonded and grounded in accordance with applicable code and ANSI/TIA-607-B.
I. J-hooks are to be supported by dedicated wires or rods installed by this contract. In no case will ceiling grid wires be used to support J-hooks. J-hooks will be attached to ceiling grid wires (where applicable) to satisfy seismic bracing requirements and to prevent swinging.

J. Adjustable cable support systems are to be securely attached to building structure and loaded as per manufacturer’s instruction.

K. Fire Rated wall and floor penetrations shall be fire-stopped in accordance with the manufacturer’s instructions using the product set referenced in 2.06 above.

END OF SECTION
PART 1 - GENERAL REQUIREMENTS

1.01 SUMMARY
   C. Section includes discrete J-Hooks, slings and related accessories for supporting low voltage cable bundles above accessible.
   D. This section pertains only to pathways in interior spaces. All exterior pathway and construction requirements are detailed in Section 27 05 43

1.02 REFERENCES
   A. The latest versions (including addenda) American National Standards Institute (ANSI) / Telecommunications Industry Association (TIA)
      1. ANSI/TIA-568-D.0-x Commercial Building Telecommunications Cabling Standard
      2. TIA-569-C Standard for Telecommunications Pathways and Spaces for Commercial Building
      3. ANSI/NFPA 70 National Electrical Code
   B. Underwriters Laboratories, Inc. (UL®)
      1. UL® 2043 Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
      2. UL® 2239 Conduit, Tubing and Cable Support Hardware

1.03 SUBMITTALS
   A. Provide submittal information in accordance with Section 27 0500 - Common Work Results for Communications and supplementary requirements described in this specification.
   B. Product Data: Submit product data on all cable support devices and accessories. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
   C. Closeout Submittals
      1. As-built Drawings: Provide as-built drawings of main pathways in AutoCAD® format as per Section 27 05 13.

1.04 QUALITY ASSURANCE
   A. Low voltage system cable supports and accessories shall be listed to Underwriters Laboratories, Inc. Standard 2239.
   B. Low voltage system cable supports and accessories shall have the manufacturer's name and part number stamped on the part for identification.

PART 2 - PRODUCTS

2.01 WIDE BASE CABLE SUPPORTS
   A. J hooks - minimum size is 1” diameter loop. Provide larger size or multiple hooks where required. A minimum of 1” wide with flared edges where cables enter and leave support.
   B. Accessories: Provide applicable accessories to independently support "J" hooks from structure. This includes extender bracket for mounting multiple J hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and "C" and "Z" Purlins as required for specific construction.
   C. Cable Retainers: Provide cable retainers at each "J" hook
   D. Finish
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

1. Dry Locations, Above Lay-in Ceiling, Below Raised Floor - galvanized
2. Wet and Damp Locations: stainless steel

E. Manufacturer
   1. ERICO Caddy CableCat™ series
   2. Chatsworth RapidTrak™ series

PART 3 - EXECUTION

3.01 INSTALLATION

A. All low voltage systems cables shall be supported. Provide supports along entire Pathway.

B. Space supports a maximum of 48 inches apart and at each change of direction of the cables. In areas covered by dropped ceiling, tiles shall be left open to allow inspection by Owner.

C. Hang cable supports from \( \frac{3}{8} \)" all thread rods, dedicated #8 galvanized ceiling drop wire or wall brackets connected directly to structure. Do not support from the ceiling grid or ceiling wire system.

D. Where main pathways are indicated on the Drawings, contractor shall follow the indicated pathways as closely as possible according to field conditions. Pathways for smaller cable counts shall be designed and documented on the as-built drawings by the contractor.

E. Install support wires, brackets or rods to route cables parallel and perpendicular to building lines.

F. Provide multiple hooks or slings at each hanger location as required by cable count.

G. Install low voltage cable support system above accessible ceilings only.

H. Elevation of Cable Supports: Contractor shall coordinate the allocation of ceiling space and the mounting elevations to allow maintenance and accessibility for future modifications. Telecommunications cable supports shall be as close to the ceiling as possible while allowing ceiling tiles to be removed. Supports shall be located to avoid interference with maintenance access to other equipment.

I. Cable installation and supports shall comply with applicable provisions of ANSI/TIA-569-C and NFPA 70.

END OF SECTION
SECTION 27 05 28.33 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes boxes and conduits related to transition of outside plant fiber optic cable from the exterior of a facility to the point of demarcation within the building.

1.02 RELATED DOCUMENTS
A. Related Sections
1. Section 26 05 33 - Raceways and Boxes for Electrical Systems
2. Section 27 05 28.29 - Hangers and Supports for Communications Systems
3. Section 27 05 28.39 - Surface Raceways for Communications Systems
4. Section 27 13 23 - Communications Optical Fiber Backbone Cabling
B. Other References
1. ANSI/TIA-569-D - Commercial Building Standard for Telecommunications Pathways and Spaces
2. ANSI/TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

1.03 DESCRIPTION
A. Provide raceway systems for the installation of the telecommunications cables.
B. This Section shall include all raceways, outlet boxes; plaster rings and all appurtenances required for the conduits and raceways.
C. Size conduits and raceways as indicated. Where no size is indicated, conduit will be a minimum of Trade Size 1.

PART 2 - PRODUCTS

2.01 RACEWAYS
A. Minimum conduit size for telecommunications outlets shall be Trade Size 1 EMT

2.02 PULL STRING
A. Shall be nylon having not less than 200-pound tensile strength.

PART 3 - EXECUTION

3.01 RACEWAYS
A. No length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent without a code size pull box. Provide pull boxes where necessary to comply with these requirements. Locate pull boxes in straight runs only, not as a replacement for an elbow.
B. Conduits with an internal diameter of two inches or less shall have a bend radius at least 6 times the internal conduit diameter. Conduits greater than two inches shall have a bend radius at least 10 times the internal conduit diameter.
C. Provide an insulated bushing on all conduits terminated in a cabinet and/ or pull boxes.
D. Terminate conduits stubbed out above accessible ceiling space so that the conduit is parallel with the ceiling and provide an insulating bushing.
3.02 PULL BOXES

A. Pull boxes may be used in locations where high-count fiber enters and a lesser fiber count exits.

B. In the event a pull box is used on the exterior of a facility is shall be rated NEMA-4 and be equipped with locking screws.

C. Pull boxes shall be sized per the following table:

<table>
<thead>
<tr>
<th>Conduit Trade Size</th>
<th>Width</th>
<th>Length</th>
<th>Depth</th>
<th>Width increase for additional conduit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>16</td>
<td>3</td>
<td>2</td>
</tr>
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<td>1-1/4</td>
<td>6</td>
<td>20</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1-1/2</td>
<td>8</td>
<td>27</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>36</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2-1/2</td>
<td>10</td>
<td>42</td>
<td>5</td>
<td>6</td>
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<td>6</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>60</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

3.03 PULL STRINGS

A. Nylon type pull strings shall be included in all raceways over 10 feet long. Leave not less than 12 inches of slack at each end of the pull wire.
SECTION 27 05 28.39 - SURFACE RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 SECTION INCLUDES
A. Surface mounted raceway (SMR).

1.02 RELATED SECTIONS
A. Section 26 05 33 - Raceways and Boxes for Electrical Systems
B. Section 27 05 28 – Pathways for Communications Systems
C. Section 27 05 28.29 - Hangers and Supports for Communications Systems
D. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems

1.03 SUBMITTALS
A. Submit under provisions of Section 27 0513
B. Samples: If other than specified product is bid, Contractor must submit a 24-inch length of proposed product. Show finished detail with boxes, faceplate, connectors, angles and transitions.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Firms regularly engaged in manufacturer of raceway systems, boxes and fittings of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years. Provide fittings and boxes produced by a manufacturer listed in this section.

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver raceways and distribution systems in factory labeled packages.
B. Store and handle in strict compliance with manufacturer's written instructions and recommendations
C. Protect from damage due to weather, excessive temperature, and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER
A. Provide surface mount raceway distribution components as manufactured by Panduit, or approved alternate.
B. All fittings and transitions pieces are to be of the same manufacturer; however, low voltage receptacles may be from a different manufacturer so long as the product is designed to be an integral part of the completed system
C. SMR shall be a low profile product and may be nonmetallic if product satisfies the Authority Having Jurisdiction.

2.02 SURFACE MOUNTED RACEWAYS AND FITTINGS
A. General:
   1. System: Surface raceway systems shall consist of bases, covers, appropriate fittings, mounting brackets, workstation boxes / enclosures and device mounting brackets and fasteners necessary for a complete installation.
   2. Surface mounted raceways shall be a rectangular design with removable covers or solid construction, constructed of shatter-proof thermoplastic (or similar) raceway, utilizing elbows, couplings, and connectors of the same material.
3. Mounting Brackets: Surface mounted raceway shall be secured to wall using properly rated anchors or mounting brackets. Brackets shall provide un-obscured inspection of fastening bolts at point of wall penetration. In no case whatsoever will surface mounted raceways be attached with drywall screws.

4. Fittings: Fittings shall include flat, internal and external elbows, tees, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Provide full capacity corner elbows and fittings to maintain a controlled 2-inch cable bend radius, meeting the specification for Fiber Optic cabling and exceeding the ANSI/TIA/569-C requirements for communications pathways.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions under which raceways, boxes, distribution systems, accessories, and fittings are to be installed and substrate that will support raceways. Notify the Owner in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Strictly comply with manufacturer’s installation instructions and recommendations and approved installation practices. Care should be taken to prevent “over tightening” of fastening devices.

B. The SMR shall be surface mounted on the wall using properly rated anchors or brackets. All fastening hardware shall be zinc plated or stainless steel. The top edge of the SMR shall be horizontally level below the suspended ceiling line or the true ceiling line, whichever is lower, shall be installed to permit visually inspection to verify the physical integrity of the raceway for its entire run, shall not block doorways or access to emergency exits, shall not inhibit the operation of windows, and shall not run across windows.

1. Support: SMR shall be supported by properly rated anchors or mounting brackets at intervals not to exceed 5 feet or in accordance with manufacturer’s installation sheets.

2. Accessories: Provide accessories as required for a complete installation.

3.03 FINAL FINISH

A. All surfaces are to be left completely smooth and finished. No cut edges are to be exposed. In the event a metallic product is used, all rough edges are to be dressed and covered with appropriate fittings that prevent any access whatsoever with sharp edges.

3.04 CLEANING AND PROTECTION

A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

B. Protect raceways and boxes until acceptance.

END OF SECTION
PART 1 — GENERAL

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

1.02 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, and handhole construction, and landscaping.

1.03 RELATED SECTIONS
A. Section 27 05 13 – Communications Services
B. Section 27 05 26 – Grounding and Bonding for Communications Systems
C. Section 27 05 28 – Pathways for Communications Systems
D. Section 27 05 53 – Identification for Communication Systems
E. Section 27 08 00 – Commissioning of Communications
F. Section 27 13 23 – Communications Optical Fiber Backbone Cabling

1.03 REFERENCES
A. The following standards contain provisions which, through reference in this text, constitute provisions of this Specification. Incorporate by reference the applicable portions. All standards are subject to revision, and parties to agreements based on this Specification are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. ANSI, NFPA, and TIA maintain registers of currently valid national standards published by them.

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 - 758: Customer-owned Outside Plant Telecommunications Cabling Standard
   b. ANSI/TIA - 568: Commercial Building Telecommunications Cabling Standard
   c. ANSI/TIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
   d. ANSI/TIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   e. ANSI/TIA-607-C: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
   f. ISO/IEC IS 11801: Generic Cabling for Customer Premises

3. Concrete:
   a. Reinforcement:
      1) ACI 301: Structural Concrete for Buildings
      2) ACI SP-66: American Concrete Institute - Detailing Manual
      3) ANSI/ASTM A82: Cold Drawn Steel Wire for Concrete Reinforcement
UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS

4) ANSI/AWS D1.4: Structural Welding Code for Reinforcing Steel
5) ANSI/AWS D12.1: Reinforcing Steel Welding Code
6) ASTM A615: Deformed and Plain Billet Steel Bars for Concrete Reinforcement
7) AWS D12: Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction

b. Pre-Cast:
   1) ASTM C478: Standard Specification for Precast Reinforced Concrete Manholes Sections
   3) ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures
   4) ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
   5) ASTM C1037: Standard Practice for Inspection of Underground Precast Concrete Utility Structures
   6) ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

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

1.04 DEFINITIONS

Aggregate: Mineral materials such as sand or stone used in making concrete
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.
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.
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.
Fill: The collective term for base, bedding, and backfill.
Handhole (HH): A structure similar to a small maintenance hole through which cable can be pulled, but not large enough for a person to fully enter to perform work.
RNC: Rigid Non-Metallic Conduit (PVC)
PSC: PVC Coated Rigid Steel Conduit.
RGC: Rigid Galvanized Steel Conduit
1.05 SYSTEM DESCRIPTION

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete Outside Plant pathway system as hereinafter specified and/or shown on the Contract Documents. The Pathway system shall support an ANSI/TIA and ISO/IEC compliant communications telecommunications infrastructure as specified in 27 05 00.

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA and ISO/IEC compliant pathway system.

1.06 SUBMITTAL INFORMATION

A. Product Data Submittals: 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. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.

2. 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.

3. 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. 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 the course of 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.
   a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.
   b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.
   c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).
   d. Show identifiers for major infrastructure components on Record Drawings.
1.07 CONTRACTOR WARRANTY:
   A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.
   B. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.
   C. The Contractor Warranty period shall commence upon Owner acceptance of the work.

PART 2 — PRODUCTS

2.01 GENERAL
   A. Materials shall consist of fill, topsoil, concrete formwork, concrete, raceway, maintenance holes, handholes and other incidentals and accessories as required.

2.02 BASE, BEDDING AND BACKFILL
   A. Use of on-site soils for base, bedding, and backfill is not acceptable.
   B. Base: Readily compactable and meet the following gradation requirements.
      1. For Handholes (provide gravel):
         | Sieve Size  | Percent Passing |
         |-------------|-----------------|
         | 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           |
   C. Bedding: Same as Base - For Trenches, above.
   D. Backfill:
      1. For Handholes - Same as Base - For Maintenance Holes and Handholes, above
      2. For Trenches
         | Sieve Size    | Percent Passing |
         |---------------|-----------------|
         | ¼" Square     | 100             |
         | ¼" Square     | 65 - 100        |
         | U.S. No. 10   | 40 - 100        |
         | U.S. No. 50   | 3 - 50          |
         | U.S. No. 100  | 0 - 4           |
         | U.S. No. 200  | - 3             |
2.03 CONDUIT AND DUCT BANKS

A. Conduit
1. Rigid Non-Metallic Conduit (RNC):
   a. UL listed, NEMA TC2 and TC6 Schedule 40 or 80 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement
   b. Fittings: NEMA TC3 and TC9, matched to conduit and material.
2. Rigid Galvanized Steel Conduit (RGC):
   a. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
   b. Couplings: Unsplit, NPT threaded with galvanizing equal to (and compatible with) conduit. Running thread or set screw threaded fittings (except for three piece and watertight split couplings) are not acceptable.
   c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.
3. PVC Coated Rigid Steel Conduit (PSC):
   a. NEMA RN 1 rigid steel conduit coated with rigid polyvinyl chloride (PVC).
   b. Fittings: NEMA RN 1.
4. Fittings:
   a. Sweeps: Factory manufactured with a single arc of not less than a 15 foot radius.
   b. End Caps (Plugs): Pre-manufactured and water-tight. Tape is not an acceptable end cap or cover.
5. Pull Ropes: ¼ inch polypropylene with a minimum tensile strength of 200 pounds.

B. HDPE Piping: Solid Wall High-Density Polyethylene (HDPE) conduit for non-pressure applications used for the protection of power and telecommunications cable.

C. Duct banks:
1. Conduit Spacers/Supports: High-density plastic interlocking spacers/supports. Spacers shall be:
2. Underground Devices Inc.: WUNPEECE®
3. Warning Tape: 6" wide metallic warning tape, orange in color.
4. Grounding/Bonding: #2 bare copper ground as required by Authority Having Jurisdiction (AHJ)

2.04 UNDERGROUND SPACES

A. Handholes: Precast, conform to ASTM C478 and other ASTM standards and specifications as listed in REFERENCES above.
1. Sizes and Types:
   a) Newbasis FCA304836-90016, 30” x 48” x 36” Fiberglass / Polymer Concrete Assembly, Tapered Sides,
   b) Utility Vault Company: 264-TA - 2'-0" W x 6'-0" L x 4'-0" H (exterior dimensions). Complete with 264P galvanized diamond plate doors equipped with locking bolt.
c) Utility Vault Company: 444-LA - 4'-0" W x 4'-0" L x 4'-0" H (exterior dimensions). Complete with Cover Section 44-332P, Base Section 444-BL, and section gaskets. Equipped with one (1) galvanized “C” channel per longitudinal side and one (1) galvanized pulling iron per corner (four (4) total). Manufactured with conduit knockouts: 4" TERM-A-DUCT '90.

d) Utility Vault Company: 504-LA - 4'-8" W x 4'-8" L x 4'-0" H (exterior dimensions). Complete with Cover Section 55-332P, Base Section 504-BL, and section gaskets. Equipped with one (1) galvanized “C” channel per longitudinal side and one (1) galvanized pulling iron per corner (four (4) total). Manufactured with conduit knockouts: 4" TERM-A-DUCT '90.

e) Utility Vault Company: 25-TA - 2'-3" W x 5'-2.5" L x 2'-7.5" H (exterior dimensions). Complete with Cover Section 38/25-T, Base Section 25-T, and section gaskets. Equipped with one (1) galvanized “C” channel per longitudinal side and one (1) pulling insert per end (two (2) total).

2. Covers: Rectangular diamond plate covers, equipped with a self-latching stainless steel slam lock, recessed lift inserts, lock down bolts, shall be labeled with 1/8" high letters stating “COMMUNICATIONS”. Shall conform to AASHTO H20 loading if located in a roadway and to AASHTO H10 loading otherwise.

3. Racking and Hardware: Galvanized

B. Grounding:
   1. ¾" x 10’ copper clad steel ground rods
   2. #4/0 pigtail for connection to interior ground conductors.

2.05 FIRESTOPPING MATERIAL:
   A. Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:
      1. Specified Tech. Inc. or approved alternate

2.06 LABELS:
   A. As recommended in ANSI/TIA-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.
      1. Hand-carried label maker:
         a. Brady: ID Pro Plus (or approved equal).
      2. Labels:
         a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

2.08 LANDSCAPING:
   A. Topsoil: Imported from off construction site.
PART 3 — EXECUTION

3.01 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 standards, references and codes listed in PART 1 - REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.
D. 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.
E. 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 Owner.
F. Remove surplus material and debris from the job site and dispose of legally.

3.02 EXCAVATING, TRENCHING AND FILL
A. 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. If an adjacent structure may be compromised or damaged by excavation work, underpin the structure as required. If the structural integrity is in question, obtain an evaluation and recommendation from a registered structural Designer employed by the Contractor prior to proceeding with the work.
   4. Maintain adequate separation between the excavation and adjacent underground utilities. Locate excavations such that duct banks, maintenance holes, and handholes have a minimum separation of twelve (12) inches between the duct bank and/or MH/HH and the nearest underground utility after installation. For gas lines a minimum separation of eighteen (18) inches is required. For water a minimum separation of thirty-six (36) inches is required. Contact the Designer prior to proceeding if minimum separation distances cannot be achieved.
   5. 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.
   6. Install, operate and maintain pump or dewatering equipment as necessary to prevent water from accumulating in the excavation.
   7. Excavation Depth/Width
a. For HH: Excavate to a sufficient depth to cover the overall assembled height of the vault plus the added height of risers, covers and bedding material consisting of a minimum six (6) to twelve (12) inches of base. Excavate to a sufficient width to provide a minimum of six (6) inches clearance around each side of the MH/HH.

b. For trenches: Excavate to a sufficient depth to provide a minimum of twenty-four (24) inches cover over the conduit or duct bank formation and to allow for the proper alignment of conduits into the MH/HH. Excavate to a sufficient width to provide a minimum of six (6) inches to each side of the duct bank formation.

8. Over-excavate, fill, and compact any soft spots in the subgrade.

9. Run trench excavation true and as straight as possible. Clear trenches of stones and soft spots.

10. Slope trench grade to fall 3 inches per 100 feet in general and ¼” per foot where possible.
   a. Slope trench toward lower HH or from high points toward HH at both ends.
   b. Slope trench away from building entrances.

B. 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:
      a. Scarify and moisture-condition the subgrade bed to receive fill prior to placing materials.
      b. Moisture-condition base material to within three (3) percent of optimum moisture content and place in loose, horizontal layers.
      c. Level the subgrade bed 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. Compact per APWA Standard Specification Paragraph 7-10.3 (11).
      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. Compact material from two (2) feet below the finished grade up to the finished grade with a minimum relative compaction of 95% of the maximum dry density per ASTM D1557.

C. Waste Disposal: Remove excavation materials and other construction debris from the site in a timely manner and dispose of legally.
3.03 CONDUITS AND DUCT BANKS

A. Conduits:
   1. Outdoor underground: Provide either
      a. RNC Schedule 40 (Type 1).
      b. RGC with half lapped wrap of Scotchrap No. 51 plastic tape or a coat of Kopper’s Bitumastic No. 505 (minimum 20 mil thickness).
   2. Outdoor exposed: Provide RGC.
   3. Transitions: Transition to PSC at stub up locations. Transition to PSC for building entrances a minimum of 10 feet before reaching building foundation. Transitioning back to RNC after passing 5 feet inside the building foundation is acceptable.
   4. Sweeps:
      a. Shallow curves comprised of continuous lengths of individual straight RNC conduit are permissible with a minimum sweep radius of 40 feet.
      b. Where the conduit sweep radius is less than 40 feet, sweeps shall be factory-manufactured bends with a minimum of 48 inch radius. Bending conduit in the field using manual or mechanical methods is not acceptable.
      c. Do not exceed 90 degrees for an individual sweep.
      d. Where unique construction requirements for bend radius or arc length do not permit the use of factory-manufactured sweeps, sweeps shall be field-manufactured using factory-recommended equipment. The internal diameter of the sweep shall not be changed during the sweep field-manufacturing process.
      e. 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.
      f. Two 90-degree sweeps separated by less than 10 feet is not permissible.
      g. Construct sweeps for conduits within a common duct bank parallel, measured from the same center-point.
      h. Do not install LB’s, condulets, or 90 degree electrical elbows.
   5. Fittings:
      a. 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 (see below).
      b. 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 work day and on conduits at night. Leave end caps in place upon final completion of the work.
      c. End Bells: Provide end bells for terminating conduit in maintenance holes and handholes. Install protective end bells on conduits flush with MH/HH walls. Do not use TERM-A-DUCT.
6. Sealing: Apply a watertight, conductive thread compound (for PSC) or solvent-type cement (for RNC) to make conduit connections waterproof and rustproof. Seal and grout conduit terminations in maintenance holes and handholes to ensure that voids in the joints are filled. Seal conduit terminations in buildings until used for cable.

7. 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. Swab away from buildings for conduit sections connected to buildings.

8. Test Mandrels: Prove out each conduit with a minimum 16 inch long test mandrel that is ¼ inch smaller than the inside diameter of the conduit. Pull the test mandrel after backfilling but prior to the replacement of landscaping. Repair or replace any conduit that does not prove out at no cost to the Owner.

9. Conduit Entrances:
   a. HH: Conduit entrances at opposite ends of a maintenance hole or handhole shall be at the same level and in the same position with respect to the side walls. Ensure that each conduit leaving a HH in any position enters the next HH in the same relative position.
   b. Buildings: Terminate conduits 4-inches above the finished floor.

10. Length: Unless otherwise shown on the Drawings, do not exceed 600 feet of duct bank between pulling points. Contact the Designer prior to proceeding if a duct bank section will exceed 600 feet.

11. Pull Ropes: Install in each conduit immediately after the conduit has been cleaned and mandreled. Leave a minimum of 10 feet looped and tied off at each end of the conduit.

12. Protection: Insure that after installation the conduit coatings and finishes are without damage. Repair as follows:
   a. PVC Coated Rigid Steel Conduit: Patch nicks and scrapes in PVC coating after installing conduits.
   b. Rigid Non-metallic Conduit: Repair damage with matching touchup coating recommended by the manufacturer.

B. Duct banks:
1. Unless otherwise noted on the Contract Documents or required for sweep radius, construct duct banks without concrete encasement.
2. Conduit Spacers/Supports: Place supports on eight (8) foot centers if encased in concrete and five (5) foot centers otherwise. Interlock spacers horizontally only. Stagger spacers encased in concrete at least six (6) inches vertically.
3. Warning Tape: Install metallic warning tape half the distance between the top of the duct bank and finished grade.
5. Slope duct bank grade to fall 4 inches per 100 feet in general and ¼” per foot where possible.
   a. Slope duct bank toward lower MH/HH or from high points toward MH/HH at both ends.
   b. Slope duct bank away from building entrances.
3.05 UNDERGROUND SPACES

A. Provide handholes in the sizes and locations shown on the Drawings.
B. Precast maintenance holes and handholes shall be free from damaged joint surfaces, cracks, or other damage that would permit infiltration. Repair of defects is not acceptable. MH/HH and incidental and miscellaneous equipment (such as cable racking brackets and supports) shall be supplied by a single manufacturer.
C. Install HH according to manufacturer’s instructions.
D. Setting and Placement: Remove water from excavation and properly install bedding material prior to setting the HH. Clean HH section seal surfaces so that they are free from dirt or other material.
   1. Set HH in place by lowering 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 HH to ensure that the rim or lid elevation is set one inch above finished grade. For vaults located in paved areas, taper pavement up to the HH rim.
E. Knockouts: Open conduit entry knockouts with care preserving the TERM-A-DUCT sidewalls. Glue conduits entering the vault to the opened TERM-A-DUCTs with PVC cement. Preserve intact the conduit entry knockouts that are not intended for current use.
F. Grouting: Apply grout in a manner to insure filling of voids in the joints being sealed. Apply grouting to conduit entrances, risers, and covers in addition to any other voids.
G. Cleaning: Clean and dry the HH after construction activity is complete and prior to releasing the HH to the Owner for the Owner’s use.

3.06 LANDSCAPING

A. Topsoil: Provide imported topsoil for excavations in grass and/or landscaped areas. Provide loosely compacted topsoil to a depth of 4” or depth of excavation for excavations less than 12”. Restore existing grades where disturbed. Rake and smooth topsoil following proper placement. Installation shall be approved by the Owner prior to placing sod. Place topsoil per APWA Paragraph 8-01.3(2).
B. Provide sod for grass areas disturbed by construction activity and replace shrubbery and trees damaged, removed or disturbed by construction activity. The use of seed/hydro-seed shall be approved by the Owner and the Designer prior to installation.

END OF SECTION
PART 1 - GENERAL REQUIREMENT

1.01 WORK INCLUDED
   A. Provide all labor, materials, tools, and equipment required for the complete labeling of the telecommunications infrastructure.

1.02 SCOPE
   A. This section includes all telecommunications cables and the associated infrastructure in the telecommunications rooms and telecommunications cabinets.

1.03 SUMMARY
   A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces. All facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.
   B. The Owner desires to implement and maintain a District wide labeling scheme for the planned fiber optic network
   C. Industry Labeling Standards and Conventions shall be used unless otherwise stated in the bid documents or by the Owner's Representative.
   D. Installer shall maintain accurate, up-to-date construction drawings. At a minimum, the construction drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and details including identifier assignments.
   E. Installer shall provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and wiring portions of the infrastructure which may each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings.

1.04 QUALITY ASSURANCE
   A. All labels shall be installed in a neat and workmanlike manner. All methods of labeling that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
   B. Labels shall be of the quality and manufacture indicated. The labels and labeling equipment specified are based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
   C. Strictly adhere to all Telecommunications Industry Association (TIA) and BICSI recommended installation practices when installing communications/data labeling.
   D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
      1. ANSI/TIA-606 Administration Standards.
      2. ANSI/TIA-569 Pathway and Spaces
      3. ANSI/TIA-568 Telecommunications Cabling Standard
      4. BICSI Telecommunications Distribution Methods Manual
      5. UL 969 - UL Standard for Safety for Marking and Labeling Systems
1.05 SUBMITTALS
A. Provide product data for the following: Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.06 COORDINATION
B. Coordinate installation of labels with other trades.
C. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 - PRODUCTS
2.01 APPROVED MANUFACTURERS
A. Panduit
B. Brady Corporation
C. Equivalent

2.02 LABEL TAGS – CABLE AND FACEPLATES
A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
C. Where insert type labels are used provide clear plastic cover over label.
D. Outside plant labels shall be totally waterproof even when submerged.
E. Equipment Room fiber backbone cable labels:
   1. Panduit Part#LS7-75NL-1 or Brady#WML-1231-292

PART 3 - EXECUTION
3.01 INSTALLATION
A. General
   1. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.
   2. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.
   3. All labels shall be printed or generated by a mechanical device.
   4. All fiber optic cables shall be labeled at each end. The nomenclature for labeling is:
      a. Origination End – Cable ID
      b. Destination End - Cable ID, “From <Facility>”to <Facility-2>”, where “Facility” is the originating location.

B. Fiber Patch Panels
   1. Patch panels shall be labeled identical to the cables

END OF SECTION
SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL REQUIREMENT

1.01 WORK INCLUDED
A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.
B. Provide complete end-to-end testing of all installed copper and fiber optic cabling.

1.02 TESTING, IDENTIFICATION AND ADMINISTRATION
A. All cables and termination points will be tested and labeled per specifications.
B. Testing is required for this project for all fiber optic testing as detailed below.
C. All test results shall be forwarded to the Owner for certification. Any results observed to be outside stated performance parameters shall be used by the Contractor for immediate correction.

1.03 POST INSTALLATION SERVICES
A. The Contractor shall provide on-site service as part of the warranty in the event of the failure of any installed components.
B. The contractor will provide support and warranty for installed cabling.
   1. The Contractor will be the first contact point and will interface between the manufacture and Owner for warranty issues.
   2. The Contractor will provide the owner with contact information of the manufacture for warranty coverage prior to cable acceptance.

1.04 QUALITY ASSURANCE
A. See Section 27 05 13

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT
A. The Contractor shall provide all tools and instruments used to test the installed telecommunications signal cabling.
B. Test instruments used by the Contractor shall be suitable for the purpose at hand, and shall be of industry-recognized manufacture. Recommended is Fluke OptiFiber® Pro OTDR.
C. Tools leased by the Contractor are acceptable, provided the operator of the test instrument(s) has a sufficient degree of operational awareness to use the rented instrument(s) correctly and obtain test data that is both, accurate and relevant.

2.02 WARRANTY
A. All fiber optic cable and connectors installed as part of a manufacturer’s certified system shall carry warranty for a minimum of 20 years.
B. The manufacturer shall provide certification attesting to on-site service as part of the warranty in the event of the failure of any installed balanced twisted pair cables, fiber-optic cables, telecommunications room terminations, telecommunications outlet terminations, or cross-connect cables.
C. Such service shall be free of charge to the Owner and shall commence from the date of project acceptance and terminate not earlier than the twentieth anniversary of that date as a minimum.
PART 3 - EXECUTION

3.01 GENERAL TESTING REQUIREMENTS

A. Fiber shall meet or exceed the wavelength specific optical characteristics
   1. Attenuation, Loose Tube Cable
      1310 nm  0.34 dB/km
      1385 nm  0.31 dB/km
      1550 nm  0.22 dB/km
   2. Attenuation, Tight Buffer Cable
      1310 nm  0.50 dB/km
      1385 nm  0.50 dB/km
      1550 nm  0.50 dB/km
   3. Mode Field Diameter
      1310 nm  9.2 + 0.3 µm
      1385 nm  9.6 + 0.6 µm
      1550 nm  10.4 + 0.6 µm
   4. Group Refractive Index
      1310 nm  1.467
      1385 nm  1.468
      1550 nm  1.468
   5. Dispersion
      1310 nm  3.5 ps/(nm-km) from 1285 to 1330 nm
      1550 nm  18 ps/(nm-km)

B. Additional Requirements
   1. Attenuation @ 1385 nm  0.32 dB/km
   2. Point Defects  0.10 dB
   3. Cutoff Wavelength  < 1260
   4. Zero Dispersion Wavelength  1302 - 1322 nm
   5. Zero Dispersion Slope  0.090 ps/(km-nm-nm)
   6. Polarization Mode Dispersion Link Design Value  < 0.06 ps/sqrt(km)

C. Contractor shall provide results from OTDR testing of fiber optic cable to attest to:
   1. Length of each fiber segment
   2. Proper polarity
   3. End-to-end performance of the installed fiber.

D. Contractor shall provide the Owner as part of the as-built documentation the factory test results indicating the actual length and the measured end-to-end loss.

END OF SECTION
SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL REQUIREMENT

1.01 WORK INCLUDED

   A. This Section covers fittings and equipment within already existing telecommunications spaces.
   B. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.02 SCOPE OF WORK

   A. This section includes the minimum requirements for the equipment and cable installations in telecommunications equipment rooms.
   B. Included in this section are the minimum composition requirements and installation methods for the following:
      1. Communication Racks and Rack Cable Management

1.03 RELATED SECTIONS

   A. Section 27 00 00 – Communications
   B. Section 27 00 05 – Common Work Results for Communications
   C. Section 27 05 13 – Communications Services
   D. Section 27 05 26 – Grounding and Bonding for Communications Systems
   E. Section 27 05 28 – Pathways for Communications Systems
   F. Section 27 05 28.29 - Hangers and Supports for Communications Systems
   G. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems
   H. Section 27 05 28.39 - Surface Raceways for Communications Systems
   I. Section 27 05 53 – Identification for Communication Systems
   J. Section 27 08 00 – Commissioning of Communications
   K. Section 27 13 23 – Communications Optical Fiber Backbone Cabling
   L. Section 27 17 00 – Testing, Identification and Administration of Fiber

1.04 CONSTRUCTION REQUIREMENTS

   A. This contract is responsible for the build out of the telecommunications spaces to include ladder racking and all required support structure to allow transition of the fiber optic cable from the pathway into the telecommunications equipment racks.

PART 2 - PRODUCTS

2.01 GENERAL

   A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.
   B. Quantities are to be determined by Contractor unless specified.

2.02 PRE-APPROVED PRODUCT SETS

   A. The following product sets only are approved for this project.
      1. Racks, cabinets, enclosures, frames and associated fastening devices
         a. Chatsworth Products Incorporated (CPI)
      2. Miscellaneous fasteners may be pulled from Contractors bench stock.
PART 3 - EXECUTION

3.01 GENERAL
A. Manufacturer's installation instructions and requirements shall be strictly adhered to in the telecommunications equipment installation, fabrication and testing process.
B. Where conflicts arise between the requirements of this Specification and the manufacturer's installation instructions, the Owner's Representative shall be consulted for resolution.
C. Equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads. Fasteners are to be a minimum of Grade 5 and constructed of stainless steel or zinc plated steel. In no case will drywall screws be accepted as permanent fasteners.
D. The installation must conform to OSHA standards and comply with state and local safety codes.
E. Installation shall be neat, well organized, and professional.
F. The Contractor shall clean up the work area at the end of each day. At the end of the project all material removed or left over, and/or not being used shall be removed from the project site unless other arrangements have been made. A final clean up shall be made before final payment is made.
G. All wall and penetrations shall be fire stopped at or before substantial completion.

3.02 PREPARATION
A. Before commencing work, the Contractor shall field-investigate each facility and ascertain if the physical and electrical conditions within the facility shall permit commencement of the Contractor's work.
B. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of HSD.

3.03 COMPONENT INSTALLATION
A. All equipment is to be bonded as per Section 27 05 26

END OF SECTION
SECTION 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLEING

PART 1 GENERAL REQUIREMENT

1.01 WORK INCLUDED
A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.02 SCOPE
A. This section includes all single mode fiber optic cable and termination requirements.

1.03 QUALITY ASSURANCE
A. See Section 27 05 13
B. All cable shall be installed in a neat and workmanlike manner.

PART 2 PRODUCTS

2.01 FIBER OPTIC CABLE
A. Fiber shall be an enhanced zero water peak full spectrum single mode fiber optic cable with usable wavelength range from 1260nm to 1625nm. Jacket rating shall be suitable for applications where placed.
B. Acceptable fiber is that manufactured by:
   1. Optical Cable Corporation
   2. CommScope
   3. Corning
C. Others will require substitution request.

2.02 FIBER OPTIC TERMINATION
A. All fiber connectors shall be duplex LC. Bulkheads shall be dark blue in color, having 6 or 12 duplex LC connectors per mounting panel (bulk head adapter).
B. Optical fiber connectors must be part of cable manufacturer’s warranted end to end cabling solution.
C. Insertion loss of mated pair at 1310 nm to be less than 0.5 dB at acceptance for every duplex connector.
D. Fitted with strain relief boots to ensure durable and robust connections
E. Durability better than 500 matings, with a maximum increase in insertion loss of not more than 0.2 dB.
F. Fitted with a tight polymer cap over the connector to prevent ingress of dirt and dust, until the connector is fitted to a coupler.
G. Acceptable fiber connector, patch panel components, and splice tray enclosures are those manufactured by:
   1. Optical Cable Corporation
   2. CommScope
   3. Corning

2.03 FIBER OPTIC PATCH PANEL ENCLOSURES
A. Rack mounted fiber optic enclosures shall be designed to manage and organize fiber optic cable to and from the equipment or cabling plant. Enclosures shall protect fiber optic connections for patching or splicing requirements. Enclosures shall accommodate up to 72 fibers (with duplex LC panels) per rack space and shall be constructed of steel material. Enclosures shall have removable front and rear covers and top and bottom pass through holes.
PART 3 EXECUTION

3.01 GENERAL

A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.

B. The bend radius shall be no less than 10 times the outside cable jacket.

C. Only Velcro®-type tie wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the Telecommunication and Equipment Rooms.

3.02 PREPARATION

A. Conduits - all conduits shall be inspected for bushings prior to cable installation.

3.03 INSTALLATION – FIBER

A. Install per manufacturer’s instructions.

B. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

C. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

F. Label fiber patch panels as per Section 27 05 53

END OF SECTION
SECTION 27 17 00 - TESTING, IDENTIFICATION AND ADMINISTRATION OF FIBER

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, tools, and field-test instruments required for the complete testing, identification and administration of the work called for in the Contract Documents.

B. Contractor shall survey the work areas and coordinate cabling testing with HSD

C. Contractor shall notify HSD of any additional tests that are deemed necessary to guarantee a fully functional system. Contractor shall carry out and record any additional measurement results at no additional charge.

1.02 SCOPE

A. This Section includes the minimum requirements for the test certification, identification and administration of backbone and horizontal optical fiber cabling.

B. This Section includes minimum requirements for:
   1. Fiber optic test instruments
   2. Fiber optic testing
   3. Identification
      a. Labels and labeling
   4. Administration
      b. Test results documentation
      c. As-built drawings

C. Testing shall be carried out in accordance with this document. This includes measuring the attenuation of the installed cable plant, verifying the length and polarity, and verifying the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR).

D. All fiber end-faces, including test jumpers and ports under test should be clean and free of damage in accordance with IEC-61300-3-35 using a fiber microscope with digital analysis.

E. Testing shall be performed on each cabling link (connector to connector).

F. Testing shall be performed on each cabling channel (equipment to equipment).
   1. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

G. All tests shall be documented, including fiber endface inspection in accordance with IEC-61300-3-35, length and attenuation measurements and OTDR traces and/or event tables for single mode links and channels.

1.03 QUALITY ASSURANCE

A. All testing procedures and test instruments shall comply with applicable requirements of:
   1. ANSI Z136.2, ANSI For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources
   3. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
   4. ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.
   5. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.


9. ANSI/TIA/EIA-606, Administration Standard for Commercial Telecommunications Infrastructure, (including the requirements specified by the customer, unless the customer specifies their own labeling requirements.)

B. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS, an OTDR and a fiber microscope with objective analysis and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
   1. Manufacturer of the fiber optic cable and/or the fiber optic connectors.
   2. Manufacturer of the test equipment used for the field certification.
   3. Training organizations (e.g., BICSI, ACP [Association of Cabling Professionals™])

C. HSD shall be invited to witness and may opt to review field-testing.
   1. HSD shall be notified of the start date of the testing phase five (5) business days before testing commences. HSD representative will select a random sample of 5% of the installed links and such links shall be tested. The results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the Contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to HSD.

1.04 SUBMITTALS
   A. Manufacturers cut sheets for fiber optic field-test instruments including, optical loss test sets (OLTS; power meter and source) and optical time domain reflectometer (OTDR).
   B. A schedule (list) of all optical fibers to be tested.
   C. Sample test reports.

1.05 ACCEPTANCE OF TEST RESULTS
   A. Unless otherwise specified, each link and channel shall be in compliance with the following test limits:
      1. Optical loss testing
         a. Single mode links and channels attenuation limit shall be calculated by the following formulas as specified in ANSI/TIA-568.3.
         1) Link or Channel Attenuation Allowance (dB) = Cabled Fiber Attenuation Allowance (dB) + Connections Attenuation Allowance (dB) + Fiber Splices Attenuation Allowance (dB)

Where:
Cabled Fiber Attenuation Allowance (dB) = Maximum Cabled Fiber Attenuation Coefficient (dB/km) x Length (km)
Connections Attenuation Allowance (dB) = Number of Connections x Connection Loss Allowance (dB/connection)
Note: The number of connections includes the connections on the ends of the link.
Fiber Splices Attenuation Allowance (dB) = Number of Splices x Fiber Splice Loss Allowance (dB/splice)
<table>
<thead>
<tr>
<th>Type of Optical Fiber</th>
<th>Wavelength (nm)</th>
<th>Attenuation coefficient (dB/km)</th>
<th>Wavelength (nm)</th>
<th>Attenuation coefficient (dB/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-mode (Inside plant)</td>
<td>1310</td>
<td>1.0</td>
<td>1550</td>
<td>1.0</td>
</tr>
<tr>
<td>Single-mode (Outside plant)</td>
<td>1310</td>
<td>0.5</td>
<td>1550</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Connection Loss Allowance = 0.75 dB  
Fiber Splice Loss Allowance = 0.3 dB

2. OTDR testing
   a. Reflective events (connections) shall not exceed 0.75 dB  
   b. Non-reflective events (splices) shall not exceed 0.3 dB  
   c. Slope shall not exceed the attenuation coefficient (dB/km) as listed in the table below

<table>
<thead>
<tr>
<th>Type of Optical Fiber</th>
<th>Wavelength (nm)</th>
<th>Attenuation coefficient (dB/km)</th>
<th>Wavelength (nm)</th>
<th>Attenuation coefficient (dB/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-mode (Inside plant)</td>
<td>1310</td>
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<td>1550</td>
<td>1.0</td>
</tr>
<tr>
<td>Single-mode (Outside plant)</td>
<td>1310</td>
<td>0.5</td>
<td>1550</td>
<td>0.5</td>
</tr>
</tbody>
</table>

3. Objective analysis of fiber connector end-faces
   a. The analysis shall be performed using a repeatable and consistent algorithmic process that provides a “pass” or “fail” result based on the acceptance requirements outlined in IEC 61300-3-35, section 5.4 and shown in the tables below.

   1) For single-mode fiber (UPC – return loss >45dB)

<table>
<thead>
<tr>
<th>Zone Name</th>
<th>Scratches</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Core (0-25µm)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>B: Cladding (25-120 µm)</td>
<td>No limit ≤3 µm</td>
<td>No limit &lt; 2 µm</td>
</tr>
<tr>
<td></td>
<td>None &gt;3 µm</td>
<td>5 from 2–5 µm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>None &gt; 5µm</td>
</tr>
<tr>
<td>C: Adhesive (120-130 µm)</td>
<td>No limit</td>
<td>No limit</td>
</tr>
<tr>
<td>D: Contact (130-250 µm)</td>
<td>No limit</td>
<td>None ≥ 10 µm</td>
</tr>
</tbody>
</table>

B. All installed cabling links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.

C. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

PART 2 - PRODUCTS

2.01 OPTICAL FIBER CABLE TESTERS
   A. The field-test instrument shall be within the calibration period recommended by the manufacturer.

   1. Single-mode optical fiber light source
       a. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).
b. Output power of −9 dBm minimum.
c. Acceptable manufacturers
   1) Fluke
   2) VIAVI Solutions

2. Optical Power Meter
   a. Provide 850 nm, 1300/1310 nm, and 1550 nm wavelength test capability.
   b. Sensitivity of -34 dBm minimum
   c. Power measurement uncertainty of ± 0.2 dB
   d. Store reference power measurement.
   e. Save at least 2000 results in internal memory.
   f. USB interface for transfer of test results
   g. Acceptable manufacturers
      1) Fluke
      2) VIAVI Solutions

3. Length measurement
   a. It is preferable to use an OLTS that is capable of measuring the optical length of the fiber using time-of-flight techniques.

B. Optical Time Domain Reflectometer (OTDR)
   1. Shall have a 5-inch TFT color touch screen
   2. Shall have rechargeable Li-Polymer battery for 8 hours of normal operation.
   3. Weight with battery and module of not more than 4.0 lb (1.81kg) and no larger than 6.9x5.4x3.2 in (175 x 138 x 80mm)
   4. Internal non-volatile memory and USB interface with at least 128 MB capacity for results storage.
   5. Remote controllable via RJ45 Ethernet interface
   6. Network and at least two USB ports to transfer data to a PC, perform upgrades, etc.
   7. Integration of fiber microscope with objective analysis.
   8. Single-mode OTDR
      a. Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
      b. Event dead zones of 0.9 m maximum at 1310 nm and 1550 nm.
      c. Attenuation dead zones of 4 m maximum at 1310 nm and 1550 nm.
      d. Distance range not less than 60km.
      e. Dynamic range of 37dB on 1310 nm and 35dB on 1550 nm wavelength

9. Acceptable manufacturers
   a. Fluke
   b. VIAVI Solutions

C. Fiber Microscope with objective analysis
   1. Dual (Low and high) magnification inspection and analysis.
   2. Must provide automated pass/fail analysis of the endface quality in accordance with IEC 61300-3-35 as indicated in TIA-526-14-C and TIA-526-7-A
   3. Must provide ability to analyze both sides of the fiber connection (patch cord and bulkhead)
   4. Must provide ability to save analysis results and generate report documentation
   5. USB 2.0 interface to PC or test device
6. Vertical field of view (VFoV) 250 µm at low magnification and 120 µm at high magnification

7. Acceptable manufacturers
   a. Fluke
   b. VIAVI Solutions

D. Integrated OLTS, OTDR and fiber microscope
   1. Test equipment that combines into one instrument an OLTS, an OTDR and a fiber microscope may be used.
   2. Acceptable manufacturers
      a. Fluke
      b. VIAVI Solutions

2.02 IDENTIFICATION
A. Labels
   1. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
   2. Shall be preprinted using a mechanical means of printing (e.g., laser printer).
   3. Where used for cable marking, provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
   4. Where insert type labels are used provide clear plastic cover over label.
   5. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18” above all direct buried services, underground conduits and duct-banks.
   6. Acceptable Manufacturers:
      a. Panduit
      b. W. H. Brady
      c. Brothers

2.03 ADMINISTRATION
A. Administration of the documentation shall include test results of each fiber link and channel.
B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.
C. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

PART 3 - EXECUTION
3.01 GENERAL
A. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.
B. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.
3.02 OPTICAL FIBER CABLE TESTING

A. Field-test instruments shall have the latest software and firmware installed.

B. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated. Fiber connector end-face testing from the fiber microscope with digital analysis shall be recorded upon completion of each test so that administrative documentation (reports) may be generated.

C. OLTS and OTDR testing shall be performed on each cabling segment (connector to connector).

D. OLTS and OTDR testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner’s instructions.

E. Testing of the cabling shall be performed using test reference cords (TRCs) with reference grade connectors. The test cords for OLTS testing shall be between 2 m and 5 m in length. The test cords for OTDR testing shall be at least 20 m for the launch cable and at least 20 m for the receive cable.

F. Optical loss testing
   1. Single-mode links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A. The One-Cord Reference Method (Annex A) shall be used to reference the power meter.
   2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

G. Length Measurement
   1. The length of each fiber shall be recorded.
   2. It is preferable that the optical length be measured using an OLTS or OTDR.

H. Polarity Testing
   1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with ANSI/TIA-568-3. The polarity of the paired duplex fibers shall be verified using an OLTS.

I. OTDR Testing
   1. Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.
      a. Single-mode: 1310 nm and 1550 nm
   2. A launch cable shall be installed between the OTDR and the first link connection.
   3. A receive cable shall be installed after the last link connection.

J. Objective analysis of fiber connector end-faces
   1. All end-faced shall be inspected and analyzed in accordance with IEC IEC 61300-3-35, section 5.3 and summarized below.
      a. Inspect and analyze fiber connector end-face
         1) If end-face meets acceptance criteria (passes), record result
         2) If end-face does not meet acceptance criteria (fails), clean end-face and re-inspect
      b. Ensure all fiber end-faces meet the acceptance criteria and have their results recorded

3.03 IDENTIFICATION

A. Labeling
   1. Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by the Owner or the Owner’s representative.
3.04 ADMINISTRATION

A. Test results documentation

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”.

2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period and shall be passed to the Owner's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.

3. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM or USB prior to Owner acceptance of the building. This can include the software tools required to view, inspect, and print any selection of the test reports.

4. Circuit IDs reported by the test instrument should match the specified label ID (see 0 of this Section).

5. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information:
   a. The identification of the customer site as specified by the end-user
   b. The name of the test limit selected to execute the stored test results
   c. The name of the personnel performing the test
   d. The date and time the test results were saved in the memory of the tester
   e. The manufacturer, model and serial number of the field-test instrument
   f. The version of the test software and the version of the test limit database held within the test instrument
   g. The fiber identification number
   h. The length for each optical fiber
      Optionally the index of refraction used for length calculation when using a length capable OLTS
   i. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
   j. Test results to include OTDR link and channel traces and/or event tables at the appropriate wavelength(s).
   k. The length for each optical fiber as calculated by the OTDR.
   l. Digital analysis result of fiber end-face inspection with high and low magnification images. Measurement regions (zones) shall be overlaid on the images along with any allowable scratches and defects.
   m. The overall Pass/Fail evaluation of the link-under-test for end face inspection, OLTS and OTDR measurements

B. Record copy and as-built drawings

1. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on USB flash drive. Record copy drawings at the end of the project shall be in AutoCAD® format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. CAD drawings are to incorporate test data imported from the test instruments.
2. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:
   a. Field directed changes to pull schedule.
   b. Field directed changes to cross connect and patching schedule.
   c. Horizontal cable routing changes.
   d. Backbone cable routing or location changes.
   e. Associated detail drawings.

END OF SECTION
## ATTACHMENT A – SITE ADDRESSES

### Elementary Schools

<table>
<thead>
<tr>
<th>#</th>
<th>Site</th>
<th>Address</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brookwood</td>
<td>3960 SE Cedar Street Hillsboro 97123</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Butternut Creek</td>
<td>20395 SW Florence Street Aloha 97078</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Eastwood</td>
<td>2100 NE Lincoln Street Hillsboro 97124</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Farmington View</td>
<td>8300 SW Hillsboro Highway Hillsboro 97123</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Free Orchards</td>
<td>2499 South Beech Street Cornelius 978113</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Groner K-8</td>
<td>23405 SW Scholls Ferry Road Hillsboro 97123</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>W. L. Henry</td>
<td>1060 SE 24th Avenue Hillsboro 97123</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Imlay</td>
<td>5900 SE Lois Street Hillsboro 97123</td>
<td></td>
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<tr>
<td>9</td>
<td>Indian Hills</td>
<td>21260 SW Rock Road Aloha 97003</td>
<td></td>
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<tr>
<td>10</td>
<td>Jackson</td>
<td>675 NE Estate Drive Hillsboro 97124</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Ladd Acres</td>
<td>2425 SE Cornelius Pass Road Hillsboro 97123</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lenox</td>
<td>21200 NW Rock Creek Blvd. Portland 97229</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Lincoln Street</td>
<td>801 NE Lincoln Street Hillsboro 97124</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>McKinney</td>
<td>535 NW Darnielle Street Hillsboro 97124</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Minter Bridge</td>
<td>1750 SE Jacquelin Drive Hillsboro 97123</td>
<td>Contiguous property with Hillsboro High School</td>
</tr>
<tr>
<td>16</td>
<td>Mooberry</td>
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<td>North Plains</td>
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<td>Rosedale</td>
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<td>Tobias</td>
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<td>25</td>
<td>Witch Hazel</td>
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<td>Contiguous property with South Meadows Middle School</td>
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### Middle Schools

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<tr>
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<td>Brown</td>
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### High Schools

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<tr>
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<td>Century</td>
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<td>Glencoe</td>
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<td>Hillsboro (HilHi)</td>
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<td>Miller Ed, East</td>
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### Other District Facilities

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<td>Facilities &amp; Support Services</td>
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<td>Hare Field</td>
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<td>Peter Boscow Conference Center</td>
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### ESD

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<tr>
<td>43</td>
<td>NWRESD</td>
<td>5825 NE Ray Circle</td>
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<td>Hillsboro, 97124</td>
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ATTACHMENT B – BASIC ARCHITECTURE

For purposes of this project, HSD has been divided into five rings. In addition these five rings are interconnected by an-arching ring to establish a high degree of redundancy and fail-over protection. Each of the five rings centers on one of HSD’s high schools. Sketches are included as Attachment C to this RFP. The sketches are numbered:

- BF-100 through BF-, showing Bayface detail at each site
- FR-1 through FR-6 are block diagrams showing strand counts and relationship between sites

The sketches show the number of strands of fiber between the facilities and the relative position of each of the sites and their interconnection to facilities on both sides. The sketches are conceptual and do not show actual routing nor distances. It is the responsibility of this contract to engineer and determine the route(s) that best utilize available utility right-of-way and minimize the associated cost to HSD.

A. **RING-1** – ring-1 begins at Glencoe High School. The clockwise route for this ring takes a 36 strand fiber to the Peter Boscow Conference Center where 12 strands are terminated and 24 are spliced through to Miller Education Center East. Twelve strands continue to Miller Education Center West.

   The counter-clockwise route places 36 strands to McKinney Elementary with 24 strands continuing to Transportation Services. The final 12 strands continuing on to Miller Education Center West to complete a ring architecture.

   A 12 strand fiber spur will be placed between Glencoe and Free Orchards Elementary.

B. **RING-2** – ring-2 begins at Glencoe High School. The clockwise route for this ring takes a 60 strand fiber to Patterson Elementary where 12 strands are terminated and 48 are spliced through to Evergreen Middle School. Twelve strands are terminated at Evergreen and twelve strands are spliced at Evergreen to North Plains Elementary. Twenty-four strands continue to Jackson School Elementary where 12 are terminated and the final 12 strands terminating at Mooberry Elementary.

   The counter-clockwise route places an 84 strand cable from Glencoe to Lincoln Street Elementary with 72 fibers spliced to Eastwood Elementary. Sixty fibers are placed between Eastwood and Poynter Middle School with 12 terminating at Poynter and 12 each going to Mooberry and Hare Field.

C. **RING-3** – ring-3 begins at HiliHi. The clockwise route places 36 strands to W. L. Henry Elementary School with strands 1 – 12 terminated and 13-24 spliced to Brookwood Elementary. Fibers 13-24 are terminated at Brookwood with the final twelve strands terminating at Facilities.

   The counter-clockwise route places 48 strands of fiber between HiliHi and South Meadows Middle School. Twelve fibers are spliced through to Groner Elementary. Twenty-four fibers are spliced through to Witch Hazel Elementary with the final twelve terminating at Facilities.

D. **RING-4** – ring-4 begins at Century High School. The clockwise route takes 48 strands of fiber to Imlay Elementary School with 36 continuing to Brown Middle School where strands 13-24 are terminated and 25-48 are spliced through to Tobias Elementary with the final 12 terminating at Indian Hills Elementary.

   The counter-clockwise route brings 48 strands to Ladd Acres Elementary where 36 pass on to Rosedale Elementary where strands 13-24 are spliced with 25-48 spliced through to Butternut Elementary School. Fibers 25-36 are terminated at Butternut with the final 12 strands going to Reedville Elementary.

   A 12 strand fiber is placed between Reedville and Indian Hills to complete a ring architecture.
E. RING-5 – ring-5 begins at Liberty High School with the clockwise route placing 36 strands to West Union Elementary where 24 strands are spliced to the Administration Center and the final twelve being spliced through to Orenco Elementary.

The counter-clockwise route places 48 strands between Liberty and Lenox Elementary where 36 strands are spliced to Quatama Elementary School. Twelve strands continue to Orenco Elementary School and twelve strands continue to as a spur to the Hillsboro Stadium.

F. MAIN- the main trunk for HSD consist of two rings, both of which touch the District Administration Center. The north main ring will place 48 strands from the Administration Center to liberty to Century and return to the Administration center.

The southern ring will place 48 strands from the Administration Center to Century to HilHi to Glencoe and return to the Administration Center.

ATTACHMENT C – Bayface Layout

Attachment C is available as a separate downloadable document.

Attachment C is a series of sketches, specifically:

BF-101 through BF-109 depict the proposed equipment Bayface layouts at each of HSD facilities. Scaled to print on 8 ½” x 11” paper, portrait format. No advantage to color printing

ATTACHMENT D – Ring Details

Attachment D is available as a separate downloadable document.

Attachment D is a series of block diagrams depicting the proposed fiber rings and associated spurs. Specifically:

- FR-1 through FR-6 are intended to be 11” x 17” printed in landscape format
- Color printing is advantageous,
- Blue is an elementary site
- Green is a middle school site
- Rose is a high school site
- Violet represents all other, i.e., administrative sites

ATTACHMENT E – District Map

High level map. Intended to be printed in color on 11” x 17” portrait format.

Attachment E is available as a separate downloadable document.

ATTACHMENT F - Excerpt from City of Cornelius

Attachment F is available as a separate downloadable document.

ATTACHMENT G - Excerpt from City of Hillsboro

Attachment G is available as a separate downloadable document.

ATTACHMENT H - Excerpt from City of North Plains

Attachment H is available as a separate downloadable document.