

Town of Penobscot

Request for Proposals

**To Design, Build and Operate a High-Speed Broadband
Internet System**

Public / Private Partnership

May 2019

Dear Internet Service Providers:

The Town of Penobscot is seeking broadband service for this coastal town. Attached you'll find a Request for Proposals that will begin the process of finding a partner to design, build and operate world class high-speed broadband internet service. We seek a public-private partnership with providers who wish to design, construct and operate a broadband system. We invite you to respond to the RFP.

The Town's goal for the network is competitively-priced broadband service to, municipal and other Town institutions, businesses, and residential premises, in order to serve the current population and to attract new residents & businesses. The Town is investigating sources of funding at the private, county, state and federal levels, to supplement committed Town funding. Having commissioned a Technology Plan, the Penobscot Broadband Committee has worked for over two years identifying the long-term goals and technical options. With a clear vision for its future, an expanding school population, and a strong sense of identity, the Town is well poised to achieve its goals of strengthening businesses and attracting new families with improved internet service.

We wish to extend fiber throughout the Town and connect fiber to each residence. We anticipate receiving responses by June 7, 2019.

Sincerely,

Joel Katz,

Penobscot Broadband Committee

Town of Penobscot, Maine

1. Introduction.

The Town of Penobscot, hereinafter also referred to as **“the Town,”** issues this Request for Proposals (**RFP**) to provide a fiberoptic Penobscot Broadband Internet System, hereinafter also referred to as the **“Broadband System,”** to offer high-speed internet service to residents throughout the Town. The Town has established and authorized the Town of Penobscot Broadband Committee, hereinafter also referred to as **“the Broadband Committee”** to oversee this proposal solicitation and selection process. Internet service providers (ISP), hereinafter also referred to as **“Providers,”** are invited to submit proposals in response to this RFP. Responding Providers are hereinafter also referred to as **“Responders.”**

The purpose of this RFP is to obtain Proposals to design, build and operate a Broadband System that will provide high-speed internet service to municipal and other Town institutions, businesses, and residential premises throughout the Town, meeting both the current and future needs of the population as well as to attract new families into the Town.

2. The Town foresees the following RFP schedule:

6 May 2019 RFP issued
16 May 2019 Questions from Respondents Due
31 May 2019 Answers to Respondent Questions Posted
7 June 2019 at noon Deadline for the Town to Receive Responses

2.1. Submission and Deadline.

Please submit responses electronically to katzvolenik@gmail.com or in a sealed envelope to the Town of Penobscot, Board of Selectmen at the address below. Please mark the outside of the envelope with the label, “Town of Penobscot Broadband RFP.” Responses may be mailed to:

Town of Penobscot
PO Box 4
Penobscot ME 04476

or delivered by hand or via FedEx or UPS to the Town Office at 1 Southern Bay Rd. Responses must be received no later than noon on June 7, 2019.

2.2 Content and Questions.

Respondents should provide the Proposals in accordance with requirements in Section 67. Responses will not be considered final or binding; however, respondents are strongly encouraged to submit Proposals that could be used as a basis for negotiating a binding agreement.

Potential respondents are encouraged to submit questions in writing to: Joel Katz, katzvolenik@gmail.com.

Questions must be received no later than 5:00 P.M. on May 16 2019. The Town will make a best effort to post answers to written questions at least one week prior to the RFP deadline.

2.3 Selection Process.

The Town will evaluate the responses to this RFP and select one or more of the Responders for continued consideration, including in-person presentations, meetings and discussions. After an initial review and evaluation of each of the proposals, the offerers submitting the most highly rated proposals may be invited for interviews prior to final selection, to further elaborate on their proposals. The Town reserves the right to award a contract without holding interviews, in the event the written proposals provide a clear preference on the basis of the criteria described. No agreement with the Town is in effect until both parties have signed a contract.

Evaluation Criteria

Item	Points Possible
Project Understanding and Approach.	25
Respondent's Experience Building Similar Network.	15
Respondent's Regulatory Plan.	10
Respondent's Timeline to Completion.	15
Documentation.	10
Funding Assistance.	<u>25</u>
TOTAL.	100

3. Background.

The Town of Penobscot has a population of 1200 according to the 2010 US Census with approximately 850 sites on approximately 60 miles of public and private roads. The population is overwhelmingly full-time residents. In addition to the school and town hall, other anchor institutions include: two houses of worship, the Penobscot Community School (grades K-8), the town hall, fire department and post office. The Maine School and Library Network (MSLN) provides 100 mbps symmetrical service to the Penobscot School. Local businesses include: numerous family farms, a year-round convenience grocery store, two seasonal eateries, seasonal vacation rentals, and home-based businesses including timber harvesting, jewelry and woodworking, art galleries, gift shop, pottery shop, computer services, video production, and other businesses.

Many Penobscot residents are self-employed and rely on internet capability to conduct their businesses. Providing broadband internet access will help ensure their success and will also help to attract new residents. Broadband can also extend the "shoulder seasons" by enticing seasonal residents and visitors to come earlier and stay longer, which will extend the time they contribute to the Town. Both year-round and seasonal residents exhibit a creative resourcefulness that makes Penobscot a rich place to live and work. To sustain this close-knit, year-round Town, surrounded by natural beauty, and proud of its marine heritage, Penobscot has identified the need for reliable, high-speed internet for attracting and retaining young families and their business aspirations.

4. Overall Town Goals.

The Town seeks reliable, high-speed internet service that has an affordable subscription price. The internet service must accommodate the future uploading needs including but not limited to: municipal and Telehealth facilities including, video conferencing and database sharing. All premises in the Town should be able to access the network at consistent speeds, and should have reasonable assurance that advertised speeds paid for will consistently match realized speeds. Internet service packages must be affordable for the different tiers of service. The Broadband System must be capable of being upgraded to faster speeds as technology improves and demand increases.

The Town's current population needs Internet service for applications ranging from email to business operations and telecommuting. The Town's students require broadband speeds to complete assignments at home and in school. Broadband will help support and potentially expand Telehealth access.

Additionally, town and home-based business, are poorly served by substandard Internet connections. In addition to serving the needs of the current population, broadband internet will attract new families and businesses to the Town and continue to support the school's future viability.

In sum, current needs are poorly served and the long-range vision seriously jeopardized because of the lack of broadband. The envisioned Broadband System will provide fiber infrastructure to entire Town including fiber to residential connections, and operate a fast, reliable, and affordable network that will serve for at least 30 years

5. Broadband System Requirements.

The broadband system must:

- 5.1 Provide capacity for a minimum 25/25 mpbs (megabits per second down/upload speeds)
- 5.2 Provide a service level at with a 99% reliability as a yearly average.
- 5.3 Designed and built for at least 30 years.
- 5.4 Provide subscription tiers of service at 25/25 mbps, 100/100 mbps and 1,000/1,000 mbps.
- 5.5 Directly connect to the three-ring binder (fiber internet) so that each subscriber in the Town communicates directly to the three-ring binder
- 5.6 Provide fiber infrastructure to every public utility pole (phone and/or electric) allowing for potential access throughout the entire Town.

Business Model.

The Broadband System will be designed, built and operated through a public/private partnership between the Provider and the Town. The Town anticipates contributing funds to the total cost of the project up to \$1 million to be obtained through local taxes and funding opportunities at the private, county, state and federal levels.

Town will not contribute to the yearly operating costs of the broadband system. The provider will provide the remaining portions of the cost to design, build and operate the broad band system using revenues from the Town subscribers monthly service charges and connection fees. The ISP will be expected to bill individual customers.

While the Town is more interested in a public/private partnership, it may be advantageous for the network to be owned by the Town in order to access additional funding sources. The Town would consider responses that propose variations on this model including, but not limited to, acquiring the network at some point in the future, as/if funding sources allow.

The Town also proposes considering an open-access network although if the network is not owned by the Town, it would not be required to be open-access. The Town entertains responses that propose variations on this model including, but not limited to, limiting access at the time of relinquishing the network, as/if funding sources allow.

The Town proposes that the provider own the risk of operating the network. The provider will include software upgrades as part of the project in order for internet service provided to meet the objective described. The provider will upgrade or replace hardware as necessary to ensure that the longevity objective is met.

7. Proposals Requirements.

7.1 Please include all relevant supporting materials within the proposal document.

7.2 Please include any additional proposals you would like to share within the appropriate sections (below) of your response. These may include:

- Any outcomes or conditions you consider to be essential or strongly desired in a potential partnership.
- Ways in which your participation could provide value to the Town.
- Any other Proposals that you believe the Town should consider.

7.3 Respondent(s) must submit a cover letter signed by an authorized representative of the entity. The cover letter must include the following:

- A concise summary of the response to the RFP.
- The legal name of the entity, its headquarters address, its principal place of business, its legal form (i.e. corporation, joint venture, limited partnership, etc.).
- The name, address, email address and telephone number(s) of the principal contact(s) for all communications pertaining to the RFP.

7.4 Please describe your company, including:

- How long the company has been in operation.

- How long the company has provided internet service.
- The approximate number of internet customers you serve.
- The approximate number of employees in the company.
- Where the company headquarters is located.
- Where any additional field offices are located.
- Growth of the company over the last 3 years.
- Technical, managerial and operational experience of the team, highlighting any key members as appropriate to this project.

7.5 Please describe at least one past project which has provided reliable high-speed internet service to a rural area. This may include building a new network or use of an existing network. In your description of past performance, please list:

- The number of premises served.
- Description of the physical environment (e.g., density of premises, terrain).
- Description of available speeds at premises.
- Description of the technology employed.
- Timeline of deployment and date of completion.
- Project size (e.g., subscribers and cost).
- Customer (Town/client) contact Proposals (name, title, phone, email, physical address), and two references with contact Proposals.
- The minimum take rate

7.6 Please describe the current services you now provide, including:

- Overall description of services.
- Business internet services and features.
- Geographic areas where services are provided.
- Speed tiers offered.
- Take rates for your services broken out by speed tiers.
- Pricing, packaging and bundling of services.
- Technologies and equipment employed.

7.7 Customer Installations. Describe how you typically build, manage and maintain customer drops. For example, do you outsource this or manage it in-house?

7.8 Please describe how you currently provide customer service and market to your subscribers:

- How customer service is handled for business and non-business accounts.
- Whether these services are in-house or out-sourced.
- What approaches and systems are used to trouble-shoot and resolve customer issues.
- Your billing and collections system, including payment options available to subscribers.
- How you market to and recruit new business and non-business subscribers.
- Your retention rates for business and non-business subscribers.

7.9 Respondents are invited to propose service levels that they deem technologically and economically achievable; however, respondents should propose solutions that provide the minimum speeds and other requirements.

Please comment on providing network reliability, network operator service, and responsiveness. Respondents should propose mechanisms to ensure that service providers live up to a reasonable service life agreement. Please demonstrate understanding of the longevity requirement.

7.10 The respondent should prepare a detailed technical approach for meeting the objective. This should include, but is not limited to, the following components:

- Necessary hardware.
- High-level geographical and topological network schematics.
- Options for backhaul.
- Quality assurance plan.
- Implementation plan.
- Possible upgrade paths for future service improvement.

7.11 Please identify any infrastructure assets or requirements for taking this technical approach:

- Do you have fiber or other assets in the area that could be leveraged?
- What would be feasible Points of Interconnection with your network and the existing networks in the area?
- What options are available to meet the requirements you've identified for taking this technical approach?
- What other key technical considerations do you wish to highlight for the Town that could improve outcomes under your participation?

8. Procurement Strategy. After the proposals are submitted, reviewed and one or more respondents are selected for further consideration, the Town plans to offer an incentive for residents to commit to being a Broadband System subscriber in the form of collecting advance deposits for future service connections. The Town will also seek citizen approval to supply up to \$1 million from taxes and from grants. Based on the outcome of these efforts, the town will call for a binding best-and-final offer(s) to design, build and operate the Penobscot Broadband Internet System from the selected respondents. Although it is the intention and plan of the Town to proceed with establishing a public-private partnership for implementing a project that meets Town goals, the Town reserves the right to discontinue these efforts based on the responses to this RFP or changes in circumstances.



CITY OF BANGOR

Request for Proposals for City-Wide Broadband Project

**Request for Proposals
City-Wide Broadband Project
Proposal No. P21-25**

**Purchasing Department
73 Harlow Street
Bangor, Maine 04401
207-992-4282**

Issue Date: April 14, 2021

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1. Introduction

The City is soliciting proposals on the design, buildout, and operation of a fiber-based broadband network throughout the community. The network will provide access to approximately 10,143 developed commercial, residential, and mixed-use parcels. The City is not predisposed to a particular optical access technology and will consider all solutions that meet the requirements laid out in this RFP, including hybrid designs that involve wireless components in areas where new fiber construction is not feasible. The design must provide 1Gbps symmetrical access speeds with options for 10Gbps access speeds for commercial subscribers.

Mission Broadband is an independent telecommunications consulting firm retained by the City of Bangor to manage the RFP process for the City-Wide Broadband Project. Mission Broadband will collaborate with the City of Bangor throughout the RFP process and will provide consultative support to the City as necessary.

2. General Information

General information is available on the City's website at the following web address: www.bangormaine.gov/proposals. By submitting a response to this solicitation, the Proposer accepts the responsibility for downloading, reading, and bidding by the terms and conditions set forth in the City's "General Information for Vendors."

Submission

To be considered, please submit one (1) original and one (1) digital copy of the Proposal in an envelope clearly marked "**Proposal No. P21-25: City-Wide Broadband Project**" by **2:00 PM, Wednesday, May 19, 2021** to the Purchasing Department, City Hall, 73 Harlow Street, Bangor, Maine 04401.

The digital copy may be submitted by flash drive or by emailing to: bids@bangormaine.gov. If emailing Proposal, please reference "**Proposal No. P21-25: City-Wide Broadband Project**" in the subject line. Proposals will be publicly opened at the time stated above.

Please indicate in or with your proposal whether you have or are working on a policy regarding domestic violence. If you do not have a domestic violence policy, please indicate whether you would like the City of Bangor to provide you a copy of its policy as an example.

A tabulation of all Proposals received will be available after 4:00 PM on the date of opening. Proposal results may be viewed on the City's website at www.bangormaine.gov/bidtabs.

Questions

Any questions must be directed in writing to bids@bangormaine.gov no later than **4:30 PM, Wednesday, April 28, 2021**.

The City will issue a response on or before **4:30 PM, Wednesday, May 5, 2021**. The response will be in the form of an addendum, which will be available on the City's website.

Vendor Registration

Vendors are encouraged to register on the City website at the following URL: <https://www.bangormaine.gov/VendorRegistration>. This is not a requirement; however, vendors who register will receive automatic notification of any Addenda related to this RFP.

Late Proposals

It is the responsibility of the Proposer(s) to see that their Proposals have sufficient time to be received by the Purchasing Department before the submittal deadline.

Any Proposal, portion of a Proposal, or unrequested Proposal revision received at the City of Bangor Purchasing Department after the time and date specified, will be returned to the Proposer unopened.

Withdrawal of Proposals

No Proposer may withdraw their Proposal for a period of ninety (90) days from the date of opening. All Proposals shall be subject to acceptance by the City during this period.

To withdraw a Proposal prior to the opening, the Proposer shall request the withdrawal in writing. All costs associated with the withdrawal (i.e., mailing fees) will be borne by the Proposer.

Rejection

The City of Bangor reserves the right to reject any and all Proposals, to waive any informalities or defects in Proposals or to accept a higher cost Proposal if it is deemed to be in the best interest of the City of Bangor. The City also reserves the right to negotiate with the successful Proposer.

Information for Proposers

All Federal and State taxes must be excluded from the Proposals. A tax exemption certificate for the City of Bangor shall be furnished to the successful Proposer upon request.

Before submitting a proposal, all prospective Proposers are encouraged to carefully examine the Specifications, visit the City, and fully inform themselves as to the existing conditions and limitations under which the work will be performed. Failure of the above will not release a Successful Proposer from the Contract Documents or the requirements to complete the contemplated work for the consideration set forth in the Proposal.

Each Proposer shall make their Proposal from their own examinations and estimates and shall not hold the City, its agents or employees responsible for any information received from them.

3. Executive Summary

The City of Bangor, Maine, is located on the western bank of the Penobscot River in central Maine. Bangor is the commercial and social center of Northern, Central, and Eastern Maine. It has become the region's largest center of retail and service businesses, and a center for government, education, and employment. Offering a widely diversified economy, Bangor has transcended its traditional roots in forest products and shipbuilding and today maintains its position as one of Maine's major urban centers.

Bangor maintains its position as the cultural and economic center of Northern, Central, and Eastern Maine. Sporting events, cultural activities, education, recreation, and shopping draw visitors from across Maine and beyond to the Bangor that has developed out of its vibrant history.

Like many communities in America, the City of Bangor is feeling the effects of gaps in broadband service within the community. Although there are multiple Internet Service Providers (ISPs) offering broadband services within the Bangor community, data gathered shows that nationally recognized problems such as the Homework Gap, insufficient access for remote workers and students, minimal investment by existing providers, affordability, and the Digital Divide are real and present issues in the City. The impact of the pandemic has also deepened the need for broadband infrastructure improvement within the city.

On July 23rd, 2018, the City Council passed an order that declared fiber as critical infrastructure for the community. Since that time, the Economic Development team within the City of Bangor has spearheaded an initiative to explore the feasibility of deploying a City-Wide Fiber Infrastructure. Since this action occurred, there have been a variety of interactions and communications with the community and stakeholders. These collaborations have explored and identified the current issues associated with lack of adequate and affordable broadband as well as the perceived benefits that could be realized with ubiquitous and affordable high-speed broadband service throughout the City.

Through an iterative process of collaborating with the City's Economic Development team, Community Anchor Institutions (CAIs), businesses, the public sector, and other stakeholders, a variety of data gathering tasks was conducted in order to create a Strategic Plan for navigating the broadband landscape and moving forward the community's desire to implement a municipal broadband network throughout the community.

Many factors need to be considered in developing a city-wide broadband plan, to include ownership models, capital expenses, operational expenses, financial feasibility, end user take rates, variations in end user costs, outside plant facilities, rights of way, central office facilities, electronics, etc. A determination of long-term success will be the utilization of the network as well as applications supported on the network and how those applications and services help to shape Bangor's future. All discussion and research to date supports that a robust, high-speed broadband network can positively impact education, economics, healthcare, transportation, and other important aspects of a vibrant 21st century city.

The broadband network is expected to be capable of providing 1Gbps symmetrical access throughout the community – approximately 10,143 developed commercial, residential, and mixed-use parcels. The City is not predisposed to a particular optical access technology and will consider all solutions that meet the requirements laid out in this RFP, including hybrid designs that involve wireless components in areas where new fiber construction is not feasible. The design must provide 1Gbps symmetrical access speeds with options for 10Gbps access speeds for commercial subscribers.

In this RFP, the City is soliciting proposals for the design, construction and/or operation of a robust broadband network throughout the City of Bangor, and provision of services over the network that achieve the broadband vision of the community, the community’s anticipated usage requirements, and other specified outcomes. The City will entertain proposals from individual vendors or vendor teams in response to any or all of the components of this solicitation.

The City recognizes that there are a variety of viable technical approaches and technology solutions available that could potentially achieve the City’s desired outcomes. Rather than prescribing a network design, the City has defined required and desired quality and performance standards including, but not limited to, key network technical characteristics, performance requirements, life expectancy, and ownership structures. All technology solutions proposed must be permissible under the zoning, land use, and other ordinances of the City of Bangor.

The City is committed to maintaining an objective perspective on the technologies and operational models to be considered for achieving its desired outcomes. All qualified vendors are invited to propose innovative solutions to achieve the City’s desired outcomes and request that all proposals provide the detail necessary for a fair evaluation of alternative proposals and determine whether and how each proposed solution will satisfy the City’s expected outcomes.

4. **Statement of Purpose**

- 4.1 The City of Bangor, Maine is issuing this Request for Proposal (RFP).
- 4.2 The City is soliciting proposals on the design, buildout, and operation of a fiber based broadband network throughout the community. The network will provide access to approximately 10,143 developed commercial, residential, and mixed-use parcels. The City is not predisposed to a particular optical access technology and will consider all solutions that meet the requirements laid out in this RFP, including hybrid designs that involve wireless components in areas where new fiber construction is not feasible. The design must provide 1Gbps symmetrical access speeds with options for 10Gbps access speeds for commercial subscribers.
- 4.3 The City also seeks responses on the deployment and management of access and transport electronics of the network. The City's preference is to own the access and transport network components, including all physical infrastructure and electronics, and the City will seek the services of a qualified respondent to operate the network. The components requiring responses are detailed in sections 8 through 13 and are as follows:
 - 4.3.1 City-Wide Broadband Access Network: Outside Plant Design and Implementation – RFP Section 8.
 - 4.3.2 City-Wide Broadband Access Network: Access and Aggregation Electronics Design and Implementation – RFP Section 9.
 - 4.3.3 Transport Electronics Design and Implementation – RFP Section 10.
 - 4.3.4 Central Office or Colocation Facility with Access to Service Providers – Section 11.
 - 4.3.5 Service Providers – RFP Section 12.
 - 4.3.6 Network Operator: a qualified operator to manage and operate the network – RFP Section 13.

5. **Instructions to Vendors**

- 5.1 Any and all information provided to vendors by the City of Bangor is considered to be proprietary information and must be used solely for the purpose of preparing the proposal and is not to be released outside the Vendor organization without written permission from the City.
- 5.2 All proposals submitted shall be valid for six months or until a contract is signed, whichever comes first.
- 5.3 The City understands vendors do not need to respond to each section of the RFP. A Vendor can team with another vendor and/or respond to some or all of the RFP. No advantage will be assessed for a proposal that addresses all RFP components, and conversely, no disadvantage will be assessed for a proposal which does not address all RFP components.
- 5.4 Vendors shall use the numbering convention in this RFP when formatting their response. The Vendor response shall be explained in detail and shall indicate how the Vendor proposes to satisfy each requirement, where necessary. At the very least,

the Vendor must indicate compliance, non-compliance, understood or exception for each line item.

- 5.5 Vendors shall cite specific terms and conditions to which they take exception. The Vendor shall state the exact requirement to which exception is taken. Any cost impact associated with an exception shall be identified and included in the proposal.
- 5.6 All proposals shall provide a straightforward, concise delineation of the Vendor's understanding of and capabilities to satisfy the requirements of this RFP. Emphasis should be on completeness and clarity of content.
- 5.7 As the selection process progresses, vendors may be asked to provide professional references from similar projects, including contact name, mailing address, phone number, email address, and description of the projects.
- 5.8 Vendor shall describe any experience serving municipal broadband networks.
- 5.9 As a separate document, but included in the RFP response submittal, the City requests an Executive Summary that summarizes the Vendor's approach to a prospective partnership with the City for this project.

By responding, the Vendor states that the Proposal is not made in connection with any competing Vendor submitting a separate response to the RFP and is, in all aspects, fair and without collusion or fraud.
- 5.10 The City reserves the right to seek clarification of each Proposal or to make an award without further discussion of the Proposals received. Therefore, it is important that each Proposal be organized and submitted in a clear and complete manner.
- 5.11 Vendors may use the accompanying file titled *City of Bangor RFP Pricing Matrix.xls* that is referenced in Exhibit B.3 for the pricing of their proposed solutions. Using this matrix is preferred but not mandatory. The tabs on the spreadsheet are named to match the RFP sections requiring proposals.
- 5.12 The Vendor shall clearly outline warranty information and annual maintenance costs for all components included in the solutions they propose.
- 5.13 This RFP document is the property of the City of Bangor and shall not be reproduced or used without permission of the City of Bangor.
- 5.14 All materials submitted in response to the RFP become the property of the City. If there is any concern about confidentiality, mark the appropriate pages of your response "Confidential."
- 5.15 No contract will be awarded except to responsible vendors deemed by the City to be capable of performing the work requested. Vendor's employees shall be trained and qualified to perform the work and operate all required equipment. Before the award of the Contract, any Vendor may be required to show that they have the necessary facilities, experience, personnel, ability, and financial resources to perform the work in a satisfactory and timely manner.
- 5.16 The Successful Vendor may be required to post a 100% Performance and Payment Bond.

6. Authorized Negotiator

- 6.1 The proposal shall be signed by the person authorized to legally bind the proposal.
- 6.2 The proposal shall designate the Vendor's authorized negotiator, who shall be empowered to make binding commitments.

7. Insurance

- 7.1 Each Vendor selected by the City shall comply with all rules, regulations, ordinances, codes, and laws relating to its work or the conduct thereof and shall secure and pay for any permits and licenses necessary for the execution of its work.
- 7.2 Each Vendor selected by the City shall be responsible for implementing precautions for the safety and security of, and shall provide reasonable protection to prevent damage, injury or loss to Vendor's employees, any subcontractor's employees, City personnel, and the general public. Each Vendor shall comply with all applicable safety regulations including Dig Safe, traffic safety laws, OSHA, and regulations of the City of Bangor. Each Vendor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss
 - 7.2.1 General Liability Insurance: \$1,000,000 per occurrence; \$2,000,000 in the aggregate.
 - 7.2.1.1 Premises/Operations
 - 7.2.1.2 Products/Completed Operations
 - 7.2.1.3 Contractual
 - 7.2.1.4 Personal Injury
 - 7.2.1.5 Bodily Injury / Property Damage
 - 7.2.2 Automobile Liability: \$1,000,000 per occurrence; \$2,000,000 in the aggregate.
 - 7.2.3 Professional Liability Insurance: \$1,000,000 per occurrence; \$2,000,000 in the aggregate.
 - 7.2.4 If the above insurance is written on a claim made form, it shall continue for three years following termination of this agreement. The insurance shall have a retroactive date of placement prior to or coinciding with the effective date of this agreement.
- 7.3 Workers Compensation and Employers' Liability – per Maine Statute
- 7.4 The City of Bangor must be named as additionally insured on the COI.
- 7.5 Each Vendor selected by the City further agrees to require its subcontractor(s), if any, to maintain General Liability Insurance, Worker's Compensation and Employer's Liability Insurance, where applicable. The amounts of such coverage shall be as reasonably determined by such Vendor selected by the City.
- 7.6 Proof of policies shall be provided with proposal.

8. City-Wide Broadband Access Network – Outside Plant Design and Implementation

- 8.1 The City is seeking proposals for the design and construction of a city-wide fiber-to-the-premise network with sufficient capacity to provide 1Gbps symmetrical Internet service to approximately 10,143 developed commercial, residential, and mixed-use parcels.
- 8.2 The City is not predisposed to a particular optical access technology and will consider all solutions that meet the requirements laid out in this RFP, including hybrid designs that involve wireless components in areas where new fiber construction is not feasible. The design must provide 1Gbps symmetrical access speeds with options for 10Gbps access speeds for commercial subscribers.
- 8.3 The City desires the network to be constructed with additional capacity beyond the infrastructure required to provide broadband services to subscribers. There are several identified applications for this additional capacity as follows:
 - 8.3.1 Connectivity to existing or future municipal locations.
 - 8.3.2 New residential and commercial subdivisions.
 - 8.3.3 Future smart city and municipal IOT applications.
 - 8.3.4 The sale of dark fiber and wholesale services.
- 8.4 There are several sections of the city where underground facilities are used to provide electrical and telecom services. Although the City has enacted a ‘Dig Once’ policy, there are areas within the community, particularly in the downtown area, that have been served via underground for some time and the availability of existing conduit or space in existing conduit is unknown. Areas of the City that have identified underground utility entrances are outlined in Exhibit B.4.
- 8.5 Aesthetics: all solutions proposed must adhere to city ordinances, which can be found at the following URL: <https://www.bangormaine.gov/code>.
- 8.6 Vendors proposing any fiber optic outside plant, design, and implementation must adhere to the requirements below.
 - 8.6.1 All fibers will be single mode.
 - 8.6.2 Vendor must provide a high-level explanation of the OSP requirements for this project and explain any powered field equipment required to provide the solution proposed.
 - 8.6.3 Vendor must provide all required Outside Plant (OSP) materials, Fiber Distribution Panels (FDP) and Racks to accommodate implementation of the physical network and termination of fiber within a Central Office or Head End facility.
 - 8.6.4 Fiber cable must be installed per manufacturer’s specifications.
 - 8.6.5 Fiber drops will be terminated into Network Interface Devices (NIDs) on the outside of residential structures. Electronics may be placed inside or outside depending on Vendor and customer preference.
 - 8.6.6 Fiber drops will be a combination of aerial and buried.

- 8.6.7 Where aerial drops exist, Vendors may use aerial solutions. Where existing utilities are underground, drops must be buried.
 - 8.6.8 For buried drops, conduit such as microduct is required.
 - 8.6.9 It is preferred that the network is engineered so that the maximum drop length from the splitter or terminal to the point pole is 300 feet. The desired average drop length is 250 feet.
 - 8.6.10 Vendor will need to engineer drops accordingly to structure, (i.e., residential, business, multi-dwelling, condominium, etc.
 - 8.6.11 Vendors proposing fiber will install slack loops in sufficient quantity to ensure all current and future service needs can be met. Explain your standard practice and distance for placing slack loops.
- 8.7 Vendors proposing any wireless technologies or wireless-hybrid technologies for access or aggregation shall adhere to the requirements below:
- 8.7.1 Vendors should clearly mark the locations and state the mounting method and the necessary provision of power supply and backhaul connection for each Access Point or Fixed-Wireless Access device proposed.
 - 8.7.2 Vendor must provide all required Outside Plant (OSP) materials, Fiber Distribution Panels (FDP) and Racks to accommodate implementation of the physical network and termination of fiber within Central Office or Collocation facilities.
 - 8.7.3 All outdoor equipment will be weatherproof.
 - 8.7.4 Each subscriber must have access to 1Gbps of symmetrical bandwidth.
 - 8.7.5 All field electronics must have sufficient battery to run for 8 hours if commercial power is lost.
 - 8.7.6 Access Points will be capable of providing 360-degree coverage as a baseline or option.
- 8.8 The Successful network construction Vendor will be responsible for the preparation of all necessary pole attachment licensing applications for this project.
- 8.9 All Vendors must provide to City the industry standards that they will adhere to for installation of all network components such as Fiber Optic Association Standards (FOAS).
- 8.10 Successful Vendor(s) will secure permits and approvals and finalize construction details with the City's support as needed.
- 8.11 Successful Vendor(s) will be required to deliver engineering maps and as-builts of final network including documents detailing all poles, drops, slack loops, splice and termination points in paper and digital formats as determined by the City.

- 8.12 Optical Time Domain Reflectometer (OTDR) acceptance testing for all fibers shall be completed after fiber installation and industry standard acceptance results will be provided for the City to review and approve.
- 8.13 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

9. City-Wide Broadband Access Network – Access and Aggregation Electronics Design and Implementation

- 9.1 The City is requesting design and implementation of the hardware and electronics necessary to provide 1Gbps symmetrical Internet access to approximately 10,143 developed commercial, residential, and mixed-use parcels. The design must provide 1Gbps symmetrical access speeds with options for 10Gbps access speeds for commercial subscribers.
- 9.2 The diagram in Exhibit A.1 illustrates an example of GPON network deployment architecture. The diagram in Exhibit A.2 illustrates the applications that may run over the end-to-end network. Vendors are encouraged to propose designs they feel optimally meet the requirements and specifications of this RFP.
- 9.3 The core network must provide scalability and flexibility to adapt to changing bandwidth and application needs over time. The desired characteristics of the network are as follows:
 - 9.3.1 The network must scale to meet short term and long-term traffic demands. It is expected that the enablement of high-speed broadband throughout the City will result in an increase in bandwidth intensive applications such as telecommuting, telehealth, gaming, streaming video, video conferencing, and distance learning. IoT applications will be important as well. The network must have sufficient capacity and scalability to meet increasing consumption habits.
 - 9.3.2 Vendor must ensure that high availability, redundancy, and hot swappable common components (i.e., control cards/processors, power supplies, etc.) are built into the core electronic components.
 - 9.3.3 The network must be flexible enough to provide different types and classes of services to meet different customer and Service Provider requirements.
 - 9.3.4 The City desires that the network is open access. The core and access platform solutions must be capable of logically segmenting traffic to/from different Service Providers via separate VLANs, VPNs or some other mechanism.

(Note: If the vendor does not want to participate in an open access network, please describe reasoning and desire for a closed network.)

- 9.3.5 Vendors proposing solutions based on Gigabit Passive Optical Network (GPON) technology must explain any backplane or uplink bandwidth constraints as take rates increase and individual PON ports become oversubscribed.
 - 9.3.6 Vendors proposing solutions involving wireless technologies must explain the frequencies, channels, and licensed or unlicensed spectrum proposed.
 - 9.3.7 Fiber-to-the-premise solutions must be capable of supporting access utilizing a single strand of fiber except where dual strands are required for a specific application or customer.
 - 9.3.8 Support for IEEE 802.3ad/802.1AX link aggregation on all uplink ports.
 - 9.3.9 Support for IEEE 802.1Q VLANs throughout entire network.
 - 9.3.10 Support for IEEE 802.1p QoS (minimum four traffic classes) throughout entire network.
 - 9.3.11 SNMP management capabilities throughout entire network.
- 9.4 Network Termination Equipment (NTE) on customer premise.
- 9.4.1 NTE is defined as the electronic devices that are installed at the customer premise, either inside or outside of the structure.
 - 9.4.2 NTE shall include model options of 10/100/1000 Base TX ports facing subscribers.
 - 9.4.3 NTE shall include single port and multi-port model options for different types of uses (i.e., single unit, multi-unit).
 - 9.4.4 Vendor will need to engineer NTE according to the type of structure, (i.e., single unit, multi-unit, hotel, etc.).
 - 9.4.5 It is required that Vendors provide NTE options capable of supporting Wi-Fi for customer use inside the premise.
 - 9.4.6 Vendors should explain compelling advantages and features of their solution beyond the baseline listed above.
- 9.5 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

10. Internet Connectivity and Transport

- 10.1 For Vendors proposing new construction of broadband facilities, it is assumed that the core electronics used for direct connectivity to the internet will be housed in the Central Office that will be constructed; however, the City is open to other solutions.

- 10.2 For Vendors proposing to expand existing broadband facilities within the City, please explain the architecture that will support the expanded services that will be provided within the City.
- 10.3 Explain your solution for transporting bandwidth to and from the City network.
 - 10.3.1 Please explain the physical route of the fiber connection that will provide Internet service to the City.
 - 10.3.2 The initial solution must support multiple 10Gbps circuits upstream and downstream facing the core aggregation equipment. It is required that the architecture connecting the City network to the Internet be redundant with physically diverse upstream routes. Please explain your approach to providing diverse upstream connections to the City network.
 - 10.3.3 Explain the capabilities the system has to handle speeds and interfaces beyond those required for the initial project launch.
 - 10.3.4 Explain any redundancy or failover capabilities of the system.
- 10.4 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

11. Central Office or Colocation Facility with Access to Service Providers

- 11.1 The City requires rack space in a Central Office or Colocation Facility within the municipal boundaries of the city. This space will be used for all of the head end and access electronics required to operate the network. This location and equipment will be used to provide transport of bandwidth to and from the Internet and access to Service Providers who will provide services in the community. The Central Office or Colocation facility shall have the following characteristics:
 - 11.1.1 Facility shall run in a High Availability (HA) configuration, with fully redundant power and cooling.
 - 11.1.2 Facility shall include uninterruptible power source (UPS) batteries, and backup power generation for survival through sustained commercial power outages.
 - 11.1.3 Facility shall have strong physical security, with limited/controlled access.
 - 11.1.4 Facility shall have environmental controls for humidity and temperature, and fire suppression systems.

- 11.1.5 Equipment shall be mounted securely in racks and cabinets, in compliance with national, state, and local codes. All equipment shall be connected with uninterrupted cutover to battery and generator.
- 11.2 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

12. Service Providers

- 12.1 City is requesting Service Providers to provide services to subscribers in the community. The City seeks vendors who will provide a superior customer experience for the City's diverse population and needs.
- 12.2 Service Provider must have a strong track record of providing outstanding customer service and support and any vendor chosen by the City shall provide the following items to demonstrate this track record. (Note: as the selection process progresses, vendors may be asked to provide the following information but this information is not required with the initial proposal):
 - 12.2.1 Three customer references.
 - 12.2.2 Summary of organizational programs or initiatives aimed at improving the customer experience.
 - 12.2.3 Annual Key Performance Indicator (KPI) goals and achievements for Customer Service and Technical Support for the past three years.
- 12.3 The City is requesting Service Providers to provide the following services:
 - 12.3.1 Internet Bandwidth. Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.
- 12.4 The City plans to negotiate final Service Level Agreement (SLA) requirements with the winning Vendor(s). Please explain your approach to SLA guarantees for residential and commercial subscribers.
- 12.5 Service Provider vendors must perform the following functions: (Question for City on their involvement with the following):
 - 12.5.1 Sales and marketing activity to sell services to subscribers.
 - 12.5.2 Billing, collection, and payment of all monthly recurring charges to include Federal and State taxes, surcharges, and assessments.
 - 12.5.3 Standard Customer Service functions.

12.5.4 Technical Support Level I / II / III: Vendor must have a Network Operations Center (NOC) or Technical Support call center to take calls from subscribers with service and repair issues.

12.6 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

13. Network Operator

13.1 The City is seeking proposals from qualified operators for the operation, management, and maintenance of the broadband network that will be constructed in the city. The network is intended to be an open access network allowing Service Providers, who wish to provide services over the network to do so provided they meet City requirements, including performance and customer service standards. The operator must have experience working with and managing relationships with multiple Service Providers. The City desires subscribers to have an excellent customer service experience. (Note: If the vendor does not want to participate in an open access network, please describe reasoning and their desire for a closed solely run/operated network.)

13.2 The City recognizes that Vendors may be unable to respond solely to this section of the RFP due to the unknown architecture of the final network. The City understands that qualified Vendors who wish to respond solely to this section will be required to partner with other Vendors for the network architecture to be defined. In the event that the City does not receive the desired responses for this section, it is possible solicitation of these services may occur through a future RFP process.

13.3 The primary functions that will need to be performed are listed below. It is assumed that the winning vendor will have existing Operation Support Systems/Business Support Systems in place and strong experience turning up, onboarding, and managing greenfield networks.

13.3.1 Operator will work with Service Providers to perform the following activities related to service delivery and trouble resolution:

13.3.1.1 Network to Network Interface (NNI) Design and Activation.

13.3.1.2 Coordination and scheduling of all activities related to a service install with internal and external parties including splicing, trenching, traffic control, etc.

13.3.1.3 Provisioning of access and core network components to facilitate turn up of new subscriber services.

13.3.1.4 Coordination and scheduling of test and turnup / service activation.

- 13.3.1.5 Providing detailed installation information to customer and Service Provider.
- 13.3.1.6 End user service requests for all adds, moves, and changes.
- 13.3.1.7 End user service requests concerning all trouble resolution.
- 13.3.1.8 Communication with all affected parties during outage events.
- 13.3.2 Platform Engineering Support: The operator must have core and access equipment expertise.
- 13.3.3 Network Engineering – Physical Layer: Operator must have expertise in outside plant and systems capable of maintaining accurate plant data for all physical components of the network. Please provide an overview of the system that will be used to house the City’s inside and outside plant data.
- 13.3.4 Network Engineering – L2/L3: Operator must have Network Engineering expertise and experience dealing with complex layer 2 and layer 3 issues.
- 13.3.5 Inventory: Operator must maintain sufficient inventory to perform new activations within 5 business days of initial order by customer.
- 13.3.6 Response Times: Operator must maintain all tools, testing equipment, and critical spares in a manner that allows both installation and trouble response time commitments to be adhered to.
- 13.3.7 Please explain your network change control processes.
- 13.3.8 Operator must have a process for performing maintenance on the network and a maintenance notification process for informing all relevant parties. Please explain.

13.4 Specific Operator Requirements

- 13.4.1 The City requires ongoing configuration, management, and maintenance of the physical network as well as the electronics supporting the network access platform. Please explain any functions listed above/below that would be outsourced.
- 13.4.2 Operator must have a strong track record of providing outstanding customer service and support and the winning Vendor shall provide the following items to demonstrate this track record: (Note: as the selection process progresses, vendors may be asked to provide the following information but this is not required for the initial responses.)
 - 14.4.2.1 Three customer references.

14.4.2.2 Summary of organizational programs or initiatives aimed at improving the customer experience.

14.4.2.3 Annual Key Performance Indicator (KPI) goals and achievements for Customer Service and Technical Support for the past three years.

13.4.3 Physical Plant

14.4.3.1 The City requires a contractor to provide ongoing maintenance of any physical plant (aerial and underground) including backbone segments, laterals, drops, field cabinets, Access Points, Fixed Wireless Devices and all other associated OSP hardware in the network. It is the City's desire that the network be repaired quickly. A Service Level Agreement (SLA) will be negotiated with the Successful Vendor upon selection.

13.4.4 Electronics

14.4.4.1 The City requires a contractor to provide ongoing operation and maintenance of the broadband network including all access and aggregation electronics.

14.4.4.2 Operate, manage and monitor the network on a 24x7 basis.

14.4.4.3 Vendor will make all network monitoring data and statistics available to the City either through reporting or portal access.

13.4.5 Vendor will facilitate the open access network. (Note: If the vendor does not want to participate in an open access network, please describe reasoning and desire for a closed network)

13.4.6 Vendor must have trouble escalation procedures in place.

13.4.7 Security Incidents: Vendor shall list any programs and procedures in place specifically for monitoring and resolving security incidents.

13.5 Vendor pricing may be provided by filling out the pricing matrix titled *City of Bangor RFP Pricing Matrix.xls* referenced in Exhibit B.3 or optionally use their own pricing format.

14. Evaluation and Selection Criteria

14.1 The City seeks a city-wide robust, scalable, and future proofed broadband network. There are several components requiring proposals in this RFP and the City will select the most appropriate vendor for each component. Each Vendor is encouraged to provide detailed responses to demonstrate its experience and expertise in providing services as requested in this RFP. The selection will be based on all factors listed for each component and may not go to the lowest price proposal if

price is outweighed by a combination of other features and factors in the Successful Vendor's proposal.

- 14.2 The City reserves the right to select proposals that in its sole judgment most nearly conform to the specifications set forth herein, best serve the needs of the City of Bangor and provide the most cost-effective means of producing those results.
- 14.3 The City is not obligated to accept or select any proposal received in response to this RFP. In particular, the City may select proposals in whole or in part, or it may disqualify any and all proposals received.
- 14.4 The City will use selection criteria that includes the following for each section of the RFP: Vendor Viability, Technical Merit, Implementation Timeline and Cost. The selection decisions made by the City under this RFP are final.
 - 14.4.1 In evaluating Vendor Viability, the City will score vendors based on the following criteria:
 - 14.4.1.1 The Vendor's previous experience with complex projects of a similar size, scope, and characteristics and/or their experience with the element(s) of the project for which they are providing proposal(s).
 - 14.4.1.2 Documentation from the Vendor that demonstrates the Vendor's experience with similar projects (or element thereof) of the same size and scope.
 - 14.4.1.3 Any other information that bears on the Vendor's suitability for this project.
 - 14.4.2 Technical Merit of Proposal scores will be assigned based on how well the proposed solution meets the currently understood and projected needs of the City. This may include, among other things, service performance characteristics (SLA terms), technology description, continuity of network platform, diversity and redundancy in the Service Provider's network, diversity from existing services, transport technology, reliability, technical support capabilities, scalability, expandability, future network capabilities, and the appropriateness of the design proposal for the City and how well it meets the stated priorities of the network.
 - 14.4.3 In evaluating the Implementation Timeline, the City will consider, among other things, the projected starting date, the overall time to install, the disruption of existing services, the complexity of the installation and the projected completion date as well as the reasons for these projections. If appropriate, a starting date relative to completion of a prior milestone may be used.
 - 14.4.4 Costs may include, among other things, monthly recurring costs, non-recurring costs, fees, the termination liability

associated with existing contractual obligations, and any additional costs that the City may potentially realize based on any given Vendor selection. All costs that can reasonably be anticipated over the desired 20-year lifecycle should be addressed. Note: The City of Bangor is tax exempt.

15. Rejection/Negotiation Rights

- 13.1 The City reserves the right to disqualify any proposals for substantial non-compliance with the terms of this RFP. The City reserves the right to accept or negotiate the contractual terms of any proposal(s) in response to this RFP.
- 13.2 The City reserves the right to select multiple Service Providers.
- 13.3 The City reserves the right to select multiple equipment providers.

Exhibit A.1: Example Broadband Architecture

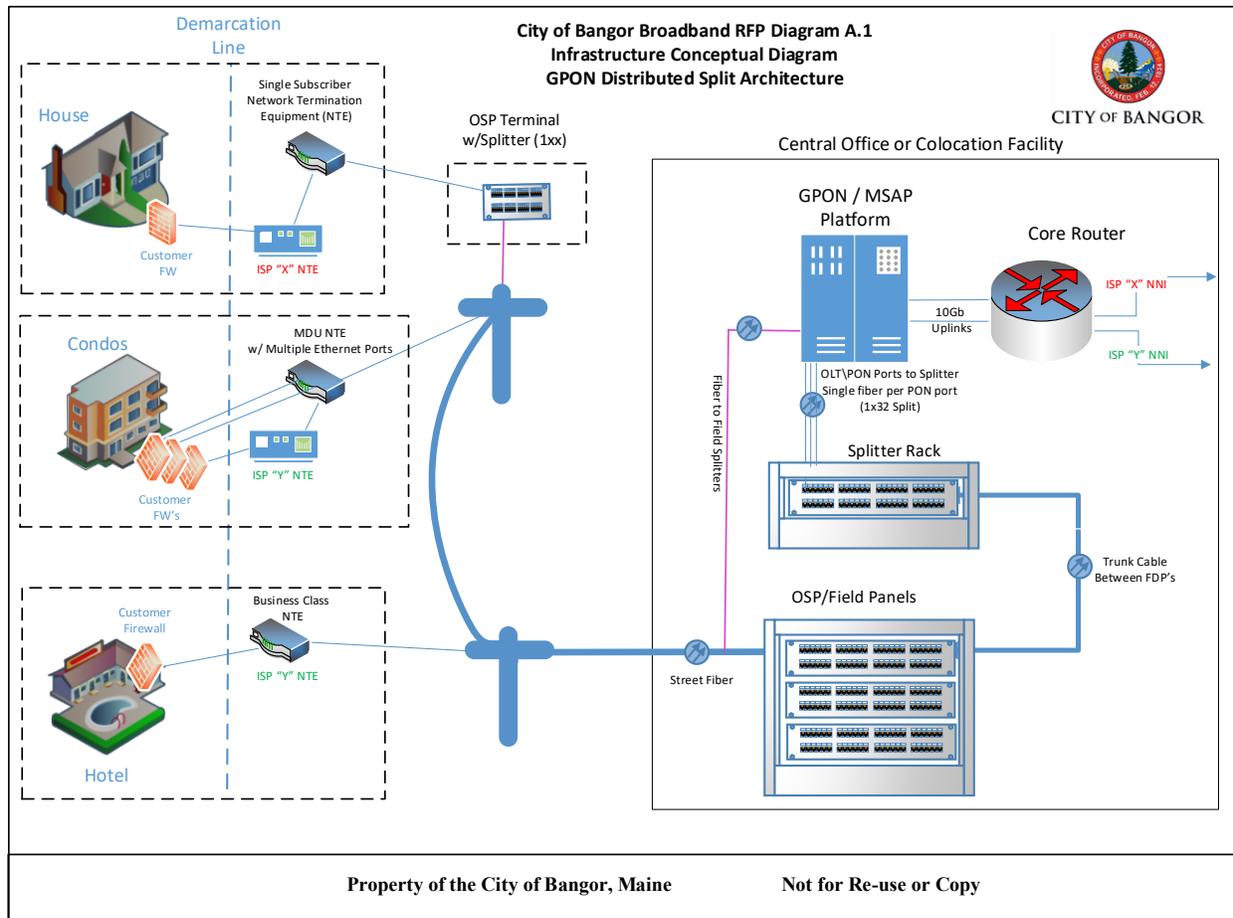


Exhibit A.2: Examples of Network Applications

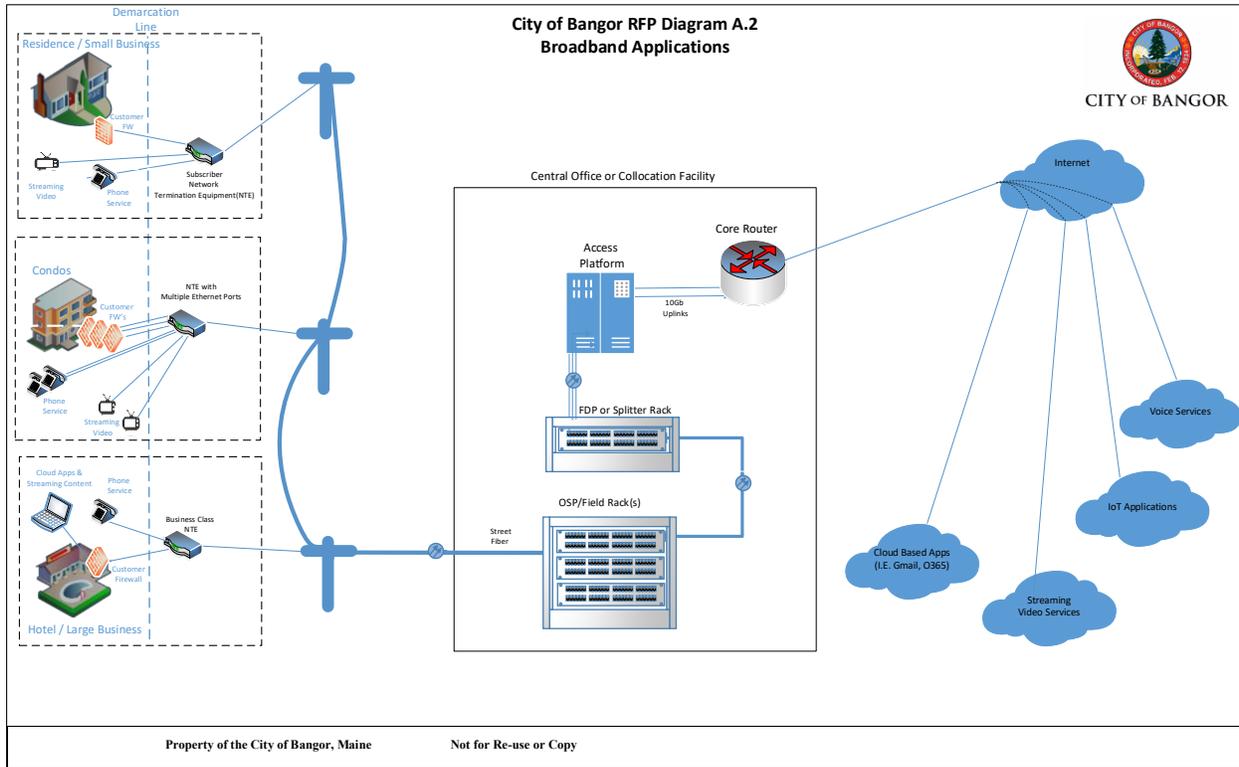


Exhibit A.3: Example of FTTP Standard Drop Configuration

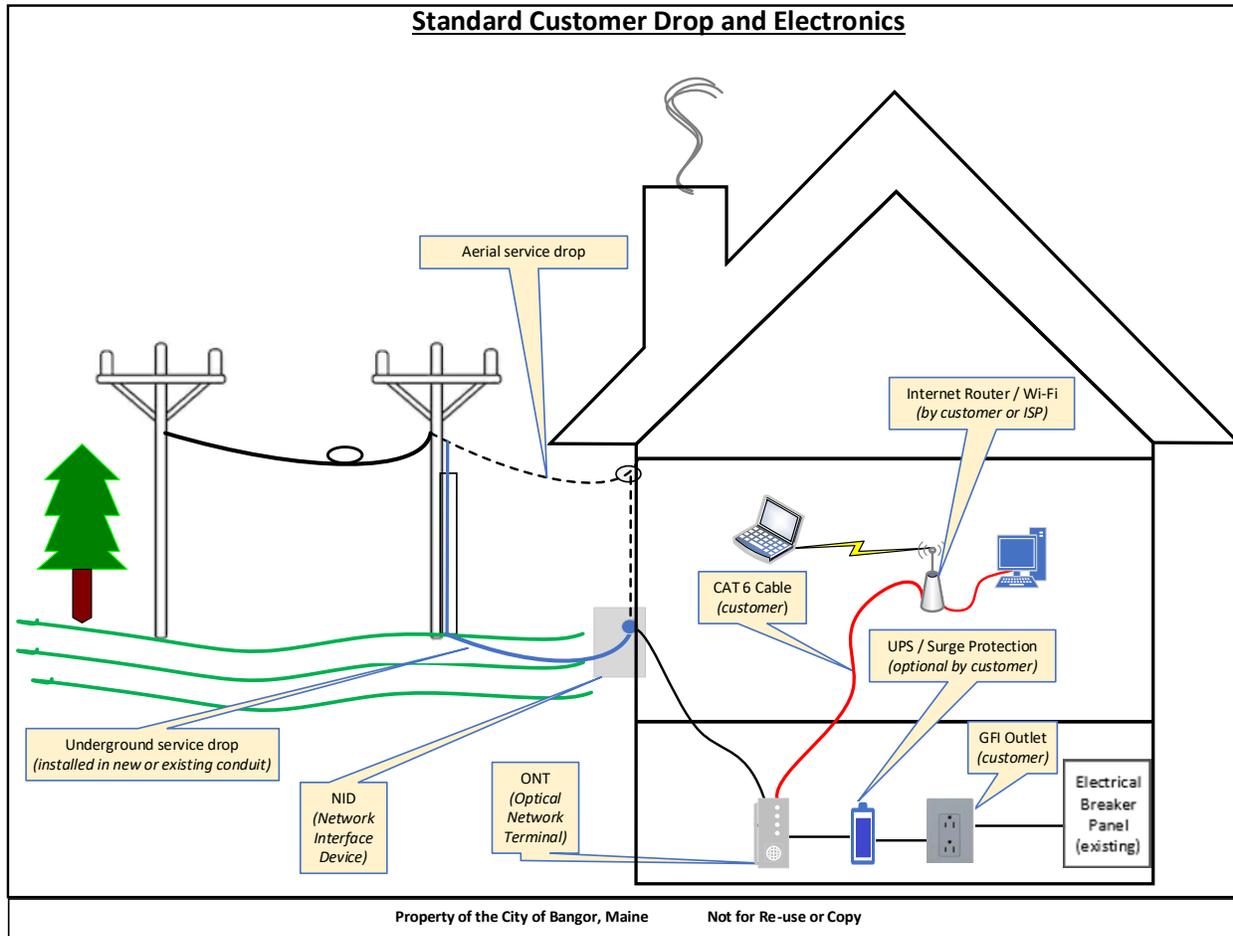


Exhibit B: List and Description of Associated RFP Documents

B.1: City of Bangor Broadband Strategic Plan and Roadmap

This document is the City of Bangor Broadband Strategic Plan and Roadmap resulting from the City's order declaration of fiber as essential infrastructure in July of 2019. The document and addendum can be reviewed or downloaded at the following URL:

<https://bangormaine.gov/broadband>

B.2: Bangor ParcelData.kmz ; Bangor AddressPoints.kmz

These documents are kmz layers depicting the boundaries of all of the parcels and the address points within the City.

B.3: City of Bangor RFP Pricing Matrix.xls

This file is an Excel spreadsheet to be used by Vendor's in pricing out their solutions. There is a corresponding tab for each section of the RFP with instructions for pricing out the proposed solution. Use of this Pricing Matrix is preferred but not mandatory.

B.4: COB UndergroundInfrastructure.kmz

This file is a kmz layer that outlines areas of the City where utility infrastructure runs underground.

Request for Proposals
Community Concepts Finance Corporation
On behalf of the Mahoosuc Community Broadband Committee
*Assessment, inventory and mapping of existing high-speed internet
and gaps in service in the Mahoosuc Area*

Introduction:

Community Concepts Finance Corporation (CCFC) is soliciting proposals on behalf of the Mahoosuc Community Broadband Committee and towns in the Mahoosuc Region – Bethel, Gilead, Greenwood, Newry and Woodstock – from experienced vendors who can provide comprehensive data collection and analysis to determine the current status of high-speed broadband service. The successful vendor must have prior experience in development and implementation of a broadband field audit that included: CATV and fiber and remote terminals, mapping existing high-speed broadband service and gaps in service, estimating costs of cable and fiber extensions to the premise. The vendor will provide the findings of the field audit in a report that can be used by Mahoosuc Region communities to determine future broadband needs and strategy.

Background information:

The five towns are located in western Oxford County. Internet service throughout the region has been a concern for a long time. The more densely populated areas of the Mahoosuc Region are fairly well served, while many of the more rural areas lack service, have poor service, or are home to people who cannot afford internet service. With the onset of the Covid-19 pandemic, the availability of reliable, affordable high-speed broadband has taken on even greater importance throughout the region.

The primary internet service providers in the area are Charter Communications, FirstLight and Consolidated Communications. Of the two DSL providers, FirstLight is replacing some of its DSL connections with fiber.

Below is demographic information for year-round residents in the five towns. The Mahoosuc region is home to Sunday River and Mt. Abram Ski Resorts and is a popular four-season outdoor recreation destination that attracts visitors, second homeowners and a growing population of remote workers.

Towns*	# of year-round Households	Est. # of seasonal Households	Has a computer	Has an internet subscription
Bethel	1103	100	916	852
Gilead	98	NA	NA	NA
Newry	134	1700	104	94
Greenwood	245	500	203	171
Woodstock	487	250	429	377

*Albany Township may participate as a sixth town.

The towns in this region began investigating better broadband in 2017 as participants in a 27 town broadband planning project that resulted in the [Maine West Regional Technology Plan](#) . More recently these towns participated in the [Maine West Broadband Boot Camp](#), a six month community engagement and broadband education and training program. As participants in the Boot Camp the towns formed a broadband committee with representatives from each community. The Committee surveyed area residents and businesses about their internet service and participated in a statewide internet speed testing initiative to identify who is served and who is unserved in the region. Based on the survey and speed test results the Committee adopted the following goal: ***Everyone in the Mahoosuc Region has access to reliable, affordable, high-speed and future ready internet service.***

To help achieve this goal and pursue additional funding for improving internet service, the Committee seeks a technical consultant to:

- Produce a detailed and accurate map of existing cable and fiber internet service
- Identify gaps in service
- Generate recommended strategies and related cost estimates for expanded cable and fiber to the premise

Scope of Services:

- Generate project timeline from start to completion
- Meet with the Mahoosuc Community Broadband Committee and other town representatives to review the timeline and study elements, respond to questions and solicit input from Committee members and town representatives
- A broadband study will be produced that includes the following elements:
 - Field audit of high-speed internet assets and ownership of assets
 - CATV
 - Fiber and remote terminals
 - Identification of potential subscriber locations using 911 data and aerial imagery
 - Mapping field audit in VETRO or equivalent platform
 - Mapping gaps in VETRO or equivalent platform
 - Validating road segments subject to Franchise Agreement obligations
 - Extracting data and metrics from VETRO or equivalent platform
 - Estimating costs
 - CATV extensions
 - FTTP
- A product Study report including:
 - Recommended strategies and related costs for filling service gaps in areas that require expansion of high-speed internet service
 - Recommended funding sources that could address the cost of planning and implementation to address the broadband gaps identified in the study
 - All data and information that is collected in support of the findings shall be included as appendices

- Meeting with the Mahoosuc Community Broadband Committee and town representatives to review the Study report and respond to questions.

Proposal Submission:

Proposals are to be submitted via e-mail no later than 5:00 P.M. (EST) on 14, April, 2021. Proposals received after this time will not be considered. All requests for additional information or questions should be directed to Mia Purcell at mpurcell@community-concepts.org, (207) 418-0179.

Proposals must include:

1. A brief summary of the Consultant's understanding of the project and relevant knowledge/experience. Provide information for all collaborators if more than one firm is involved.
2. An outline of the approach proposed to accomplish the Scope of Services and the manner in which the Consultant will work with the Mahoosuc Community Broadband Committee and towns and township to complete the project.
3. A description of the Consultant's qualifications, capabilities and organizational structure. Identify the project team, including qualifications, experience, and specific responsibilities of the project manager and staff that will be assigned to the project (include a resume for each person).
4. Examples of projects similar in scope and scale completed by the Consultant. Provide a brief description of each project including completion date, type and scope of the project, and contact person with telephone number for reference.
5. A detailed schedule and timeline, including a proposed start date and completion date, indicating how the project tasks will be organized to complete the work.
6. Proposed budget and "not to exceed" cost for completing the project which must include a task breakdown of project cost by each staff/team member and hours assigned to each staff/team member. A separate cost for any proposed additional items shall be provided apart from the Scope of Services outlined.

Evaluation Process & Criteria:

Proposals will be reviewed and evaluated by CCFC and members of the Mahoosuc Community Broadband Committee in accordance with the following criteria:

- Submission of a complete and concise proposal with the Consultant's approach to the project, which contains all information, services and requirements of this RFP.
- Thoroughness of services the Consultant proposes to provide.
- The Consultant's stated ability to perform and complete all work as indicated in the Scope of Services and in a timely manner.
- The background and relevant experience of all members of the project team.
- Overall experience and past performance on similar projects.
- Comparative costs of the proposals will be considered but will not be the only basis for selection.

CCFC will notify applicants with a final decision or request for additional information within three weeks of the submission deadline.

Disclaimers

- CCFC reserves the right to accept or reject any or all submittals received, cancel or modify the RFP in part or in its entirety, or change the RFP guidelines when it believes it is in CCFC's and the Mahoosuc Community Broadband Committee's best interest to do so.
- CCFC will not be responsible for any costs incurred by the respondent in the preparation of a response to this Request for Proposals.
- CCFC reserves the right to delay or discontinue this selection process at any time during the process.
- CCFC reserves the right to request clarification and/or additional information from the Respondent during the evaluation process.
- All proposals submitted in response to this RFP become the property of CCFC. CCFC has the right to disclose information contained in the proposals after an award has been made. All submitted reports, documents, and materials shall be considered public information and shall be the property of CCFC.



Construction Services for Fiber Optic Broadband
Infrastructure
Request for Proposals
ISL-2017-01

Town of Islesboro
150 Main Road
Islesboro, ME 04848
www.townofislesboro.com

June 16, 2017

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REQUEST FOR PROPOSALS
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CONSTRUCTION SERVICES FOR FIBER OPTIC BROADBAND INFRASTRUCTURE

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1. Request for Proposals Overview

1.1. General Information

Through this Request for Proposals (RFP), the Town of Islesboro is seeking an experienced fiber optic network equipment installation and testing firm to perform services related to fiber optic facilities in Islesboro, Maine. The fiber network is open access and designed to support use by the community. Respondents will be asked to provide pricing for Scope B services outlined below for managing the construction and network installation tasks detailed below.

1.2. Expected RFP Schedule

Unless otherwise indicated, all deadlines are 1:00 PM EDT on the date listed.

RFP POSTED	June 16, 2017
NOTIFICATION OF INTENT TO RESPOND DUE	June 22, 2017
MANDATORY PRE-BID CONFERENCE CALL	June 29, 2017 11:00 a.m.
RFP Q&A CONFERENCE CALL	July 6, 2017
WRITTEN QUESTIONS DUE	July 13, 2017
Q&A POSTED	July 14, 2017
PROPOSALS DUE	July 26, 2017

2. Background

The Town of Islesboro intends to build and own a fiber optic and wireless network connecting community anchor institutions (CAIs), private enterprises, and the residences of the Town of Islesboro. The Town of Islesboro is a municipal corporation organized and existing under the laws of the State of Maine.

The Town of Islesboro is seeking an entity or entities capable of performing equipment installation and testing services for Scope B of our project as described in the RFP. This RFP along with the appendices and attachments are critical in understanding the level of work required by the Contractor.

Respondents shall describe in their proposal their approach and firm, fixed-price bid for installing and testing the work as described in this RFP.

For bids which include teams of more than one firm, the Town of Islesboro expects each bid team to identify one firm as the General Contractor (General Contractor or GC). Collectively each entity, and other teamed entities are referred to as “Bidders,” “Contractors,” “Proposers” or “Respondents” in this RFP. The General Contractor shall be responsible for purchase, installation and testing of equipment, insurance, and bonding. The Owner’s Project Manager (OPM), James W. Sewall Company, will oversee construction to ensure compatibility with the proposed network infrastructure.

2.1. Islesboro Background

Islesboro is a vibrant island community in Waldo County, Maine, located approximately three miles off the coast of Lincolnville in Penobscot Bay. The Lincolnville-to-Islesboro ferry provides access to the island with seven week-day round trips per day, and expands to nine week-day round trips per day from the end of March to mid-October. There is also a Quicksilver water taxi that makes two weekday morning trips from Lincolnville to Islesboro at 6:10 AM and 6:45 AM.

The Town now has over 600 year-round residents. Islesboro's population swells to over 2,000 people in the summer months, when many seasonal residents return to vacation with family and friends. That being said, traffic on the island will be at its peak while construction of the network is taking place.

2.2. Project Background

Contracts arising from this RFP will be conditionally awarded and executed, with payment and performance obligations subject to Board of Selectmen approval of the contract price.

The following companies are associated with this project, and are cited throughout this RFP:

- The Town of Islesboro is the Owner and duly authorized to enter into contract negotiations.
- Tilson Technology Management (Tilson) is the original designer of the Town of Islesboro's fiber-to-the-premises (FTTP) system.
- Waveguide of Nashua NH is the Town of Islesboro's outside plant contractor and designer of the "as built" network.
- Biddeford Internet Corporation d/b/a Great Works Internet (GWI) is the proposed network operator for the Town of Islesboro. GWI will maintain and deliver service over the network under a public-private partnership.
- James W. Sewall Company, of Old Town, Maine, is the Owner's Project Manager.
- Central Maine Power Company (CMP), a subsidiary of Iberdrola USA Networks, is the local electric utility.
- Northern New England Telephone Operations, LLC d/b/a FairPoint Communications – NNE (FairPoint) is the local communications utility.

3. General Information

3.1. Response Information

3.1.1. Single Point of Contact

All communications concerning this Request for Proposal (RFP) are to be sent by email to:

Vernon Ziegler, Assessor
Town of Islesboro
150 Main Road
Islesboro, Maine 04848
Phone: (207) 734-2253
Fax: (207) 734-8394
e-mail: assessor@townofislesboro.com

3.1.2. Mandatory Pre-Bid Conference Call

Each Proposer must attend the mandatory pre-bid conference call and inform itself of the conditions relating to the area in which the construction services shall be performed. The pre-bid conference call on June 29, 2017 will begin at 11:00 A.M. via conference bridge provided to all Proposers by Owners, 150 Main Road, Islesboro, Maine. The Town disclaims any and all responsibility for injury to Proposers, their agents or others while examining the site or at any other time.

3.1.3. Questions and Answers

Questions about the Request for Proposal and the proposal contents need to be in writing and submitted to Vernon Ziegler on or before the date listed in Section 1.2. Questions will be answered during a conference call on the date listed in Section 1.2. All questions and answers will be posted in the Question and Answers file under RFP ISL-2017-01 on the Islesboro List of Published Requests on www.townofislesboro.com/bbrfp2 by the date listed in Section 1.2.

3.1.4. Revisions to RFP

If the Owner determines that it is necessary to revise any part of this RFP, or if additional data is necessary to clarify any of its provisions, a supplement will be posted to the Owner's website. The Owner reserves the right to amend the RFP at any time prior to the deadline for submission of responses, and will notify all bidders who are on the Owner's distribution list via the mandatory pre-bid meeting attendance sheet.

3.1.5. Bid Deposit

All Bidders must submit a bid deposit in an amount equal to 10% of the bid amount in the form of a bid bond or certified check made payable to the Town of Islesboro. Bid deposits shall be returned upon the signing of a contract in substantially the same form as shown on Appendix A: Owner-Contractor Agreement, which shall be signed, if at all, no later than eighty (80) days after the opening of bids, and also shall be returned in the event that the Owner rejects all bids. Should a Bidder withdraw its proposal prior to the signing of a contract between the successful bidder and the Owner, the Bidder's bid deposit shall be forfeited to the Town of Islesboro.

No Proposals may be withdrawn within a period of eighty (80) days after the opening of Proposals. Proposals may be held by the Town for a period not to exceed eighty (80) days from the date of the opening of Proposals for the purpose of reviewing proposals and investigating the qualifications of the Proposers prior to the award of a contract.

3.1.6. Proposal Deadline

Please provide the Town with an original plus seven (7) copies of the firm's proposal in a sealed envelope, marked "Broadband Infrastructure Proposal – Scope B," addressed to Islesboro's Single Point of Contact at 150 Main Road, Islesboro, ME 04848. Proposals must be submitted in hardcopy form, and may be supplemented with an electronic copy within the sealed bid envelope. Proposals must be received by the Town on or before **1:00 P.M. EDT on the date listed in Section 1.2**. Proposals received after that date and time will not be considered.

3.1.7. Bid Opening

Bids shall be opened by the Town Manager, or the Manager's designee, in public on July 27, 2017 at 10:00 A.M. at:

Islesboro Town Office
150 Main Road
Islesboro, ME 04848

A tabulation of all received bids will be made available for public inspection.

3.2. Other Preparation Information

3.2.1. Proposal Acceptance

The Owner reserves the right to accept or reject any or all proposals, in whole or in part, as deemed to be in the best interest of the Town of Islesboro. The Owner may elect to negotiate with multiple entities prior to making final decisions.

3.2.2. Business Good Standing

To be awarded a contract by the Town of Islesboro, a Respondent must demonstrate that it is authorized to conduct business in Maine as evidenced by a certificate of good standing from the Maine Secretary of State's Office.

3.2.3. Costs of Preparation

The Respondent shall be solely responsible for all expenses incurred in the preparation of a response to this RFP and shall be responsible for all expenses associated with any presentations or demonstrations associated with this request and/or any proposals made.

3.2.4. Other Response Information

Unless otherwise specified in this RFP, all communications, responses, and documentation must be in English, and all cost proposals or figures in U.S. currency. All responses must be submitted in accordance with the specific terms of this RFP.

The Owner may provide reasonable accommodations, including providing material in an alternative format, for qualified Respondents with disabilities or other hardships. Respondents requiring such accommodations shall submit requests in writing, with supporting documentation justifying the accommodations, to the Owner.

3.3. Contract Award Information

The Owner may award one or more contracts, and reserves the right to make additional awards to the same bidder at any time during the contract term if such award is deemed to be in the best interest of the Town of Islesboro.

3.4. Contract Evaluation

The Owner intends to evaluate all submitted proposals as quickly as possible. Upon completion of the evaluation process, the Owner may select one or more Contractors with which to simultaneously execute contracts, based on the evaluation findings and other criteria deemed relevant for ensuring that the decision made is in the best interest of the Town of Islesboro.

3.5. Standard Terms and Conditions

The successful Proposer(s) shall be required to sign an Owner-Contractor Agreement substantially in the form attached hereto as Appendix A. Respondents should also familiarize themselves with the Town's Purchasing Policy, a copy of which is available at the Town Office, and on the Town's website at <http://www.townofislesboro.com/bbrfp2>.

3.6. Public Records

The successful response will become part of the contract file and will become a matter of public record as will all other responses received.

4. Scope B – Network Electronics & Equipment Installation

4.1. Performance Requirements

4.1.1. General Information

This section provides key material and workmanship requirements for Point of Presence (POP) facilities and their care, electronics and equipment installations or removal and shall be a basis for audit and evaluation of a job. The workmanship items described in this section are both generic and specific in nature and may be applicable to all installation and removal operations. In addition, the experienced network equipment installation and testing firm shall adhere to the specific installation, removal, and operational standards established in applicable equipment specifications as well as all handbooks and technical information required to successfully complete installation or removal of the equipment.

The experienced network equipment installation and testing firm shall not deviate from standards or guidelines outlined in this section without written permission from the OPM. Any questions not answered by this section, the job specifications, drawings/records, etc. shall be referred to the OPM for resolution and documented in the job log by the Respondent.

4.1.2. Network Equipment Specifications

See Appendices B through J.

4.1.3. Installation Requirements

4.1.3.1. Installation Scope

Installation work will be done in two locations:

1. within the POP Shelter that is currently under construction by Waveguide. The building is adjacent to the Town of Islesboro Town Office Building at 150 Main Rd.
2. A Fiber Distribution Hut on 700 Acre Island adjacent to the Dark Harbor Boat Yard. Bidder can contact the boat yard for information and costs regarding transportation to and from the island.

Bidder can assume that electrical, including backup power, and heating ventilation and air conditioning will be in place. Please refer to Appendix E: Point of Presence (POP) Installation Standards Guide.

4.1.3.2. Network Equipment List

Please refer to Appendix D: Network Equipment Bill of Materials. It is required that firms provide a firm, fixed bid on the specific set of equipment from specific manufacturers contained in Appendix D at the minimum. The option to submit an alternate set of equipment that meets the network requirements at a lower cost, but similar warranty, to the Owner is in addition to the requirement stated above. Excess materials purchased but not used during the construction will be property of the Owner upon acceptance of the network.

Please be aware that all necessary construction equipment of the Contractor to be transported from Lincolnville, ME to Islesboro, ME on the MV Margaret Chase Smith ferry is subject to cargo dimension limits of: 60' x 10' x 15'.

4.1.3.3. Staging Area

The staging area for all network equipment will be the POP Shelter. All building construction within the areas designated for POP equipment shall be completed before the scheduled start of the network equipment installation activity. Any exceptions shall be subject to agreement between the Installer, the Owner, and its OPM.

4.1.3.4. Network Equipment Testing

4.1.3.4.1. Acceptance Test Plan (ATP)

The Contractor shall provide a comprehensive ATP(s) as follows:

- a. The Contractor shall develop and submit to the OPM within 15 days prior to any tests, an ATP for review and approval, which details all testing for all new material, cables and equipment based on final design and the minimum technical requirements, the manufacturer's recommended test procedures, and industry standard practices.

- b. The ATP shall include procedures and data forms for the OPM's review prior to the day the tests are to begin. The Test Plan shall include the sequence in which the tests will be conducted. The Test Plan shall have the OPM's approval prior to the start of testing.
- c. All test results, including results of failed tests or re-tests, shall be submitted, and delivered to the OPM. The data forms shall contain all of the data taken, as well as quantitative results for all tests. The data forms shall be signed by an authorized representative of the Contractor. At least one copy of the data forms shall be sent to the OPM within 10 working days of the test's conclusion.
- d. The OPM reserves the right to have a representative witness all tests. The results of each test shall be compared with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and the equipment shall be subject to rejection by OPM. Rejected equipment may be offered again for a retest, provided that all non-compliances have been corrected and retested and evidence thereof submitted to OPM.
- e. The Contractor shall be responsible for providing the test fixtures and test instruments for all the system and fiber optic related tests.
- f. The ATP shall cover all testing to demonstrate that the fiber and network are meeting the design intent and requirements.

4.1.3.4.2. Original Equipment Manufacturer (OEM) Tests

Original Equipment Manufacturer (OEM) tests are performed by the OEMs in a controlled environment at the manufacturer's facilities. These tests shall consist of functional performance tests to determine the maximum performance limits of an item. These tests could measure such things as electronics characteristics, min/max operating temperatures, ability to withstand shock, vibration, dust, humidity, fungus, solar radiation, etc. and may include destructive tests. These tests shall be done in accordance with Industry standards.

4.1.3.4.3. Lab System Prototype Tests

Individual components of the system must be combined into a prototypical test network or system. This testing can be accomplished at the equipment vendor's site, or location where equipment has previously been installed. Lab System Tests are aimed to simulate the logical environment of the system. Physical components such as fiber span distances and OSP/Facilities components are not part of the Lab System Prototype Tests.

The primary objectives of the Lab System Prototype Tests are to:

- a. Verify interoperability and operation of the individual components as an integrated system.
- b. Verify system and service functionality requirements (Fault recovery, QoS/CoS mechanisms, service provisioning, service monitoring, etc.).
- c. Verify system and service performance specs and baseline performance (Latency, Jitter, Packet Loss, BER) for reference during field acceptance testing.

4.1.3.4.4. Conditional Acceptance Tests

Please refer to Appendix F: Conditional Acceptance Testing, for the guidelines associated with each level of conditional acceptance tests.

4.1.3.5. Documentation Requirements

The Contractor will provide an as-built package at the completion of this project. This package shall include at a minimum the following items:

- Updated drawings with any changes implemented.
- Test results for the approved ATP.
- Warranty Package to include dates (Product Warranty)
- Certificate of Acceptance (pre-and post-installation)
- Summary sheet of test results for quick reference

Test results shall be provided as indicated in the testing sections of this specification. Drawings provided to the Respondent can be used as the basis for any as-built. If changes are noted in the field, they shall be indicated on the Respondent's updated drawings. The updated drawings shall be provided to the OPM via electronic data format and in hard copy (in color).

4.1.3.6 Job Completion

Job completion occurs when all of the following conditions are met by the General Contractor:

1. submits last invoice;
2. notifies the Owner that construction is complete;
3. final inspection has occurred;
4. all punch list items have been completed;
5. all documentation has been completed and submitted to the town
 - a. Network Equipment Installation Project
 - b. Design As-Builts
 - c. Test data
 - d. Equipment Organization Drawing
 - e. Equipment testing

4.1.4. Safety Requirements

The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions to reasonably protect the public and private property connection with the performance of the work covered by the contract.

The Contractor shall take the necessary precautions and bear the sole responsibility for the safety of the methods employed in performing the work. The Contractor shall at all times comply with the regulations set forth by Federal, State and local laws, rules, and regulations concerning "OSHA" and all applicable state labor laws, regulations and standards.

Please refer to Appendix E: Point of Presence (POP) Installation Standards Guide, for detailed guidelines pertaining to installation, cabling, fiber optic cable, wiring, connecting, power, batteries, bonding, and grounding.

4.1.5. Warranty Requirements

1. The Contractor shall warrant that all materials furnished shall be new, and free from defects.
2. The Contractor shall warrant that the materials and workmanship used in this installation are as herein specified, and shall provide all material and labor required to make good any defects due to faulty materials or workmanship which become apparent within a one year period from substantial completion.
3. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives, as well as misrepresentations of such data.
 - a. When the products have been installed in accordance to the manufacturer's published or written instructions and recommendations, and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to the Owner.
4. Warranty information is required for all materials supplied by the Contractor.
5. Damage by vandals, fire, traffic accidents or "acts of God" is excluded from warranty.

4.1.6. Schedule Requirements

The contract period is expected to begin on or around August 11, 2017 and extend through the close-out of the project in fall of 2017.

SELECTION NOTIFICATION	August 10, 2017
CONTRACT EXECUTED	August 10, 2017
BEGIN CONSTRUCTION	August 24, 2017
COMPLETE CONSTRUCTION	October 30, 2017
OPM'S ACCEPTANCE OF SYSTEM	November 1, 2017

5. Proposal Requirements

Each Proposal must answer each of the following sections to be considered for evaluation. If a Respondent fails to meet any material terms, conditions, requirements or procedures, its response may be deemed unresponsive and disqualified.

5.1. Company Information

1. Provide your company information, including legal name, state of incorporation, year of incorporation, type of entity, all contact information, and a list of affiliated companies or other names you have done business as.
2. Please identify whether you are currently authorized to operate in the State of Maine and whether you maintain a physical presence within the state.

3. What other states or locations, if any, do you maintain an office or operations?
4. How many employees comprise your workforce: a) full time; b) part time; c) contract?
5. What are the functional groups within your company?
6. Please identify any awards or recognition received by your company in the past 3 years.
7. Please list any licenses, certifications or accreditations awarded to your company.
8. Are you currently under contract or negotiations for a contract with the State of Maine? Any other state or municipality? Please list.
9. If selected as a vendor of choice, how soon can your company begin providing construction services to the Owner?
10. Please provide evidence that you are capable of complying with the bond and insurance requirements of this project, as more specifically set forth in the Owner-Contractor Agreement attached as Appendix A.

5.2. Industry Experience

Please provide the following for your company and all Sub-Contractors:

1. Please provide three (3) customer/client references including name, email, address, project timeline, and description of work.
2. Please list the training certifications that your technicians hold and any experience with standards such as NECA 301 Standard and OTDR/loss testing.
3. Please provide your company's safety program, as well as any OSHA reportables within the past 3 years.
4. Which activities of Scope B will your company perform? Which activities will your company Sub-Contract out?
5. Are your technicians trained and experienced with NECA 301 standards?
6. Are your technicians trained in OTDR/Loss testing?
7. Do your technicians hold certifications for splicing?

5.3. Bond Requirements and Insurance

Proof of insurance is required upon notification of award. The successful bidder shall provide proof of worker's compensation insurance, comprehensive general liability insurance, and comprehensive automobile insurance in their response, in the amounts required by the Owner-Contractor Agreement attached as Appendix A.

5.4. Conformance to Requirements

Please identify how your company will conform to all requirements as identified in Section 5. Please identify any subsections you do not believe you can or will conform to. Please identify any subsections in Sections 4, 5 or 6 and Appendices A through J that you do not believe are necessary or will change your proposal in scope, performance or price.

5.5. Price

Please provide a firm fixed price for the work described in this RFP. Respondents must provide their unit price labor costs for installation of the items included in the Bill of Materials.

The Town of Islesboro is a municipal corporation organized and existing under the laws of the State of Maine. Our sales tax exemption number will be provided to the selected Contractor(s).

5.6. Value Engineering

If able, Respondents are invited to submit an alternative design on all or part of this RFP for the Owner's review that provides equal or greater function at lower cost.

5.7. Project Management

1. List what primary tools, equipment, software and hardware you use for Contractor project management.
2. Identify how you make your work effective and efficient.
3. Describe your recommended project management approach for coordination and communication.

5.8. Schedule Requirements

Describe the schedule you will meet for this project. Also, specifically describe how you intend to meet that schedule and what kind of guarantees or assurances you can provide.

5.9. Approvals and Certifications

Affirm that your proposal to this RFP will be valid for all parts of the network identified even if some of that work must be completed by a Sub-Contractor.

5.10. Safety

The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions to reasonably protect the public and private property connection with the performance of the work covered by the contract.

The Contractor shall take the necessary precautions and bear the sole responsibility for the safety of the methods employed in performing the work.

5.11. Warranty

Please describe how you will meet the minimum warranty requirements specified and appropriate within this document. Description must meet minimum requirements but additional items or lengths of time will be viewed favorably.

6. Proposal Evaluation Criteria

The Owner will review the RFP responses in accordance with the submittal requirements and using the criteria generally described as follows. Criteria are not necessarily listed in order of importance.

1. The thoroughness and comprehensiveness of each response.

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2. The ability to meet the construction requirements, installation and testing requirements.
3. The qualifications, experience and knowledge of the Respondent and the proposed project personnel.
4. Ability to meet schedules and deadlines.
5. Price of the work requested under this RFP.
6. Familiarity with the proposed project areas or areas of similar geography.
7. Ability to work in a safe manner.
8. Ability to control and minimize costs as demonstrated in the response and through experience in prior projects.
9. Agreement to conform, or have Sub-Contractors conform, to Appendix A: Owner-Contractor Agreement.
10. Compliance with Sections 3.2.2 – Business Registration and Sections 3.5 Standard Terms and Conditions.

Appendix A: Owner-Contractor Agreement

AGREEMENT

THIS AGREEMENT is made this _____ day of _____, 2017, by and between the **INHABITANTS OF THE TOWN OF ISLESBORO**, a municipal corporation existing under the laws of the State of Maine and located in the County of Waldo, State of Maine (hereinafter "OWNER") and , a Maine [type of entity] with a principal place of business in _____, Maine (hereinafter "CONTRACTOR").

WITNESSETH:

In consideration of the mutual covenants and conditions contained herein, the OWNER and the CONTRACTOR agree as follows:

1. SCOPE OF THE WORK

The CONTRACTOR shall furnish all of the materials and perform all of the work described as Scope B in the Construction Services for Fiber Optic Broadband Infrastructure Request for Proposals dated _____, 2017 and as amended through _____, 2017 by Addenda Nos. ____ (the "RFP") and the Drawings dated _____ (the "Drawings") provided to the CONTRACTOR by the OWNER (collectively the "Work"). The RFP, the Drawings, and the CONTRACTOR's Response to the RFP (the "RFP Response") (hereinafter collectively the "Project Manual") are incorporated herein and made a part hereof by reference, and the CONTRACTOR covenants that it shall do everything required by this Agreement, the conditions of this Agreement, and the Project Manual in return for payment as provided herein. The restatement in this Agreement of any of the terms of said Project Manual shall not be deemed to waive any terms not so restated. To the extent that there is any conflict between the RFP and the RFP Response, the terms of the RFP shall control. To the extent that there is any conflict between the Project Manual and this Agreement, the terms of this Agreement shall control.

2. CONTRACTOR OBLIGATIONS

The CONTRACTOR warrants:

- a. That it will furnish all vehicles, materials, personnel, tools and equipment, except as otherwise specified herein, and do everything necessary and proper to satisfactorily perform the Work required by this Agreement.
- b. That it is financially solvent, is experienced in and competent to perform the Work and is able to furnish the vehicles, materials, personnel, tools and equipment to be furnished by it.
- c. That it is familiar with all federal, state and local statutes, laws, rules, regulations, ordinances and orders that may in any way affect the Work.
- d. That it has carefully examined the Project Manual, this Agreement and the site of the Work and has conducted its own investigation of the nature and location of the Work, the character of equipment

and personnel needed to perform the Work and all conditions that may in any way affect the performance of the Work.

- e. That any increase in CONTRACTOR'S costs during the term of this Agreement shall be the sole responsibility of the CONTRACTOR.
- f. The Work shall conform to the 2014 Edition of the National Electrical Code, National Electrical Safety Code and all state and local codes and ordinances. ANSI/TIA/EIA Standards shall be adhered to during all installation activities.
- g. That materials and equipment furnished under this Agreement will be of good quality and new unless otherwise required or permitted by the Project Manual and this Agreement, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Project Manual and this Agreement. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The CONTRACTOR's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the CONTRACTOR, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Owner's Project Manager, the CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3. COMPLETION DATE

The work to be performed under this Agreement shall be commenced by _____, 2017 and substantially completed on or before _____, 2017. Due to the difficulty of calculating damages for late completion, liquidated damages in the amount of \$100.00 per day for late completion shall be awarded to the OWNER for delay in Substantial Completion not otherwise excused or permitted under this Agreement.

Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete in accordance with the Project Manual and this Agreement so that the OWNER can occupy or utilize the Work for its intended use.

4. CONTRACT PRICE

The OWNER shall pay the CONTRACTOR for the performance of this Agreement the sum of _____ Dollars (\$ _____) in accordance with the terms and conditions set forth in Sections 17, 18 and 19 of this Agreement.

5. PERFORMANCE AND PAYMENT BONDS

The CONTRACTOR shall furnish to the OWNER at the time of the execution of this Agreement a performance bond and a separate labor and material payment bond, each in the amount of \$ _____ [contract price] executed by a surety company satisfactory to the OWNER, guaranteeing the faithful performance of this Agreement and payment of obligations arising hereunder by the CONTRACTOR, including the guarantee period and free and clear of any and all liens, attachments and encumbrances.

6. GUARANTEE

The CONTRACTOR warrants to the OWNER that materials and equipment furnished under the Agreement will be of good quality and new unless otherwise required or permitted by the Project Manual and this Agreement, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Project Manual and this Agreement. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The CONTRACTOR's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the CONTRACTOR, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the OWNER, the CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The CONTRACTOR and the subcontractors shall guarantee their work against any defects in workmanship and materials for a period of one year from the date of Substantial Completion of all of the Work, and agrees to repair or replace at no cost or expense to the OWNER all work, materials and fixtures at any time during said one year period. The OWNER shall give notice to CONTRACTOR promptly after discovery of the condition. If the CONTRACTOR fails to correct nonconforming Work within a reasonable time after receipt of notice from the OWNER, the OWNER may, without prejudice to other remedies the OWNER may have, correct such deficiencies, and the CONTRACTOR shall pay the cost to the OWNER.

7. PERMITS AND LICENSES

Permits and licenses necessary for the prosecution of the work shall be secured by the CONTRACTOR.

8. OWNER'S RIGHT TO TERMINATE CONTRACT

Without prejudice to any other right or remedy, the OWNER may terminate this Agreement for cause by providing the CONTRACTOR and its surety with seven (7) days' written notice of termination. For purposes of this Agreement, cause includes, but is not limited to: the adjudication of the CONTRACTOR as a bankrupt; the making of a general assignment by the CONTRACTOR for the benefit of its creditors; the appointment of a receiver because of the CONTRACTOR's insolvency; the CONTRACTOR's persistent or repeated refusal or failure, except for cases in which extension of time is provided, to supply enough properly skilled workers or proper materials; the CONTRACTOR's persistent disregard of federal, state or local statutes, laws, rules, regulations, codes, ordinances or orders; and the CONTRACTOR's substantial violation of any provisions of this Agreement. In the event of a termination for cause, the OWNER may take possession of the premises and of all materials, tools and appliances thereon and finish the work by whatever method it may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract Price shall exceed the expense of finishing the work, including compensation for additional design, managerial and administrative services, such excess shall be paid to the CONTRACTOR. If such expense shall exceed such unpaid balance, the CONTRACTOR shall pay the difference to the OWNER.

9. INSURANCE

The OWNER shall purchase and maintain builder's risk insurance. The CONTRACTOR shall purchase from and maintain in a company or companies lawfully authorized to do business in Maine

such insurance as will protect the CONTRACTOR from claims set forth below which may arise out of or result from the CONTRACTOR's operations under this Agreement and for which the CONTRACTOR may be legally liable, whether such operations be by the CONTRACTOR or by a subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The CONTRACTOR shall obtain and maintain throughout the term of this Agreement at no expense to the OWNER the following insurance coverages written for not less than the following limits, or greater if required by law:

- a. Commercial General Liability Insurance including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards) in the following amounts:

- \$1 million Each Occurrence
- \$2 million General Aggregate
- \$1 million Personal and Advertising Injury
- \$1 million Products - Completed Operations Aggregate
- \$5 million Umbrella (Each Occurrence and General Aggregate)

The policy shall be endorsed to have the General Aggregate apply to this project only. Products and Completed Operations insurance shall be maintained for a minimum period of at least one (1) year after either 90 days following Substantial Completion or final payment, whichever is earlier. The Contractual Liability insurance shall include coverage sufficient to meet the obligations in Section 10.

- b. Automobile Liability Insurance (owned, non-owned and hired vehicles) for bodily injury and property damage in the following amount:

- \$1 million Each Accident.

- c. Workers' Compensation Insurance in such amount as required by Maine law and Employer's Liability Insurance, as necessary, as required by Maine law. In case any class of employees engaged in hazardous work under this Agreement is not protected under the Worker's Compensation Act, the CONTRACTOR shall, at its own expense, provide for the protection of its employees not otherwise protected.
- d. All required insurance coverages to work on utility poles, lines and within the communication space owned by Central Maine Power and FairPoint.
- e. All such insurance policies shall name the OWNER and its officers, agents and employees as additional insureds, except that for purpose of workers' compensation insurance, the CONTRACTOR instead may provide a written waiver of subrogation rights against the OWNER. The CONTRACTOR, prior to commencement of work under this Agreement shall deliver to the OWNER certificates evidencing such insurance coverages, which certificates shall state that the CONTRACTOR must provide written notice to the OWNER at least thirty (30) days prior to cancellation, non-renewal, material modification or expiration of any policies, evidenced by return receipt of United States Certified Mail, notwithstanding anything herein to the contrary. Replacement certificates shall be delivered to the OWNER prior to the effective date of cancellation, termination, material modification or expiration

of any such insurance policy. The CONTRACTOR shall not commence work under this Agreement until it has obtained all insurance coverages required under this subparagraph and such insurance policies have been approved by the OWNER. All such insurance policies shall have a retroactive date which is the earlier of the date of this Agreement between the parties or the CONTRACTOR's commencement of services thereunder.

10. INDEMNIFICATION

The CONTRACTOR shall indemnify and hold harmless the OWNER, its officers, agents, and employees, from and against any and all claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), resulting from the fault of, or any negligent acts or omissions or willful misconduct of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 10.

In claims against any person or entity indemnified under this Section 10 by an employee of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 10 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or a subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

The provisions of this Section 10 shall survive the termination or expiration of this Agreement.

11. LIENS

Neither the final payment nor any part of the retained percentage shall become due until the CONTRACTOR, if required by the OWNER, shall deliver to the OWNER a complete release of all liens arising out of this Agreement, or receipts in full in lieu thereof and, if required in either case, an affidavit that so far as it has knowledge or information the releases and receipts include all the labor and material for which a lien could be filed, but the CONTRACTOR may, if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the OWNER to indemnify it against any lien. If any lien remains unsatisfied after all payments are made, the CONTRACTOR shall refund to the OWNER all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

12. ASSIGNMENT

Neither party to the Agreement shall assign this Agreement or sublet it as a whole without the written consent of the other, nor shall the CONTRACTOR assign any moneys due or to become due to it hereunder, without the previous written consent of the OWNER.

13. SUBCONTRACTS

By appropriate agreement, written where legally required for validity, the CONTRACTOR shall require each subcontractor, to the extent of the Work to be performed by the subcontractor, to be bound to the CONTRACTOR by terms of the Project Manual and this Agreement, and to assume toward the CONTRACTOR all the obligations and responsibilities, including the responsibility for safety of the subcontractor's Work, which the CONTRACTOR, by these documents, assumes toward the OWNER. Each subcontract agreement shall preserve and protect the rights of the OWNER under the Project Manual and this Agreement with respect to the Work to be performed by the subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the CONTRACTOR that the CONTRACTOR, by the Project Manual and this Agreement, has against the OWNER. Where appropriate, the CONTRACTOR shall require each subcontractor to enter into similar agreements with sub-subcontractors. The CONTRACTOR shall make available to each proposed subcontractor copies of the Project Manual and this Agreement to which the subcontractor will be bound. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed sub-subcontractors.

14. USE OF PREMISES

The CONTRACTOR shall confine its apparatus, the storage of materials and the operations of its workers to limits indicated by law, ordinances and permits and shall not otherwise unreasonably encumber the premises with its materials. If any part of the project is completed and ready for use, the OWNER may, by written and mutual consent, without prejudice to any of its rights or the rights of the CONTRACTOR, enter in and make use of such completed parts of the project provided such occupancy or use is consented to by the insurer providing property insurance. Immediately prior to such partial occupancy or use, the OWNER, CONTRACTOR and Owner's Project Manager shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Such use or occupancy shall in no case be construed as an acceptance of Work or materials not complying with the requirements of the Project Manual and this Agreement.

15. CLEANING UP

The CONTRACTOR shall at all times keep the premises free from accumulation of waste materials or rubbish caused by its employees or work, and at the completion of the work it shall remove all its rubbish from and about the project, and all its tools, scaffolding and surplus materials and shall leave its work "broom-clean" or its equivalent, unless more exactly specified. In case of dispute, the OWNER may remove the rubbish and charge the cost to the CONTRACTOR.

16. CHANGE ORDERS

A Change Order is a written instrument prepared by the Owner's Project Manager and signed by the OWNER, CONTRACTOR and Owner's Project Manager, stating their agreement upon all of the following:

- (a) change in the Work;
- (b) the amount of the adjustment, if any, in the Contract Price; and
- (c) the extent of the adjustment, if any, in the Completion Date.

A Change Order shall be based upon agreement among the OWNER, CONTRACTOR and Owner's Project Manager; provided, however, that no written Change Order adjusting the Contract Price or the

Completion Date shall be effective unless and until approved by formal vote of the OWNER's Board of Selectmen.

17. PROGRESS PAYMENTS

Based upon Applications for Payment submitted to the Owner's Project Manager by the CONTRACTOR and Certificates for Payment issued by the Owner's Project Manager, the OWNER shall make progress payments on account of the Contract Price to the CONTRACTOR as follows:

On or before the 30th day of each month following commencement of construction, the CONTRACTOR shall submit to the OWNER an itemized pay requisition outlining the percentage and dollar amount of work completed. Upon receipt of said document, the Owner's Project Manager shall inspect the premises and make a payment recommendation to the OWNER. Upon the OWNER's approval of the Owner's Project Manager's payment recommendation, payment of the approved amount less five percent (5%) retainage shall be made by the OWNER. Provided that the OWNER has received the itemized pay requisitions by the 30th of the month, the OWNER shall pay the CONTRACTOR on or before the 15th of the following month. All retainage shall be held until the OWNER's final acceptance of the work.

All Applications for Payment shall include, in addition to other required items, (a) lien waivers, in form and substance sufficient as a matter of law to waive all liens or claims of liens for all Work covered by the Application for Payment, executed by (i) the CONTRACTOR, and (ii) each subcontractor or materialman to be paid an amount in excess of \$500 out of the progress payment, and providing that such lien waiver shall become effective upon payment of the amount requested for payment to such party under the Application for Payment; and (b) evidence reasonably adequate to demonstrate that previous progress payments have been disbursed by the CONTRACTOR to subcontractors and materialmen in accordance with the Applications therefor.

18. PUNCH LIST/SUBSTANTIAL COMPLETION

When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is substantially complete, the CONTRACTOR shall prepare and submit to the Owner's Project Manager a comprehensive list of items to be completed or corrected prior to final payment ("punch list"). Failure to include an item on such punch list does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Project Manual and this Agreement.

Within seven days of receipt of the CONTRACTOR's list, the Owner's Project Manager will, in consultation with the OWNER's designee, make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Owner's Project Manager's inspection discloses any item, whether or not included on the CONTRACTOR's list, which is not sufficiently complete in accordance with the Project Manual and this Agreement so that the OWNER can occupy or utilize the Work or designated portion thereof for its intended use, the CONTRACTOR shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Owner's Project Manager. In such case, the CONTRACTOR shall then submit a request for another inspection by the Owner's Project Manager to determine Substantial Completion. During the Owner's Project Manager's initial inspection, the Owner's Project Manager, in consultation with the OWNER's designee, shall prepare a list of any unfinished work not already included on the CONTRACTOR's list that must be completed prior to Final Completion. Any item not included either on the CONTRACTOR's list or the Owner's Project Manager's list shall be treated as warranty work.

When the Work or designated portion thereof is substantially complete, the Owner's Project Manager will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the OWNER and CONTRACTOR for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the CONTRACTOR shall finish all items on the list accompanying the Certificate. Warranties required by this Agreement shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

The Certificate of Substantial Completion shall be submitted to the OWNER and CONTRACTOR for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the OWNER shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Project Manual and this Agreement.

19. FINAL PAYMENT

Final payment, constituting the entire unpaid balance of the Contract Price, shall be made by the OWNER to the CONTRACTOR when (1) the Work has been completed and the Agreement has been fully performed by the CONTRACTOR except for the CONTRACTOR's responsibility to correct nonconforming Work, as provided in Section 6, and to satisfy other requirements, if any, which necessarily survive final payment; (2) a final Application for Payment has been submitted by the CONTRACTOR; and (3) a final Certificate for Payment has then been issued by the Owner's Project Manager; such final payment shall be made by the OWNER not more than thirty (30) days after the issuance of the Owner's Project Manager's final Certificate for Payment.

Neither final payment nor any remaining retained percentage shall become due until the CONTRACTOR submits to the Owner's Project Manager with the final Application for Payment: (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the OWNER or the OWNER's property might be responsible or encumbered (less amounts withheld by OWNER) have been paid or otherwise satisfied; (2) a certificate evidencing that insurance required by this Agreement to remain in force after final payment is currently in effect and will not be cancelled or allowed to expire until at least thirty (30) days' prior written notice has been given to the OWNER; (3) a written statement that the CONTRACTOR knows of no substantial reason that the insurance will not be renewable to cover the period required by this Agreement; (4) consent of surety, if any, to final payment; and (5) documents establishing that all subcontractors and suppliers have waived their liens or that the period for asserting such liens has expired. If a subcontractor refuses to furnish a release or waiver required by the OWNER, the CONTRACTOR shall furnish a bond satisfactory to the OWNER to indemnify the OWNER against such lien. If the subcontractor files a lien, the CONTRACTOR shall furnish a bond satisfactory to the OWNER to indemnify against such lien. If the subcontractor has not filed a lien, and the CONTRACTOR has provided the OWNER with a payment bond for the Project in an amount sufficient to cover the Subcontractor's claim, then the CONTRACTOR shall not be required to provide any additional security.

20. OWNERSHIP OF DOCUMENTS

All drawings, notes, documents, plans, and specifications or other material to be developed under this Agreement shall become the property of the OWNER and be promptly delivered to the OWNER upon the completion of work under this Agreement or sooner upon the OWNER's request. The

County). This dispute resolution mechanism shall be binding upon the successors, assigns, foreclosing mortgagee and any trustee or receiver of any Party.

This Agreement is made and shall be construed under the laws of the State of Maine except any law that purports to apply the substantive law of any other state, or jurisdiction. Except as otherwise expressly agreed by the parties in writing, exclusive venue for any such civil action shall be in Maine Superior Court (Waldo County).

25. COMPLIANCE WITH APPLICABLE LAWS

The CONTRACTOR agrees that it and its subcontractors shall comply with all applicable federal, state and local statutes, laws, rules, regulations, codes, ordinances and orders in the performance of work under this Agreement.

26. EXTENT OF AGREEMENT

This Agreement (and the Project Manual incorporated into this Agreement) represents the entire and integrated Agreement between OWNER and the CONTRACTOR and supersedes all prior negotiations, representations, or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both the OWNER and the CONTRACTOR.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.

OWNER - INHABITANTS OF THE
TOWN OF ISLESBORO

Witness

By: _____
Janet Anderson
Its Town Manager, duly authorized

CONTRACTOR - _____

Witness

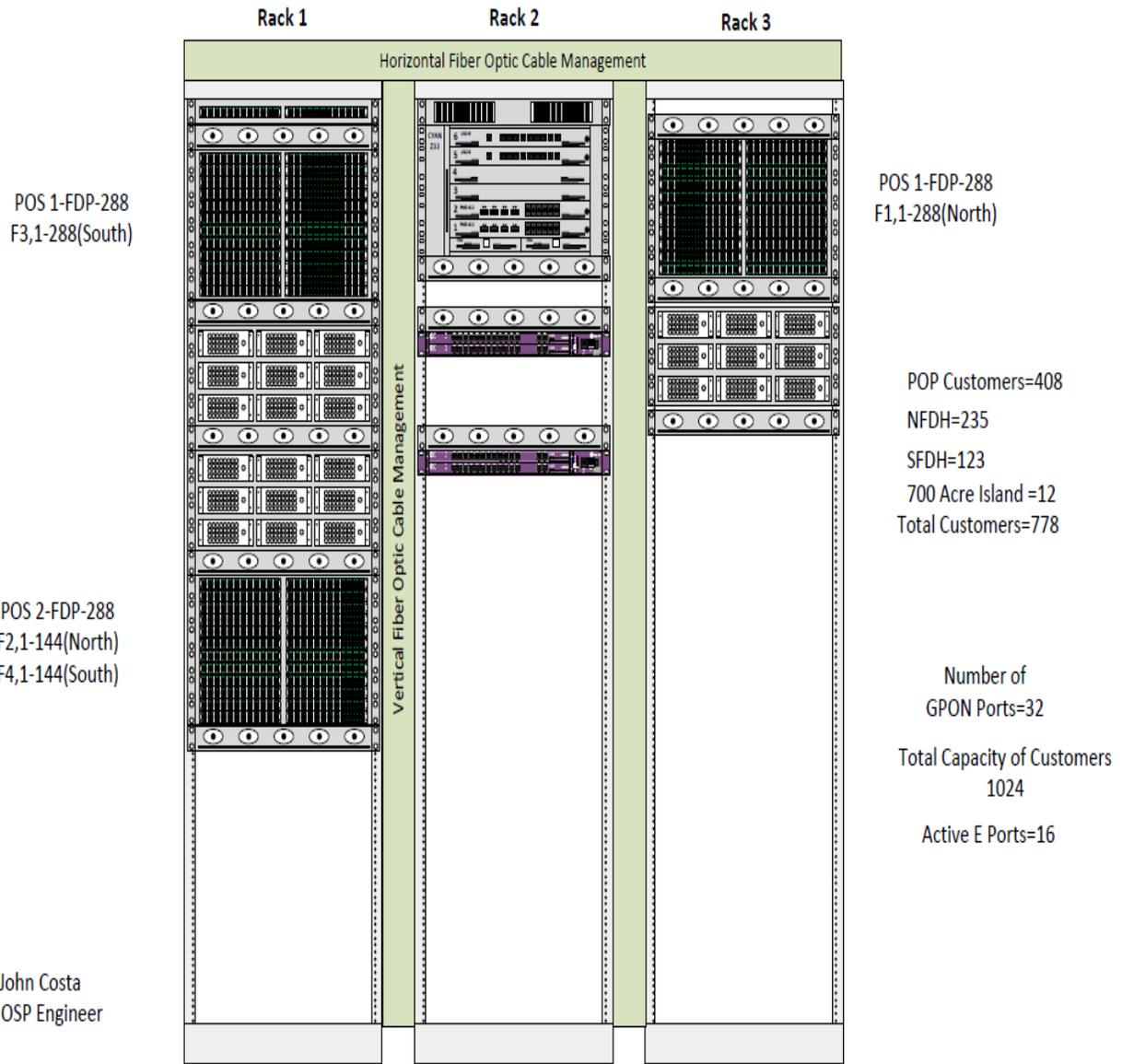
By: _____

Its _____, duly authorized

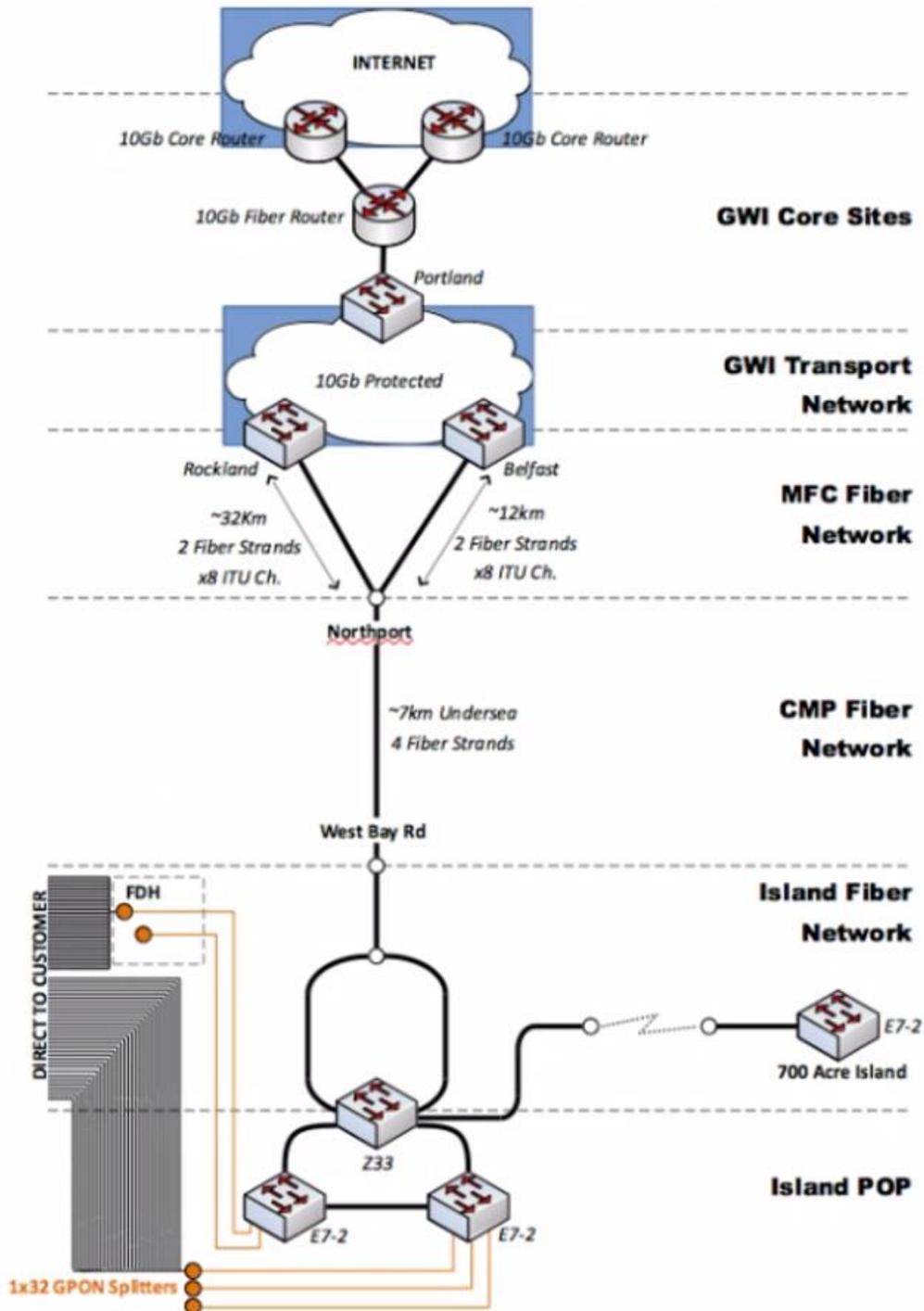
Appendix B: Islesboro POP Relay Rack Design

December 16, 2015

Islesboro POP Relay Rack Design



Appendix C: Interconnection with GWI's Network



Appendix D: Network Equipment Bill of Materials

Part	Description	Manufacturer or equivalent	Part # or equivalent	Quantity
POP				
Z33 GSP	Z33 GSP	Ciena	001-0002-00	1
Management Module	LINECARD AMB (Management Module)	Ciena	950-0004-00	3
LAD-8	LAD-8	Ciena	800-0020-03	2
PME-412	PME-412 --> Switch line card w/ 4xXFP and 12xSFP	Ciena	800-0026-01	2
XFP & Jumper Kit	XFP, ITU CH 30 AND FIBER JUMPER KIT	Ciena	002-0046-00	2
10G XFP SR MM	XFP, 10G-SR Multimode	Ciena	280-0056-00	2
SFP, 1000BASE-LX, 10KM	SFP, 1000BASE-LX, 10KM	Ciena	280-0030-00	2
E7-2 Shelf	E7-2 Field Install Package (CO & ODC/RT): Shelf with Blank Card, FTA, and Field installation Kit	Calix	000-00372	4
E7-2 GPON-8 card	E7-2 GPON-8 (8x GPON OIM, 4x GE SFP, 2x 10GE SFP+)	Calix	100-03006	5
Copper cable SFP	Direct Attach SFP/SFP+ copper cable, 0.5 m, 30AWG, I-Temp	Calix	100-01424	4
10GE SFP+ 300m	10GE SFP+, Multi-Mode dual fiber transceiver, 300m, 850nm, LC, C-temp	Calix	100-01515	2
GPON SFP	GPON SFP OIM, Class B+, 1490/1310nm Single FiberTransceiver, C-Temp (CO), C- & E-Series	Calix	100-01782	40
1GE BIDI SFP, 20km	1GE BIDI SFP, Single Mode single fiber Downstream transceiver, 20Km, Tx1490nm, LC, I-Temp	Calix	100-01669	16
CAP-Software	Calix Advantage Program - Entry Tier - North America - Certified	Calix	110-00881	1
Consumer	Compass Consumer Connect -	Calix	130-00057	12

REQUEST FOR PROPOSALS
RFP No. ISL-2017-01
CONSTRUCTION SERVICES FOR FIBER OPTIC BROADBAND INFRASTRUCTURE

Connect-Software	Monthly Service Charge for up to 1000 Devices			
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700 Acre Island				
E7-2 Shelf	E7-2 Field Install Package (CO & ODC/RT): Shelf with Blank Card, FTA, and Field installation Kit	Calix	000-00372	1
E7-2 GPON-8 card	E7-2 GPON-8 (8x GPON OIM, 4x GE SFP, 2x 10GE SFP+)	Calix	100-03006	1
GPON SFP OIM C&E series	GPON SFP OIM, Class B+,1490/1310nm Single Fiber Transceiver, I-Temp (RT), C- & E-Series	Calix	100-01783	1
1GE SFP, 10km	1GE SFP, Single Mode dual fiber transceiver, 10Km, 1310nm, LC, I-Temp	Calix	100-01662	2
IDU Interface – 2Km	Horizon Quantum Pluggable IDU Fiber Interface, SX (2 Km)	Horizon Quantum	A-OPT-PLG-FIB-SX-HQ	1

Appendix E: Point of Presence (POP) Installation Standards Guide

1. Introduction and Scope

1.1. Introduction

- 1.1.1. This Appendix describes the Environmental and Installation Requirements, including the Cabling, Powering and Grounding options for Telecommunications Equipment to be placed in the Town of Islesboro Broadband Network Point of Presence (POP) locations.
- 1.1.2. Work at POPs consists of network cabling and equipment installation.

1.2. Reason for Issuance

- 1.2.1. This publication is being issued primarily to define installation guidelines for telecommunications equipment and cabling installation at POP locations.
- 1.2.2. The guidelines and standards referenced herein are intended to allow the Network Equipment Vendor to properly evaluate and make ready POP facility locations and to produce “detailed” Method of Procedure or installation procedure (MOP) documents resulting in consistent site builds and related documentation.
- 1.2.3. This Appendix may be revised or updated at any time and for any reason, including but not limited to, conformity with standards promulgated by various institutes, governmental or regulatory agencies; advances in technology; or to reflect changes in the design of equipment, techniques, or procedures described or referred to herein. Liability to anyone arising out of use or reliance upon any information set forth herein is expressly disclaimed, and no representation or warranties, expressed or implied, are made with respect to the accuracy or utility of any information set forth herein.
- 1.2.4. This Appendix is not to be construed as a suggestion to any manufacturer to modify or change any of its products, nor does this publication represent any commitment to purchase any specific products or services.

1.3. Items Not Covered

- 1.3.1. This publication does not include specifications for active network components, topologies and/or depicting network architectures.
- 1.3.2. This publication does not include guidelines for acceptance testing or any other specific test plans that may be associated with the work being performed.

2. General Requirements

2.1. General

- 2.1.1. It shall be the responsibility of the Installer to have a current copy of this Appendix on site and available for use at all times during the installation.

- 2.1.2. No work shall start or be performed without a properly approved MOP. A copy of the MOP shall be posted in the work area.

2.2. Application of Codes, Standards, Regulations and Guidelines

- 2.2.1. The following Codes, Standards and Regulations shall be applied in the following order of precedence:
 1. Local and/or national building and fire and safety codes.
 2. Vendor and Manufacturer requirements for installation.
 3. This Publication and the industry codes, standards and publications referenced herein.
 4. Questions and/or conflicts discovered during the application of the Codes, Standards and Regulations referenced herein shall be referred to the OPM.
- 2.2.2. All standards, guidelines, technical specifications and deliverables as defined in the RFP shall apply. The following standards and guidelines are intended to clarify the Minimum Technical Specifications, or to supplement those standards by defining a particular standard practice when multiple options are available. Effort has been made to insure that any technical specifications, standards or guidelines outlined in this Appendix conform to the technical specifications of the RFP. In the event the Installer determines that a conflict does exist, the OPM must be notified for clarification and/or resolution.
- 2.2.3. Applicable Local, State and Federal Electrical and Building Codes, Fire and Safety Regulations, Standards and Guidelines shall govern the installation practices and materials used in the construction of POI telecommunications facilities.
- 2.2.4. All equipment and materials used shall be Underwriters' Laboratories (UL) listed and labeled.
- 2.2.5. All installation practices must conform to the Equipment Manufacturer's requirements for their network elements.
- 2.2.6. The latest editions and amendments of the following codes, standards and publications are minimum requirements:
 - Local Municipal Code related to Electrical Inspections (Electrical Code)
 - NAFPA 70 National Electrical Code (NEC)
 - NESC 2012 National Electrical Safety Code
 - ANSI/TIA/EIA-568-A, Commercial Building Telecommunication Cabling Standard
 - ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A-2
 - ANSI/TIA/EIA-568-A-3, Addendum No. 3 to Tia/EIA-568-A
 - ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
 - ANSI/TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard
 - ANSI/TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces
 - ANSI/TIA/EIA-570, Residential and Light Commercial Telecommunications Wiring Standard
 - ANSI/TIA/EIA-598-A, Optical Fiber Cable Color Coding
 - ANSI/TIA/EIA-606(A), The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - ANSI/TIA/EIA-607(A), Commercial Building Grounding and Bonding Requirements for Telecommunications

- ANSI/TIA/EIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- ANSI/TIA/EIA-526-14A, Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
- ANSI/TIA/EIA-758(A), Customer-Owned Outside Plant Telecommunications Cabling Standard
- ANSI/TIA/EIA-758(A)-1, Addendum No. 1 to ANSI/TIA/EIS-758 Customer-Owned Outside Plant Telecommunications Cabling Standard
- ANSI/ASHRAE Standard 62, Ventilation and Acceptable Indoor Air Quality
- ICC International Building Codes (IBC 2012)
- TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines.
- TIA/EIA TSB-75 Additional Horizontal Cabling Practices for Open Offices.
- Federal Communications Commission's (FCC) Part 15 - FCC Rules Addresses electromagnetic radiation, National Fire Protection Association Life Safety Code (NFPA 101)
- BICSI -- Telecommunications Distribution Methods Manual
- BICSI -- Cabling Installation Manual
- BICSI -- LAN and Internetworking Design Manual
- BICSI – Customer-Owned Outside Plant Design Manual
- BICSI – DD120 Grounding and Protection Fundamentals for Telecommunications Systems
- International Association of Electrical Inspectors – Soares Book On Grounding, NEC-2011

2.2.7. Any questions not answered by referenced technical publications, the job specification (MOP), standard configurations, drawings/records, etc. shall be referred to the OPM.

2.3. Environmental Conditions – Temperature and Humidity Guidelines

- 2.3.1. The environment in which telecommunications equipment resides must be maintained to proper conditions in order to minimize service outages and economically optimize the usable life of the equipment. For purposes of this Appendix, all equipment placed in the POI is classified as telecommunications equipment.
- 2.3.2. The standards of this Section 2.3 shall be read as absolute requirements for all POI space that houses Telecommunications Equipment. Under no circumstances during the execution of any MOP shall any telecommunications equipment be energized unless the POI facility in which the equipment resides meets these environmental standards.
- 2.3.3. Temperature, humidity and ventilation requirements are 7x24x365. They must be maintained continuously, even during “off-hours”. Environmental requirements for optimal equipment operation are described in Table 2-1 below:

Table 2-1: Environmental Requirements for Optimal Operation

<i>Normal Operating Temperature Limits (can be tighter)</i>	<i>55° to 85° F</i>
<i>Maximum Rate of Temperature Change</i>	<i>2.5° F per 10 minutes</i>
<i>Short Term Temperature Limits</i>	<i>40° to 120° F</i>
<i>Normal Equipment Extended Operability Temperature</i>	<i>32° to 122° F</i>
<i>Operating Relative Humidity</i>	<i>5% to 55%</i>
<i>Short Term Relative Humidity</i>	<i>5% to 90%</i>
<i>Lead-acid Battery Extended Temperature Limits</i>	<i>40° to 95° F</i>
<i>Lead-acid Battery Short-Term Temperature Limits</i>	<i>30° to 122° F</i>

Table 2-1 Notes:

1. "Short Term" is defined as not more than 72 consecutive hours and a total of not more than 15 days in 1 year.
 2. Ambient temperature should be measured at a height of 5 feet above the floor, and 15 inches out from the equipment (or in the center of the aisle if it is narrower than 30 inches). These ambient temperatures must be maintained regardless of equipment heat dissipation. Enclosed spaces may need separate temperature control in order to maintain 55-85 °F.
- 2.3.4. In order to determine if the HVAC system is adequate, an approximate heat release of the Telecommunications Equipment is required. The Installer shall be responsible for calculating the approximate heat release for each telecommunications equipment rack/cabinet, including power plant being installed at the POP and for working with the building owner to insure the guidelines of Table 2-1 are met.

2.4. Environmental Conditions – Ventilation Guidelines

- 2.4.1. The standards of this Section 2.4 shall be read as absolute requirements for all POP space that houses Telecommunications Equipment. Under no circumstances during the execution of any MOP shall any telecommunications equipment be energized unless the POP facility in which the equipment resides meets these environmental standards.
- 2.4.2. Ventilation with outside air must be periodically accomplished to relieve buildup of toxic and explosive gasses, and for human safety. For occupied buildings, local codes, the International Building Codes (IBC), and ANSI/ASHRAE Std. 62 specify minimum air change requirements for human occupancy (typically between 2-6 ach). When telecommunications equipment is placed on the portions of the Customer’s Premises that were designed for human occupancy, ventilation of any potential harmful gasses is practically assured. However, when the Customer Premises space was designed as an equipment or mechanical room, care should be taken to ensure that gasses are ventilated. The lead-acid batteries normally used to back up the telecommunications equipment are capable (under high temperature and/or shorted cell conditions) of venting explosive gasses. Even under normal charge conditions these batteries can and will ventilate small amounts of Hydrogen.
- 2.4.3. The Installer shall be responsible for calculating the ach ventilation rate to the surrounding space for each telecommunication equipment rack/cabinet, including power plant, being installed at the POI and for working with the building owner to insure the above referenced guidelines are met. Airflow in the telecommunications cabinets should be from bottom to top, since batteries are traditionally placed at the bottom, and they should receive the coolest air possible.

2.5. Environmental Conditions – Air Quality Guidelines

- 2.5.1. The standards of this Section 2.5 shall be read as absolute requirements for all POP space that houses Telecommunications Equipment. Under no circumstances during the execution of any MOP shall any telecommunications equipment be energized unless the POP facility in which the equipment resides meets these environmental standards.
- 2.5.2. Accumulation of airborne contaminants on circuit boards can result in bridging of electrical and electronic circuits leading to circuit faults or intermittent failures. Contamination may be introduced by dust, textile fibers, human debris, soil contributions, products of combustion, etc.
- 2.5.3. Normal air quality operating conditions for telecommunications equipment should be Class 100,000. This means that there should not be more than 100,000 particles of 0.5 microns or greater per cubic foot of air. This can normally be easily obtained by 85% ASHRAE efficiency filtration (pre-filters are probably advisable, depending on the quality of the outdoor air in the city). Short-term (see Note 1 to Table 2-1 for a definition of “short-term”) guidelines are Class 150,000.
- 2.5.4. Proper filtration to achieve the efficiencies mentioned above should be left to the building owner. Local air qualities will determine the amount of filtration needed, and 85% may be excessive.
- 2.5.5. The Installer shall be responsible for insuring that these air quality guidelines are met at POI location. If the customer wishes to determine particle counts in an equipment area, they may refer to Telcordia GR-63-CORE for further information.

2.6. Powering Guidelines

- 2.6.1. This Section on Power addresses the general powering philosophy for POI sites. For specific installation guidelines for power, refer to Section 8 of this Appendix.
- 2.6.2. Six (6) hours of DC Plant backup battery reserve (sized at the List 1 or average drains of the served equipment) are required when the AC feeding the rectifiers (reference Section 2.6.9) is not backed up by a permanent standby engine-alternator with automatic transfer switch. Only three (3) hours of backup is required if the rectifiers are backed up by a permanent standby set with automatic transfer switch.
- 2.6.3. It is required that POI installations shall use VRLA (Valve-Regulated Lead-Acid) batteries as approved in the individual POI designs. When VRLA cells are used, the served equipment must be able to tolerate a maximum voltage of -54.8 VDC. Most equipment should easily work at this voltage (the Telcordia NEBS upper voltage limits for equipment design are -56.0 VDC for normal operability, with a short term maximum of -60.0 VDC). If there is equipment that will not function at -54.8 VDC, flooded batteries must be used.

2.7. Grounding Guidelines

- 2.7.1. This Section on Grounding addresses general grounding principles. For specific installation guidelines for grounding see Section 10 of this Appendix.
- 2.7.2. For individual and internal ground paths impedance should be kept as low as possible among internal grounding cables to facilitate the flow of electrons back to ground and limit voltage differentials during a lightning strike or power fault to ground. The desirable limit for any internal grounding path back to the building PGP is 0.03 ohms (up to 0.01 ohms on any one branch). The following distances show the 0.01 ohm limit

for the given stranded (preferred) or solid copper cable size: #6 AWG < 20 ft.; #2 AWG < 50 ft.; 1/0 AWG < 80 ft.; 2/0 AWG < 100 ft.; 4/0 AWG < 160 ft.; 350 kcmil < 260 ft.; 500 kcmil < 375 ft.; and 750 kcmil < 575 ft.

- 2.7.3. The initial building ground source is a point from which electrical current will see a low impedance (resistance in the case of DC only) to ground. Per the National Electrical Code, this impedance should not exceed 25 Ω , a lower impedance is preferred.
- 2.7.4. The POP Facility owner must provide at least one ground source (with a cable sized according to the NEC, at a minimum of #6 AWG — (see Section 2.7.2 for cable sizing requirements based on distance) to an Installer-provided ground bar (within 6 ft. of the POI equipment unless otherwise approved).
- 2.7.5. Grounding cables running to the ground bar shall have a green-colored insulation.
- 2.7.6. The ground source should not be run in ferrous metal conduit. If it is, it shall be end-bonded at both ends of the conduit with a #6 AWG minimum.
- 2.7.7. The Installer shall collect all of its grounds to a single collection point or multiple ground points for larger installations. From each collection point, a cable (appropriately sized depending on the size of the installation) shall be run between the POI ground collection point(s) and the ground bar that represents the extended building ground source. Failing the presence of a ground bar that is an extension of the ground sources, the Installer shall tie the collection bar to the ground source.
- 2.7.8. As mentioned above, all POI grounds shall be connected to a single collection point before connecting that point to the chosen ground source. The collection point shall be a bar, instead of simply a conductor to which all grounds are H-tapped. Depending on the size of the installation and taking into account expansion sufficient to support a fully configured equipment/cabinet, the bar could vary in size and number of holes for termination. The bar may be mounted inside the cabinet, above a relay rack, in a relay rack, hanging from cable rack (and insulated from it), mounted in the space under a raised floor (if that floor is not a plenum, or if the room meets the requirements of Article 645 of the NEC), or mounted on a wall (perhaps inside an electrical cabinet). The bar shall be built for 2-hole lugs. Two-hole irreversible crimp compression lugs are required for all power and grounding connections except for small wall-mount power plants or connections internal to a bay or shelf where the manufacturer's design is for single-hole. When single-hole irreversible crimp compression lugs are used, they must use a star washer to prevent loosening of the connection.
- 2.7.9. Regardless of whether the power plant return busbar is used or a separate bar is provided, the following grounds shall be connected to this "telecommunications equipment ground collection point":
 - Power Plant Battery Return busbar (connected to the telecommunications ground collection bus with a minimum #6 AWG copper wire. If it is a larger installation, this connection may be increased (for example #2 AWG).
 - Equipment Cabinets (Rails, walls, and doors of equipment cabinets shall be electrically bonded to each other, and then a connection shall be made from each cabinet to the ground collection point directly with a #6 AWG, or indirectly to a #2 AWG stringer run from the collection bar).
 - Relay Racks (Equipment relay racks should be connected to the collection point. If there are multiple relay racks and/or lineups, the Installer may run a #2 AWG stringer above each lineup. A splice with a #6 AWG can be made to each relay rack frame from this stringer).
 - Splice Cases (The shields of cables entering the space from the Outside Plant feeding digital equipment should be bonded to a splice case ground point,

which is in turn connected to the collection point with a #6 AWG. If there are metallic cables entering the space that do not feed POI equipment, then their sheath grounds should be tied to the customer's ground bar, as opposed to the POI collection bar). The NEC requires that the protector ground be bonded back to the building grounding electrode, so care must be exercised in equipment placement.

- Appliance Outlet ACEGs (The ACEGs of any appliance outlets in the telecommunications equipment space may be optionally extended to the collection point. As above, this is not necessary if the ACEG or AC Neutral is the ground source).
- Other Metallic Cabinets (any other metallic bays, cabinets, or other metal objects in the POI telecommunications equipment area may be bonded directly to the collection point with #6 AWG, or connected to the collection point through "stringers" as described above. This is especially helpful in reducing ESD problems for cabinets that are used as storage for circuit packs).

2.8. Fire Systems and Fire Stopping Guidelines

- 2.8.1. The Equipment Floor Space must meet the local Fire Codes. The walls, floors, and doors should be a minimum of one-hour fire-rated. Fire detectors and alarms shall have remote monitoring capability.
- 2.8.2. Fire-rated openings (as defined by the Customer and/or building/fire inspector) through which cable or conduit passes (whether pre-existing or opened during the installation process) on interior walls or getting from the outside of the building to the inside will be fire-stopped by the Installer.
- 2.8.3. When fire-stopping new cable penetrations, an attempt should be made to utilize the Premises owner's preferred materials, provided they meet or exceed Project standards.
- 2.8.4. Where existing cable penetrations are disturbed, they must be re-sealed with like materials. Mixing of fire-stop materials is prohibited.

3. Installation Guidelines

3.1. Site Construction and Equipment Staging Guidelines

- 3.1.1. The amount of space and its location required for temporary storage of build out materials, tools and telecommunications equipment shall be a matter of agreement between the Installer and the OPM prior to the start of a job. Every attempt shall be made to locate this area outside the room or compartments containing active telecommunications equipment. In those cases where this cannot be accomplished, the area should be set as far away as possible from the active equipment locations.
- 3.1.2. All equipment and materials shall be unpacked and cleaned outside of the facility or in the facility's authorized unpacking area. Equipment and materials shall be free of contaminants prior to being brought into the POI equipment area.
- 3.1.3. The cutting, filing, drilling, and milling or painting of auxiliary framing, cable rack, etc. should be done outside of the POI equipment area whenever possible. When cutting, filing, drilling of equipment that cannot be removed from a facility, proper protection, and the use of a High Efficiency Particulate Arrestor (HEPA) vacuum, capable of filtering particles larger than 0.3 microns in size, and equipped with a static dissipative hose shall be required.

- 3.1.4. All drilling of the equipment building envelope, consisting of floors, walls, ceiling, or any wall or separation therein, should be accomplished in a safe and environmentally sound manner, which captures and contains any debris using proper protective materials and HEPA vacuum, capable of filtering particles larger than 0.3 microns in size, and equipped with a static dissipative hose.
- 3.1.5. Portable electrical tools shall be equipment grounded or of the double insulated type.
- 3.1.6. All extension cords being used shall have a grounding conductor. Multiple plug adapters shall be prohibited. Use of extension cords beyond the installation interval is prohibited in a POP environment.
- 3.1.7. Ground-fault circuit interrupters shall be installed when temporary 15 or 20 ampere, 120 volt AC circuits are required to perform construction, demolition, modifications, alterations or excavations. Extension cords are considered to be temporary wiring and must be equipped with a ground lead (e.g., 3-pronged plug).
- 3.1.8. Suitable disconnecting switches or plug connectors at the junction with permanent wiring shall protect all temporary circuits.
- 3.1.9. Electrical installations in hazardous dust or vapor areas shall conform to requirements outlined in the National Electrical Code (NEC) for hazardous locations.
- 3.1.10. Exposed wiring and cords with frayed or deteriorated insulation shall not be used. Flexible cords and cables shall be free of splices or taps. Clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc. shall be securely held in place. All cord, cable and raceway connections shall be intact and secure.
- 3.1.11. All disconnecting switches and circuit breakers shall be labeled to indicate their use or equipment served. Disconnecting means "shall always be opened before fuses are replaced.
- 3.1.12. Interior wiring systems shall include provisions for grounding metal parts of electrical raceways, equipment and enclosures. Electrical raceways and enclosures shall be securely fastened in place.
- 3.1.13. All energized parts of electrical circuits and equipment shall be guarded against accidental contact by approved cabinets or enclosures.
- 3.1.14. Sufficient access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operations and maintenance. NEC Article 110.26 provides requirements for working clearances in front of, to the sides of, above, and below AC equipment.
- 3.1.15. Unused openings (including conduit knockouts) in electrical enclosures and fittings shall be closed with appropriate covers, plugs or plates. Electrical enclosures such as switches, receptacles, and junction boxes, shall be provided with tight fitting covers or plates.
- 3.1.16. General cleaning of the POP equipment facility or storage area in which work is being done is to be performed by the Installer during the entire installation or removal process. Care shall be taken to generate a minimal amount of airborne dust. The Installer should use only a HEPA vacuum, capable of filtering particles larger than 0.3 microns in size, and equipped with a static dissipative hose to capture dust and chips from the drilling of floors, walls, ceiling, ironwork, and equipment during the uncrating process, and while cleaning cable racks and equipment.

3.2. Electrostatic Discharge (ESD) Guidelines

- 3.2.1. A wrist strap connected to an appropriate ground terminal shall be worn by the Installer when removing, inserting, or handling devices and components not in static dissipative packaging. The wrist strap shall be snug fitting and make contact with the skin.
- 3.2.2. The Installer should test each of their wrist straps daily (on days when they are going to use them) with either a pass/fail wrist strap test set or by using a Volt- Ohm meter. The reading shall be $1M\Omega \pm 15\%$.
- 3.2.3. The Installer shall maintain a static safe environment for the handling of circuit packs and other electronic equipment. All containers or packing materials used shall be marked with ESD warning labels.
- 3.2.4. The Installer shall minimize the handling of circuit packs. Devices and components shall be stored in their static dissipative packaging prior to insertion in the equipment. Package and transport all circuit packs, including those presumed defective, in an approved protective static dissipative container. When removing a circuit pack from service, the pack shall be immediately placed in an anti- static, protective container. The correct size container shall be used to adequately contain and physically protect the individual circuit pack.
- 3.2.5. Circuit packs shall be handled by their front face plates. If additional support is required, use the outermost top and bottom edge, being careful not to touch any components or conductive paths.
- 3.2.6. Keep synthetic fibers, plastics, foams, etc., which are not anti-static, out of the environment where circuit packs are being handled.

3.3. Fire Protection Guidelines

- 3.3.1. Nothing shall be placed on top of a unit of equipment that interferes with the airflow necessary for the cooling of that equipment.
- 3.3.2. All doors in an equipment room should be kept closed at all times. Fire doors and internal security doors shall not be blocked open or have lock assemblies impeded or disabled.

3.4. Assembly and Iron Work Guidelines

- 3.4.1. The location of auxiliary framing, cable racks, frames, relay racks, bays, cabinets, and other equipment shall conform to the particular plans, drawings/records, and specifications for each installation in accordance with the previously approved POI civil design.
- 3.4.2. Overhead clearance in all aisles and equipment areas must be maintained at a minimum of 7 feet, unless otherwise approved by MTC. This includes auxiliary framing, cable rack, cableway systems, grounding feeders, vent ducts, conduit, lighting, etc. Environments with 9 or 11.5-foot equipment shall maintain clearance's equivalent with the 9 or 11.5-foot heights.
- 3.4.3. Where applicable Unistrut may be installed to support telecommunication equipment environments.
- 3.4.4. Auxiliary framing used exclusively for the support of cable rack shall be consistent with other existing levels of framing where possible to be consistent with current standard arrangements.
- 3.4.5. Where one additional row of frames is to be ultimately installed, the auxiliary framing shall be engineered to allow for the ultimate installation build-out of cable rack.

- 3.4.6. All assemblies and ironwork referred to in this section should be installed to meet Seismic zone requirements for the area in which they are installed.

3.5. Bolts, Threads, Screws, and Threaded Rod Guidelines

- 3.5.1. All bolts, nuts and screws used to secure any part or unit shall be plated to prevent corrosion (an exception are solid copper and stainless hardware), tight, plumb; free of damage, and meet specific / manufacturer's torque requirements where required.
- 3.5.2. All threads of a nut must be used. Bolts/screws may protrude beyond the nut, but not to the extent that they would create a safety or service hazard. Maximum allowable protrusion, where exposure may create a safety or service hazard, shall not exceed the diameter of the threaded unit.
- 3.5.3. Both ends of bolts, screws or threaded rods shall be free of sharp edges.
- 3.5.4. Threaded rod splices may be used only under the following conditions:
- The splice has jam nuts installed top and bottom.
 - The splice has an inspection hole in the center of the splice to permit visual confirmation that the two rod sections are fully inserted and meet in the center of the splice.
 - Where no practical alternative exists for the installation of non-spliced thread rod of the correct length.
 - Only one splice may be used.
- 3.5.5. The tips of all cotter pins shall be bent back and rest again the rod to prevent injury from projecting ends.

3.6. Cable Racking Guidelines

- 3.6.1. All cable racks shall be of the proper size and type, and located, leveled and aligned per the individual approved POP design.
- 3.6.1.1. All sections of cable rack shall have both stringers supported at a minimum of one point, regardless of length. An exemption is made for short transition racks or vertical/horizontal bends. Vertical cable rack shall be supported with a minimum of two supports. The ends of both cable rack stringers shall be bolted to the auxiliary framing support and a minimum of one bolt is required at intermediate auxiliary framing supports on alternate sides of the rack. Additional intermediate bolts may be required depending on actual support requirements.
- 3.6.1.2. Cable rack runs consisting of one piece of rack require a minimum of two points of support on each cable rack stringer (a minimum of four points of contact/supports per cable rack).
- 3.6.1.3. Maximum distance between supports shall not exceed six feet (standard spacing is 5 feet). Distance between last supports and cable rack ends shall not exceed three feet. Sections of cable rack four feet or less in length may be supported by two corner clips at each end. Transition cable racks do not need to be supported unless they are longer than 6 feet. Supporting shall be accomplished by drilling the sides of the cable rack, and installing an angled drop rod bracket on each side. Cable rack stringer splices do not constitute a support.
- 3.6.2. Cross-aisle sections of cable rack five feet or less in length may be supported by two corner brackets.

- 3.6.3. Open and protruding ends of ladder type cable rack shall be finished with closing details or protective rubber caps. All splices, junction details, brackets, and hangers shall be securely installed according to the individual POP design.
- 3.6.4. New cable rack shall be of the solid bar stringer type. The installation of new tubular or hollow stringer type cable rack is prohibited. However, in POP facilities where there is existing tubular or hollow stringer type cable racking, the same racking material may be used provided there is no reasonable way of incorporating the preferred solid bar stringer type and provided the allowable support loads for the existing cable racking will not be violated. At locations where there is existing channel stringer type cable racking, solid stringer cable rack should be used to as an extension to complete the POP installation.
- 3.6.5. Cable rack shall be placed above the front aisle whenever possible. Where this is not possible, consideration should be given to heat dissipation, size of the cable rack (loading), and installer access when placing cable rack in the rear aisle.
- 3.6.6. A minimum vertical clearance of 12 inches shall be maintained above cable racks.
- 3.6.7. Power cable rack located within the power room area for battery stands and power board equipment will be set at a minimum of 8 feet from the floor to the top of the cable rack stringer whenever practical, or as designed according to the previously approved individual POI civil design.

Note: Ground windows, due to their arrangement, may constitute a lower minimum cable rack height or where lower ceiling conditions dictate. In these instances, the power cable rack shall be located no lower than 6 inches above top of cabinet. This lower power cable rack height may also be used where low ceiling heights require power cable racks to be placed at this lower level.

- 3.6.8. When horizontal switchboard or fiber cable rack has a vertical change in elevation of more than 9 inches, a connecting cable rack (waterfall) shall be installed between the horizontal levels of cable racks. When horizontal power cable rack has a vertical change in elevation of more than 12 inches, a connecting cable rack (waterfall) shall be installed between the horizontal levels of cable rack. The connecting cable rack shall be installed typically at an angle (as close as possible to either 45° or 90° as applicable).
- 3.6.9. The height of cable rack is measured from the finished floor to the top of the cable rack stringer.
- 3.6.10. Standard lengths of cable rack and / or auxiliary channel should be installed wherever possible.
- 3.6.11. Cable rack should be placed above the center of the row of cabinets unless wall mounting space becomes an issue in which case the cable rack should be positioned closer to the rear of the cabinets where the cable knock outs are located.
- 3.6.12. Cable racks positioned vertically for the purpose of adjoining parallel horizontal cable racks at different elevations (offsets greater than 9 inches for switchboard or fiber or 12 inches for power) shall be installed at a 45° or 90° angle, as applicable, using fixed-degree edge clamps.
- 3.6.13. Cable rack brackets shall be placed at intervals not to exceed 18 inches. Cable rack stand offs shall be staggered (on alternating sides of every other cable rack cross-strap). At crossing points and where cables break off the racks, it may be necessary to locate additional brackets to add protection for the cables when cables are unsupported for more than 12 inches.

3.6.14. Where only one cable tray is being placed in a POI, cable stand offs shall be used to keep data cable separated from power cables. AC and DC power cables shall be kept separated on cable stand offs.

3.7. Fiber Optic Protective / Distribution System Guidelines

- 3.7.1. Systems installed in equipment locations shall be assembled and aligned per drawings/records, specifications, Technical Publications, Standard Configurations, and technical documents.
- 3.7.2. Fiber optic cable troughs shall be used to support OFN fiber cable patch cords/jumpers or OFNR (1-to-8 fibers/cable) and troughs should be sized according to greatest possible number of customers plus an additional 40%.
- 3.7.3. All covers and devices used to maintain fiber cable/jumpers within their horizontal and vertical protective duct systems shall be in place and secure.
- 3.7.4. The use of "split flex" tubing within vertical or horizontal fiber trough or raceway systems is restricted.
- 3.7.5. Fiber optic cables and jumpers shall be run on dedicated racks or in existing dedicated cableways.
- 3.7.6. Maximum length of fiber slack storage available for placement in approved fiber management systems is defined in the manufacturer's documentation for fiber slack storage devices. Fiber slack storage in cable racks or fiber management system systems is prohibited.
- 3.7.7. A dedicated cable slot/hole/sleeve shall be used for fiber cable entering the equipment facility from the cable entrance facility with provisions for approved fire/smoke and gas stopping.
- 3.7.8. Using cable sleeves associated within distributing frames for running fiber cable is prohibited. Placing any type of fiber management systems and OFN rated fiber cables through a floor or wall cable penetration is prohibited.
- 3.7.9. Horizontal sections of solid fiber management system shall be supported per manufacturer requirements as follows (Also Reference Figures 3-1 and 3-2 below):
 - 2" X 2" solid = 2'- 6" on center standard, 3' maximum.
 - 4" X 4" and 4" X 6" = 5 feet on center.

Figure 3-1:
Typical Horizontal Fiber Management System



Figure 3-2:
Typical Horizontal Fiber Management System with Bend



- 3.7.10. Vertical 2"X 2" multi-slotted fiber management arrangements shall be provided for every relay rack or cabinet requiring patch cord termination. Fiber cables transitioning from a horizontal fiber management system must be loosely bundled and secured as close to the top of the vertical 2"X2" multi-slotted fiber management system as possible using the holes on the back of the duct. Sharing a single duct between two bays is prohibited except as described in Section 3.7.11.
- 3.7.11. Sharing a single fiber management system downspout between two bays in a POI lineup is allowed where a trumpet flare fitting is used on the downspout and the horizontal duct can be located so the vertical fiber cable can drop almost directly into the 2"X2" multi-slotted vertical duct.

3.8. Equipment Frames, Bays, Cabinets, and Stands

- 3.8.1. Locate all frames, bays and piece parts per job specification and drawing/record. All frame parts shall be free of defects, secure, and aligned.
- 3.8.2. All frames, and bays, shall have a minimum of two top supports and a minimum of two bottom floor supports. Specific manufacturer designs may require additional top or floor supports (e.g., cabinets and BDFB's require four top supports).
- 3.8.3. Frame guardrails, end guards, and spacers shall match and be in alignment, as indicated by the floor plan (front of frame bases shall be flush). Transition plates or guard rail adapters shall be installed where this cannot be accomplished.
- 3.8.4. Cabinets on casters or rollers shall have the rolling system disabled or removed and be anchored to the floor.
- 3.8.5. The vertical alignment of all frameworks should be plumb within the allowable deviations shown in Table 3-1 below:

Table 3-1: Framework Alignment and Clearances

VERTICAL ALIGNMENT				
(Maximum Allowable Deviation From Plumb)				
Height		Maximum Deviation		
4' 6" or Less		1/16"		
Over 4'6" and Less than 7'		1/8"		
7' to 9' inclusive		3/16"		
Over 9'		1/4"		
HORIZONTAL ALIGNMENT				
Should be Level				
COMPONENT PERPENDICULAR TO WALL OR COLUMN				
Equipment Type	Standard Distance From Wall (Aisle)	Minimum Distance From Wall (Aisle)	Standard Distance From Column	Minimum Distance From Column
Equipment Frames or Cabinets	4"	3"	6"	6"
Auxiliary Framing	6"	6"	6"	6"
Cable Racking	6"	6"	6"	6"
AISLE SPACING				
Equipment Type	Standard Front Aisle	Minimum Front Aisle	Standard Rear Aisle	Minimum Rear Aisle
Toll Equipment (up to 1200 Watts)	3'	2' 6"	2' 6"	2'
DC Power (BDFB, PBD)	3'	2' 6"	2' 6"	2'
Front Access Eqpt. (e.g. CEV's, CPE)	3'	2' 6"	6"	
Battery Stand	3' 6"	3"	3' 6"	3'
AC Powered Eqpt. (Rated ≥240VAC)	3'		3' (If Rear Access Is Required)	
AC Powered Eqpt. (Rated ≤480VAC)	3' 6"		3' 6" (If Rear Access Is Required)	
Main Aisles and Egress Routes	Any egress aisle, to the front, rear, or side of a bay, shall be a minimum of 4 feet wide			

- 3.8.6. Table 3-1 Notes:
- This distance to a column is for the end of a bay to the column. Standard and minimum front or rear aisle spacing will apply to distances from the front or rear of a bay to a column
 - **Toll Equipment** is defined as traditional fan-led telecommunications equipment with a total heat release of less than 1200 Watts per bay or cabinet.
 - **Data Equipment** is defined as technologically advanced and concentrated telecommunications equipment with a total heat release greater than 1,200 Watts.
 - **Main Aisle** in a POI environment provides space for placement of feeder cable racks, conduit, equipment lineup designation numbering and identification, and breaks at the ends of the 50-foot equipment lineups. The main aisle may also be considered the main egress, see below.

- **Egress** is defined by OSHA as "Means of egress." A means of egress is a continuous and unobstructed way of exit travel from any point in a building or structure to a public way. For our purposes a public way is defined as an exit that leads out of the building.
 - Equipment frame aisles will be measured from the outer most edge of the frame guard rail or guard rail extension to the outer most edge of the opposite frame guard rail or guard rail extension.
 - Cabinets with doors that extend beyond the base of the cabinet shall be measured from the outer most edge of the portion of the cabinet which protrudes the farthest.
 - Main aisles are measured from the outer most point of the end guard attached to the first frame in one lineup to the outer most point of the end guard attached to the first frame in the lineup directly across the new main aisle. Aisle shall be considered clear and unobstructed space.
 - A maximum difference of 3 inches in depth is allowable for framework or cabinets within a single lineup. For the purpose of aligning the frame flanges, a protrusion of 1 inch into the front aisle is allowable. If the frame protrudes into the front aisle 1 inch, the rear guard rail depth can be increased a maximum of 2". Frame base footprints can be adjusted by adding approved guard rail extensions or by replacing the front or rear guard rails to bring the base footprint depth within 3".
- 3.8.7. Frame bases, end guards, and spacers shall match and be in alignment. Transition plates or guards shall be installed where this cannot be accomplished.
- 3.8.8. The uprights of all frames or cabinets (7 feet high or taller) where the flanges align will be junctioned together. Equipment frames 7 feet high require a minimum of three junction plates. Taller equipment frames require a minimum of four junction plates.
- 3.8.9. All battery stands shall be floor-secured to meet manufacturers' recommendations.
- 3.8.10. The distance between the TOP of a pipe stand and the BOTTOM of the supported ironwork shall not exceed 2 inches.

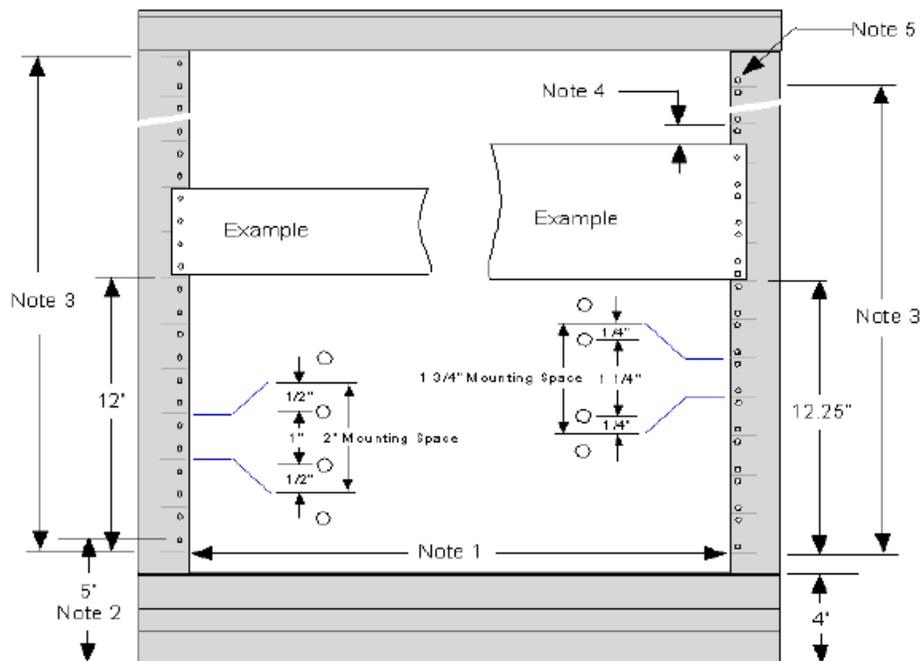
3.9. Framework and Iron Work Components

- 3.9.1. All piece parts (i.e., ironwork, framework, threaded rod, miscellaneous details, etc.) shall be installed per equipment drawings/records and shall be secure, aligned, plumb, and free from defects, sharp burrs, points, etc.
- 3.9.2. All splices on cable racks, auxiliary framing bars or junction bars shall be butted together or butted against junction hardware. Gaps shall not exceed 1/8".
- 3.9.3. All surfaces of equipment and ironwork parts shall be free of rust, dirt and contaminants. If rust is apparent on equipment or parts, they shall be cleaned and painted.
- 3.9.4. All cut ends of cable rack auxiliary framing, threaded rods, and other unprotected metal parts shall be plated or painted.
- 3.9.5. End guards shall be provided for end of equipment lineups, and end shields provided when frame duct / uprights (wiring and cables) are exposed within an equipment lineup, according to the individual POP Design. End guards are required to close off frames where spacers are needed.
- 3.9.6. Approved stanchions shall be secured with 2 floor anchors of the correct size or 4 floor anchors of the correct size in accordance with the individual approved POI design.

3.10. Guidelines for Mounting of Shelving / Equipment

- 3.10.1. All units of equipment, including cabling and brackets, shall be installed, aligned and secured in accordance with job specifications and drawings.
- 3.10.2. When mounting positions are identified in inches or in fractions of inches, these measurements are from the lowest mounting position to the uppermost mounting position. The actual measurement to the physical bottom edge of the shelf may vary depending on manufacturer design but the shelf should not infringe on an adjacent mounting space. (Refer to Figure 3-3 below).

Figure 3-3: Mounting Hole Reference



3.10.3. Figure 3-3 Notes:

1. The bottom of the first mounting space in a framework is the zero (0) reference point.
 2. The location of the first mounting hole will vary depending on the type of framework (Network, Unequal Flange, etc.) and the mounting space configuration (1 3/4", 2").
 3. Refer to Table 3-2 for numbers of mounting spaces in varying frameworks.
 4. In some cases this portion of a mounting space may need to be designated as "space not available" (SNA). The next added shelf may need to start at the next full mounting space.
 5. Besides the tapped holes for mounting equipment some frameworks may be equipped with additional holes above or below the actual mounting spaces. The mounting of equipment in these locations is prohibited.
- 3.10.4. All Installer mounted units shall be secured with a minimum of four screws (one screw each in the upper and lower most available mounting holes on each side of the unit). Units exceeding 8 inches in height require 1 additional mounting screw on both sides

for each additional 8 inch interval. Additional screws may be required for heavier units or as required by manufacturers' specifications.

- 3.10.5. Mounting space adapters shall be used where hole spacing is incorrect for the equipment being mounted in the frame, bay, or cabinet. The frame, bay or cabinet shall not be drilled to accommodate equipment mounting.
- 3.10.6. All equipment shall be mounted as designed according to the previously approved individual POI civil design.
- 3.10.7. Where equipment is wall mounted, it generally should not be mounted above 7' from finish floor.

3.11. Floor Anchors and Installation Guidelines

- 3.11.1. Floor Anchor Installation Instructions are provided by the manufacturer, and shall be followed by the Installer.
- 3.11.2. The requirements for floor anchors apply to equipment frames, stanchions, cabinets, DF frames, etc. Exceptions are allowed for anchoring ironwork assemblies, such as cable rack.
- 3.11.3. An anchor bolt assembly with red slip ring (example Hilti® item #230712) is approved for use on all floor anchoring applications (with the exception of battery stands, see section 3.12.5). The anchors are available in kit form containing two anchors and two 2" X 2" hold-down plates. The anchor has a 2-1/2 inch (~70 mm) insertion depth and a 60mm embedment depth. The head of the torque-indicating anchor will break off at 60 foot pounds when installed correctly.
- 3.11.4. Frames and cabinet must be anchored prior to cable termination, top supporting, or junction to adjacent bays. If floor depth problems are encountered, the Installer shall contact the Installation Supervisor who will coordinate a resolution. Floor anchor holes shall not exceed the 70mm pilot hole depth of the anchor bolt assembly.
- 3.11.5. An anchor bolt assembly is required (example Hilti® item # 97413007) for use on all battery stands placed in any telecommunications power area.

3.12. Floor Anchors and Installation Guidelines

- 3.12.1. Floor Anchor Installation Instructions are provided by the manufacturer, and shall be followed by the Installer.
- 3.12.2. The requirements for floor anchors apply to equipment frames, stanchions, cabinets, DF frames, etc. Exceptions are allowed for anchoring ironwork assemblies, such as cable rack.
- 3.12.3. An anchor bolt assembly with red slip ring (example Hilti® item #230712) is approved for use on all floor anchoring applications (with the exception of battery stands, see section 3.12.5). The anchors are available in kit form containing two anchors and two 2" X 2" hold-down plates. The anchor has a 2-1/2 inch (~70 mm) insertion depth and a 60mm embedment depth. The head of the torque-indicating anchor will break off at 60 foot pounds when installed correctly.
- 3.12.4. Frames and cabinet must be anchored prior to cable termination, top supporting, or junction to adjacent bays. If floor depth problems are encountered, the Installer shall contact the Installation Supervisor who will coordinate a resolution. Floor anchor holes shall not exceed the 70mm pilot hole depth of the anchor bolt assembly.
- 3.12.5. An anchor bolt assembly is required (example Hilti® item # 97413007) for use on all battery stands placed in any telecommunications power area.

3.13. Equipment and Cabling Labeling & Naming Guidelines

- 3.13.1. All designations should be accurate, permanent, legible, visible, aligned, secure, the proper color, at the prescribed location, complete, and conform to standard equipment designation patterns. Refer to [Appendix H: Network Equipment Labeling and Naming Standards](#) for examples of labels that could be used in a POP.
- 3.13.2. The use of labeling machines with black lettering on white background is required.
- 3.13.3. Labels should be located on the part of the frame, bay, or cabinet that is not normally removable by maintenance personnel and which shall remain fully visible.
- 3.13.4. Stamping on painted or plated surfaces must be approved by OPM.
- 3.13.5. Designate connectors on connectorized cables as identified in the MOP or drawing/record. All connectorized cables that could be removed and improperly re-plugged shall be identified with connector or jack number.
- 3.13.6. Designate all frames, bays, shelves and cabinets, with frame type (BDFB, RR, etc.) and number on the front and rear. The recommended locations are: first choice — frame base; second choice — mid-frame to eye level left frame upright, or as the existing office convention dictates. The designations shall be readily visible.
- 3.13.7. Designate each shelf, unit, or position on the front and rear or as instructed in the detailed MOP and drawings/records. The procedure for numbering shelves within a bay, relay rack or equipment frame shall be consistent for all network elements utilized across all POI's. Refer to [Appendix G: Cable and Wire Lacing Techniques](#) for label formatting examples.
- 3.13.8. Shelves, units, and positions in the same frame shall be numbered as follows: lowest to highest, bottom to top, left to right; as viewed from the front.
- 3.13.9. Shelf, panel, bank, and fuse panel numbers shall consist of two digits, starting with 01, and be unique within a given frame; i.e., there shall be only one shelf, panel, bank, or fuse panel 01, 02, 05, 19, etc. Typical single frame designation formats could be as follows: SH-01, BK-02, PN-03, FP-04, etc. Units should have an electrical connection (power, fiber, frame, timing, alarm, etc.) in order to be designated. Frame filler plates, heat deflectors, and cableways should not be given a shelf number.
- 3.13.10. Designate all AC circuits connected at utility outlets, inverters, rectifiers, and power strips. These circuits shall be designated at the source (panel) and at the equipment.
- 3.13.11. Higher voltage receptacles (those greater than nominal single-phase 120 VAC) shall have the receptacle cover plate marked with the appropriate voltage (e.g., 208V AC, 240VAC, 277V AC). Stamp or label with three sixteenths of an inch or equivalent font characters in vermilion (red) ink.
- 3.13.12. Electrostatic Discharge (ESD) All framework connectors for ESD wrist straps shall be designated with the term "ESD" or shall be designated with the universal symbol for ESD.
- 3.13.13. All forms of DC distribution shall be clearly designated both front and rear as to frame, panel, row, plate, fuse / breaker position, voltage, and load so as to coincide with equipment and assignment drawings/records. BDFB fuse / breaker positions shall be numbered from the top down, with consecutive numbering for each load.
- 3.13.14. Fuse panels assignment designations shall show a minimum of Frame / Bay / Cabinet, shelf / plate number and amperage for all assignments. All fuse panels assignments shall be designated using an approved labeling system (i.e. Designation card or label, fuse assignment book, direct labeling).

4. Cabling: Forming, Running, Securing and Repairing Guidelines

4.1. General Requirements

- 4.1.1. The requirement for cable routing and segregation shall be per job specification and records/drawings, except where manufacturers' requirements, critical routing, and/or critical lead lengths shall take precedence.
- 4.1.2. Route cables to avoid pileups and blocking of cable runs. All cables shall be run within the confines of the cable rack stringers. Do not run cables on existing cable racks where cable pileup exceeds the top of existing cable horns.
- 4.1.3. Cables shall be run directly, from point to point, with only a maintenance loop of slack (not to exceed 4 feet) stored on the cable rack. All "maintenance loop" cabling must remain within the confines of the cable rack or designated cable support system. Routing of cables between relay racks and frames without using the overhead cable support systems is prohibited.
- 4.1.4. Placement of vertical splices, adapters on or in the relay rack uprights and cable ways and or horizontal/vertical cable support systems is prohibited.
- 4.1.5. Supporting or securing of any cable to AC conduit is prohibited.
- 4.1.6. Cable spanning horizontal planes shall not exceed 9 inches without additional support. Vertical cable rack offsets of greater than 9 inches in parallel planes shall be made using fixed degree edge clamps. Where it is not practical to use fixed degree edge clamps for vertical offsets, adjustable clamps may be utilized. Interim support points (auxiliary framing, conduit, etc.) must be installed so as not to interfere with future cross aisle cable racks or cable access to bays, cabinets, BDFB return bars, etc.
- 4.1.7. Remove all cable running tags and binder grouping material after the completion of testing.
- 4.1.8. Cable and cable management systems shall be at a distance sufficient to maintain a maximum cable enclosure temperature of 115° F. At a minimum, the distance shall be no less than six inches clearance from steam pipes, or other environmental hazards.
- 4.1.9. Where cables transition off a cable rack, they shall be routed over the side stringers or off the end of a cable rack that will not be extended at some future date. A typical installation is shown in Figure 4-1 below:

Figure 4-1: Typical Cable Transition

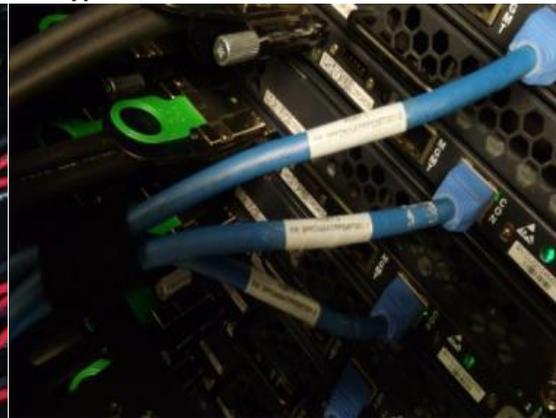


- 4.1.10. Cables shall not be routed through the cable rack. All cables dropping into a frame from a horizontal cable rack or duct system must be routed to align as directly above the frame upright or vertical duct system as possible. At no time will cable of any type make a horizontal transition greater than nine inches across the top of the bay to access the opposite bay upright or vertical duct arrangement. Overhead horizontal cable rack or duct systems must be extended beyond the location below where the cable will enter the bay upright or vertical duct.
- 4.1.11. All cable connections within a bay shall be supported within 24 inches of a point of termination.
- 4.1.12. Cables larger than No. 14 AWG must not be routed through a frame’s uprights.
- 4.1.13. All cables should have a label with CLLI code printed on both ends, to/from locations using a sticky rolled label (example - communications cables) or flag tag label (example – power cables). Examples of cable labels are shown in Figures 4-2 and 4-3 below:

**Figure 4-2:
Typical Flag Label**



**Figure 4-3:
Typical Rolled Label**



4.2. Cable Bending and Forming Guidelines

- 4.2.1. Sharp bends in cables shall be avoided to prevent damage to insulation and conductors. Table 4-1 below provides the minimum bending radii for cable and wire:

Table 4-1: Minimum Bending Radius for Cable and Wire

Cable Type	Bending Radius
Power Cable	9 Times Cable Diameter
Armored Cable (BX), Flexible Steel	5 Times Cable Diameter
Grounding Conductor	1 Foot Minimum (12 inches)
Fiber Optic – Single Fiber	1-1/2 inches
Fiber Optic – Dual Fiber	2-3/4 inches
Fiber Optic – Quad Fiber	3-5/16 inches
Fiber Optic – 12 Count or higher	If manufacture’s requirements are not specified, diameter times 10.
Cable and Wire not specified above	10 Times Cable Diameter

4.3. Cable Protection and Storage Guidelines

- 4.3.1. Protect all cables and wires against damage at all locations where they come in contact with sharp edges or threaded rod, using sheet fiber paper, plastic edge

- guard, and/or protective tubing as appropriate. Refer to Figure 4-1: Typical Cable Transition, for example.
- 4.3.2. Wherever fiber cables may come in contact with any sharp or metal edge, the cable shall be protected with sheet fiber paper or equivalent. Fiber jumpers and cables shall be protected from lacing twine by wrapping the fiber in one layer of sheet fiber paper.
 - 4.3.3. All cables stored for future use shall be identified at the point of termination with both far and near end location information. All cables shall be stored in a manner that allows for future access.
 - 4.3.4. Cables run (extended), but not yet connected, shall be coiled, banded, and stored in a manner that shall not damage equipment or cause a safety hazard. Under no circumstances shall unconnected cables be stored in the cable rack system, in frame uprights, or vertical duct systems. Unconnected cables in cable support systems must be removed.
 - 4.3.5. Plastic electrical tape or heat shrinkable tubing shall be used to wrap/protect the butt location of ABAM and shielded cables.
 - 4.3.6. All cables shall have their exposed ends covered (taped) during the running process to protect existing equipment. The tape shall be left on until the cables are terminated.
 - 4.3.7. All types of cable rack that have threaded rod(s) in contact with the cable rack, shall have the threaded rod(s) protected with protective tubing.
 - 4.3.8. Provide protection using fiber sheathing on inverted ladder-type cable rack in a horizontal or vertical plane where the wire and cable are in contact with the flange side of the cross straps.
 - 4.3.9. Power wires fastened to the underside of channel type cable rack straps shall be protected.
 - 4.3.10. Cables on distributing frames that are butted at the traverse arm require fiber protection or fanning rings.
 - 4.3.11. All soft rubber insulated cables require protection when secured with 9-cord, or equivalent. Cable insulation that will not cold flow is exempt from this requirement. Cold flow is a condition where insulation thins or flows away from an impingement point.
 - 4.3.12. All exposed ends of power or ground cables shall be protected with rubber insulating tape and plastic electrical tape or heat shrinkable end caps. This requirement applies specifically to common feeders serving multiple bays or cables that have been dead ended.

4.4. Cable & Wiring Securing and Supporting Guidelines

- 4.4.1. All cables and wires are to be secured in a manner that affords access to the equipment.
- 4.4.2. All cables shall be tied with 9 cord, or equivalent, at cable rack break-off points, banded or tied between the cable rack and first support (where this distance exceeds eighteen inches), and tied at the first available support (cable support bracket) on a frame, bay, vertical fiber management system or cabinet. Where no cable support bracket exists, the Installer shall secure cabling through rear relay rack upright mounting holes or rear vertical fiber management system mounting holes to meet the eighteen-inch requirement provided that cable bending radius tolerances are maintained (reference Section 4.2). At the point of break-off the cable rack stringer

- (side of the cable rack) cables shall be bundled together and protected with sheet fiber paper or equivalent. When cable rack pileup prevents the installer from securing cables at the cable rack break-off, they shall be secured to the existing cables.
- 4.4.3. Horizontal runs are to be sewn every sixth strap and when necessary to keep cable in the cable rack or from sagging through the cable rack. Vertical runs (and waterfall rack) are sewn on every alternate strap. No more than two square inches of cable shall be secured under a single stitch. The band between cable rack break-off and first frame support is exempt from the two square inch requirement. (See Table 4-3: Cable Securing requirements).
- 4.4.4. To the extent possible and prudent, cables shall be sewn in complete layers the approximate width of the cable rack before starting additional layers.
- 4.4.5. Installer may leave securing cord provided that an ending stitch is made and the cord is properly stored (secured back so that it doesn't provide a safety hazard for equipment or personnel) for future use. No excess securing cord slack shall be allowed in equipment frames or on cable racks.
- 4.4.6. Care shall be taken, when sewing or banding, not to indent or collapse coaxial cables. Fiber sheet or protective-tubing protection may be required.
- 4.4.7. Where cables extend from a ceiling supported racking system to equipment frames that are floor supported only, or not physically connected to the feeder rack, an additional 9 inch slack loop shall be provided. Where no vertical cable support bracket exists, the Installer may secure cabling using the rear relay rack upright mounting holes to meet the eighteen-inch requirement provided that cable bending radius and strain relief tolerances are maintained. At the point of break-off the cable rack stringer (side of the cable rack) shall be protected with cable rack sheet fiber paper or equivalent.
- 4.4.8. All non-fiber cables and wires shall be secured at intervals not to exceed three sheath feet in protected ducts or eighteen inches in open ducts and at all turns or junctions within the frame, bay, or cabinet.
- 4.4.9. Cable ties used for banding of fiber protection, PVC protection etc. shall be of an adequate size, type, strength, etc. for the particular application. Tightening cable ties to the point of damaging the cable is prohibited.
- 4.4.10. Cable ties shall be trimmed at the locking head with a flush cutting device that provides automatic tensioning.
- 4.4.11. Under no circumstances shall cable ties have sharp or jagged cut ends protruding from the locking head. A cable tie is considered to have sharp or jagged ends when it is sharp to the touch.
- 4.4.12. The locking head of reusable cable ties shall be positioned so as not to interfere with the installation or removal of apparatus or equipment.
- 4.4.13. When superimposing additional cable or wire to forms, existing cable ties shall be removed where the heads of tie wraps interfere with additional cable or wires.
- 4.4.14. Where cable or wire forms are secured to cable securing brackets, the locking head of the cable tie shall be positioned on the side of the bracket opposite the side on which the cables or wires are run.
- 4.4.15. Cable ties shall not be used for banding or securing fiber optic cables/jumpers or any communications cables.
- 4.4.16. Multi-Fiber cable counts (24 and larger) no longer require the placing of sheet fiber paper as a means of protection (encircling each cable before it is secured with No. 9 lacing cord) against POI ironwork (e.g., cable rack and auxiliary framing). Standard

lacing requirements, however, still do apply to these cables at every fourth cross strap on horizontally-positioned cable racks and at every cross strap on vertically-positioned cable racks. Single fiber optic cables and smaller multi-fiber cable counts (< 24) will still require the placing of sheet fiber paper for protection at the same securing points listed above.

- 4.4.17. Secure and support all cables before, at, and after turns or junctions of horizontal runs.
- 4.4.18. Cable shall not be unsupported for a distance greater than three sheath feet, measured from the last support on the cable rack or waterfall to the first support on the frame, bay, relay rack, or vertical fiber management system unless otherwise specified in Standard Configurations, specifications or drawings.
- 4.4.19. Distributing frame cabling requires the securing of all cables on first and every alternate transverse arm, at break-off points, turns, and at the terminal strip location. Cables secured to horizontal transverse arm shall be secured in accordance with Table 4-2 below. Transverse arms on the horizontal side of the distribution frame shall have their cabling equally distributed across the served area. Cables are butted on the transverse arm at the point of break-off. Cables shall be secured using No. 9 waxed cord or equivalent.

Table 4-2: Distribution Frames Cable and Wiring Securing

How To Identify Need	Securing Guidelines
On transverse arms 5” or less	Secure cable sheath within 1/2 inch of butt
On transverse arms 5” to 12” in length	Secure cable sheaths within 1/2 inch of butt
On transverse arms greater than 12”	<ol style="list-style-type: none"> 1. Secure at cable turn 2. Secure at cable butt location 3. Secure midway between butt and turn
Frame vertical side	Sew cables at alternate transverse arms
Unsupported drop at bottom or top of frame	Maximum cable distance 3 sheath feet
Distribution of fanning rings	No additional support required
Wires that cross under a transverse arm at cable butt	Requires a fanning ring instead of butt fiber

- 4.4.20. Power cables (Battery and Battery Return) on unsecured cable racks shall be closely coupled/paired and secured together at 12-inch intervals.
- 4.4.21. Cables from the rectifiers to the battery, charge/discharge bus, between the battery stands and from the batteries to the distribution panels shall be on a separate cable rack, or on standoffs separated from all other cables as per the approved individual POP design. These cables shall be referred to as UNFUSED POWER CABLES.
- 4.4.22. Power (battery and battery return) cables shall be supported within 12 inches of a point of termination.
- 4.4.23. Power alarm and monitoring leads run within POI locations only may be secured directly to cable rack stringers with No. 9 cord. The use of metal securing clips, and/or nylon (or other) tie wraps, on cable rack stringers or auxiliary framing for securing these leads is prohibited. Refer to Figure 4-1: Typical Cable Transition, for example.

- 4.4.24. Grounding conductors 1/0 AWG and smaller may be secured directly to the side of cable racks.
- 4.4.25. Grounding conductors larger than 1/0 AWG should be suspended on and secured to cable hangers. Cable hangers should be placed at maximum eighteen inch intervals (see Table 4-3 below).
- 4.4.26. Individual p-wire (16-26 AWG) alarm leads may be sewn on the outside of the rack or to the outside of hangers.
- 4.4.27. Cable and wire securing requirements are further defined in Table 4-3 below:

Table 4-3: Cable Securing Requirements

Size of Wire	Sew at Strap	# Twine Strands	Ultimate # of Layers	Cables per Stitch
Sewing Horizontal Resting Runs Resting On Power and Cable Racks				
400 kcmil or Larger	Every 4 th	4	Limited to 1 in ²	2
250-377 kcmil				4
4/0 and Smaller				1
Fiber cable (wrapped with fiber sheeting)	2			
Cat3 / Cat5, etc. cable	Every 6 th			6, Not to exceed 2 in ²
Sewing Vertical or Inverted Horizontal Runs Resting On Power and Cable Racks				
250 kcmil or Larger	Every Strap	4	Limited to 1 in ²	1
4/0 - #4				2
#6 and Smaller				Not to exceed 2 in ²
Cat3 / Cat5, etc. cable	Alternate Strap	2		
Sewing on Horizontal Runs of Cable Hangers Spaced at 18" Intervals				
250 kcmil or Larger	Every Hanger	2	Limited to 1 in ²	1
4/0 and Smaller				2, Not to exceed 2 in ²

- 4.4.28. Refer to Appendix G: Cable and Wire Lacing Techniques (9-wire or equivalent) for detailed specifications on proper lacing techniques. The Installer must adhere to the lacing techniques described in this Appendix.

4.5. Cable and Wire Pile-up Guidelines

- 4.5.1. All cabling and wiring shall be run within the confines of the cable rack stringers and shall not be run so as to block access to the entrance of a bay. Do not run cables on existing cable racks where cable pileup exceeds cable pile-up limits or the top of cable stand offs. Cable stand offs are limited to a maximum usable length of twelve inches.
- 4.5.2. Vertical run cables are limited to 12 inches of pile up for cable racks 12 inches and larger.
- 4.5.3. The maximum pile-up for cable and wiring is given in Table 4-4 below:

Table 4-4: Cable and Wire Pile-up on Horizontal Cable Rack

Width of Cable Rack	Maximum Pile-up Height	
	Supports on 5' 1" Centers	Supports on 6' 0" Centers
12" or less	Equal to width of Rack	
15" to 25"	12"	10"
30"	10"	7"

4.5.4. The maximum pile-up on cable hangers or "T" bars shall be limited to 2 1/2 inches. One-inch cable minimum clearance shall be maintained between hanger and supporting cable rack stringer. The maximum pile-up on cable brackets shall not exceed the manufacturers recommended weight restriction or the width of the bracket whichever is more stringent.

4.5.5. Coaxial cables may be run with other types of cable. Where possible, coaxial cables should be bundled and segregated to increase protection.

4.6. Power Cable Pile-up Guidelines

4.6.1. The maximum pile-up on vertical and horizontal "Power Only" cable rack shall not exceed 7 inches.

4.6.2. The maximum width of horizontal and vertical dedicated power cable rack shall not exceed 20 inches before converting to a reinforced cable rack. Any dedicated power cable rack 25 inches in width or larger shall be a reinforced cable rack. All power cable rack shall be solid stringer type only.

4.6.3. The maximum pile-up for power cable is given in Table 4-5 below:

Table 4-5: Power Cable Pile-up on Horizontal and Vertical Cable Rack

Width of Cable Rack	Maximum Pile-up Height	
	Supports on 5' 1" Centers	Supports on 6' 0" Centers
12" to 20" (Solid Stringer Only)	7"	7"
25" to 30" (Reinforced Only)	7"	7"

4.7. Fiber Cable Pile-up Guidelines

4.7.1. The maximum Fiber optic cable trough capacity pileup, by duct size, are given in Table 4-6 below:

Table 4-6: Fiber Optic Cable Trough Pile-up

Fiber Guide Size	Duct Pileup in Inches	Quantity 1.7 mm Cables	Quantity 2.0 mm Cables	Quantity 3.0 mm Cables
2" x 2"	2	480	360	160
	2	960	720	320
2" x 4"	3	1440	1080	480
	4	1920	1440	640
2" x 6"	2	1440	1080	480
	3	2160	1620	720
	4	2880	2160	960
2" x 12"	2	2880	2160	960
	3	4320	3240	1440
	4	5760	4320	1920

- 4.7.2. The pileup estimates in Table 4-6 above are based on the following assumptions:
- Fiber cable quantities listed above are laid straight within the duct to obtain the maximum capacity available.
 - Fiber cables are singles or small "duals" only.
 - These estimates apply only to horizontal sections of fiber management system.
 - All fiber cables placed in the trough are the size indicated.

4.7.3. The maximum pile-up for riser type fiber cable is given in Table 4-7 below:

Table 4-7: Fiber Optic Riser Type Cable Pile-up on Horizontal and Vertical Cable Rack

Width of Cable Rack	Maximum Pile-up Height	
	Supports on 5' 1" Centers	Supports on 6' 0" Centers
5 Inches	5 Inches	5 Inches
12-20 Inches	7 Inches	7 Inches

4.8. Repair of Damaged Cables

- 4.8.1. Damaged outer jackets of Polyvinyl Chloride (PVC) covered cables shall be repaired with electrical tape. The tape shall be applied in two half-lapped layers with the final two wraps applied without tension and overlapping. The tape shall extend a minimum of two inches past the damaged section.
- 4.8.2. Seriously damaged sections of outer jackets of PVC covered cables shall be repaired by removing the damaged section and replacing it with the covering from a similar cable. Apply a single half-lapped layer of electrical tape over the new section, extending two inches to either side of the repaired section, to secure it in place.
- 4.8.3. Damaged outer jackets of power cable shall be repaired with insulation equivalent to that of the original insulation or with an insulating device identified for the purpose. Heat shrink tubing and/or electrical tape are approved for this use.
- 4.8.4. A run of cable shall be replaced if the number of damaged conductors exceeds five percent of total conductors.

- 4.8.5. Repair of damaged fiber cables must be evaluated (for loss characteristics) to insure proper operation after repairs.

4.9. Spliced Cables, Splicing Systems, and Mated Connectable Cables

- 4.9.1. Splicing of any type of cables shall be kept to a minimum and, if required, shall be done at the equipment shelf or approved splice shelf. All splices shall be protected. Splices shall not appear on the cabling surface of cable racks.
- 4.9.2. Mating of connectable cables shall be kept to a minimum and if required shall be done at the equipment shelf. Connectors shall not appear on the cabling surface of a cable rack and only in the vertical upright of frames, bays or cabinets.
- 4.9.3. Mated connectable cables shall be mated and secured by using twine, tie wraps, hook and loop systems, screws, spring clips, clear heat shrink etc.
- 4.9.4. Protective covers or caps shall be installed on unused connectors to protect contacts from mechanical or ESD damage.

5. Fiber Optic Cable

5.1. General

- 5.1.1. Fiber Optic Intra-office Riser cables and jumpers shall not be pulled or twisted during installation. Fiber cable (12 fiber and smaller) must be bundled together and loosely secured every 6' along horizontal cable support systems to prevent coiling or snagging. Manufacturers' guidelines regarding bend radius shall be followed at all times where these requirements are more stringent than those listed in this chapter.

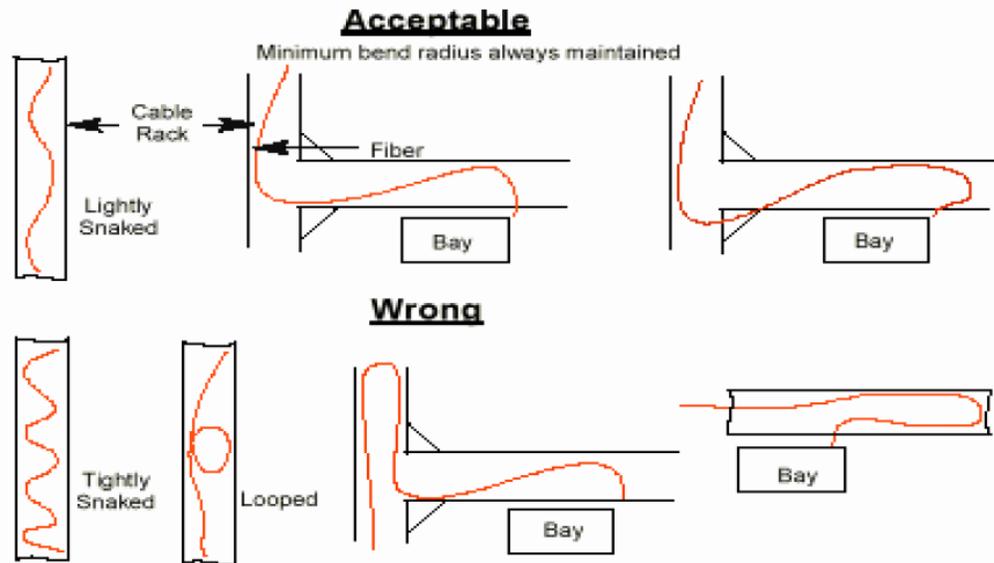
5.2. Installation Guidelines

- 5.2.1. Fiber Optic Cable slack storage or looping within dedicated, segregated fiber-only cable racks or fiber management system-type protection systems is prohibited. Fiber optic cable slack shall be stored in approved slack storage panels and facilities only. Fiber jumper slack shall be stored on reels or trays, specifically designed for that purpose. Slack lengths stored in the horizontal fiber management system or on the "Fiber Optic Cable Only" cable rack shall not be looped and will adhere to the following examples:

**Fiber Cable
Rack Slack
Installation
Examples**

Approved Methods:

- The **first** choice for installing fiber optic cables is to lay the cables within the fiber cable rack or duct support systems in a straight line enabling utilization of the maximum capacity of fiber support systems.
- There are ways to manage the acceptable slack limits within cable racks. The examples below depict acceptable and unacceptable methods of consuming the fiber cable slack limits documented herein:



5.2.2. Acceptable fiber cable slack limits within horizontal sections of the fiber management system or “Fiber Only Cable” rack will be equal to or less than those stated in tables 5-1 and 5-2 below:

Table 5-1: Maximum Fiber Cable Slack Lengths (Within “Fiber-Only Cable Racks”)

Run Length in Meters	Run Length in Feet	Maximum Slack in Feet (Meters)
1-15	~3.3' to ~50'	2' (~.6m)
16-25	~53' to ~82'	3' (~.9m)
26-50	~85' to ~164'	5' (~1.5m)
51-75	~167' to ~246'	7' (~2.1m)
> 76	>~250'	10' (~3m)

Table 5-2: Maximum Fiber Cable Slack Lengths (Within “Fiber Management Systems (ADC or equivalent))

Run Length in Meters	Run Length in Feet	Maximum Slack in Feet (Meters)
1-15	~3.3' to ~50'	1' (~.3m)
16-25	~53' to ~82'	2' (~.6m)
26-50	~85' to ~164'	3' (~.9m)
> 76	>~167'	5' (~1.5m)

- 5.2.3. Metallic type fiber optic cables shall be grounded. Components include: protective cable covering, cable sheath and/or any metallic inner strength members.
- 5.2.4. All 90-degree corners used to route and support fiber cables on “FIBER OPTIC CABLE ONLY” cable racks must be equipped with corner brackets. Fiber cables are routed around the corners using the approved corner brackets.
- 5.2.5. All fiber management systems will be dedicated to support fiber optic cables only. Use of ADC or similar fiber management system is approved (Refer to Figures 5-1 and 5-2 below).

Figure 5-1: ADC Fiber System – Straight System - 90° Bend



Figure 5-2: ADC Fiber System



- 5.2.6. All covers and devices used to maintain fiber cable/jumpers within their horizontal and vertical protective duct systems shall be in place and secure. The use of “split flex” tubing is only approved for short transition (24 inches or less) applications from horizontal solid duct to vertical slotted duct on equipment frames. Horizontal runs of

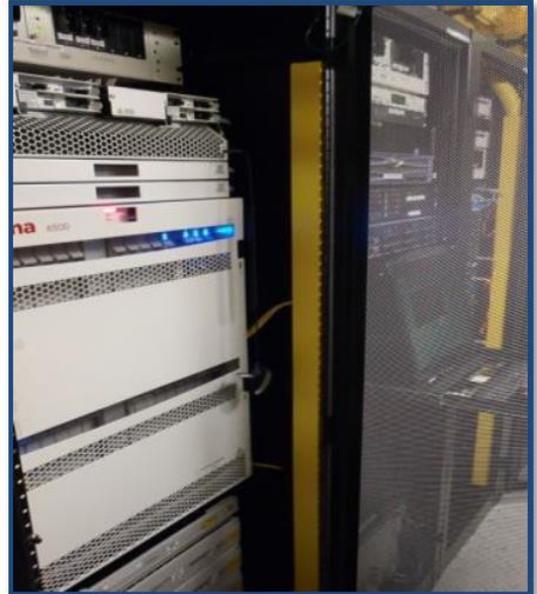
split flex tubing are strictly prohibited. Horizontal sections of fiber trough shall be supported as follows: 2"x 2" slotted = 18 inches; 2"X 2" solid = 24 inches; 4" X 4" solid = 5 feet.

- 5.2.7. Vertical fiber cable rack will be installed using plastic pan with cover on the sides of cabinets and relay racks. Refer to (Figures 5-3 and 5-4 below).

Figure 5-3: Vertical Fiber – FDP



Figure 5-4: Vertical Fiber - Ciena



- 5.2.8. The vertical fiber cable itself must be manually wrapped with sheet fiber paper and securely tied with No. 9 cord to every cable rack cross strap to secure the cable on vertical runs. Fiber optic inter-office "MIC" type cable will be laid in cable rack unsecured.
- 5.2.9. End caps are required on the end of all horizontal or vertical fiber system sections.
- 5.2.10. Running fiber optic cables or patch cords with any other type of cable is prohibited. Fiber jumpers and cables will be run in either an approved fiber protection system or on dedicated, segregated cable rack per the guidelines shown in Table 5-1 below:

Table 5-1:

Fiber Optic Cable / Jumper Type	Shall be run in a Fiber Protection System	Shall be run on Fiber Cable Rack
OFN type Fiber Jumpers	Yes	No (Note 1)
OFNR / OFNP Type Fiber Cable: 1 fiber	Yes	Yes (Note 3)
OFNR / OFNP Type Fiber	Yes (Note 2)	Yes (Note 3)
Cable: 2 to 12 fibers		
OFNR / OFNP Type Fiber Cable: over 12 fibers	No	Yes

- 5.2.11. Table 5-1 Notes:

- Fiber patch cords/jumpers shall not be run commingled with larger type fiber optic cables. The weight of the larger cables has the potential to cause service-disrupting micro bends in the smaller patch cords/jumpers.
- Small quantities of fiber optic cables (10 cables or less total) containing between 4 – 8 fibers/cable may be run in the fiber management system where existing office conditions prevent the installation of a cable rack system (or where the maximum quantity of 10 cables would not be exceeded).
- Multiple groups of single or dual OFNR fiber cables may be run on dedicated, segregated panned and bracketed orange fiber-only cable rack when the small fiber cables are bundled together by wrapping the fiber cable group with sheet fiber paper and loosely security them with No. 9 cord every 5' to 6' within the ladder [panned and bracketed] orange cable rack.
- Care must be taken to ensure that small fiber cable bundles remain undamaged on the cable rack. Where possible, segregate the fiber cable bundles from larger cables within the cable rack and limit instances where large cables cross over smaller cable bundles.

6. Wiring

6.1. General Requirements

- 6.1.1. All equipment installed shall have the all wiring run and terminated to the locations specified using the type, color, and gauge specified in the drawings/records and/or manufacturer's specifications and instructions.
- 6.1.2. Wire shall be neatly dressed in such a manner as to avoid congestion, to ensure accessibility to the equipment, including but not limited to, all chassis cards, power supplies, cooling fans, air filters, open slots etc. and to maintain clearance between terminals. This is critical for the proper operation and maintenance of the equipment.
- 6.1.3. Wires connected in distribution frame blocks shall be dressed to allow visual inspection of terminal connections.
- 6.1.4. Wire dress shall be sufficient to provide enough wire length so they may be re-skinned and reconnected without splicing the conductor.
- 6.1.5. Wire shall be both listed and rated for the application.

6.2. Sowed Forms

- 6.2.1. All sowed forms shall be secured in a manner that avoids congestion and affords access to the equipment including but not limited to, all chassis cards, power supplies, cooling fans, air filters, open slots etc. and to maintain clearance between terminals. This is critical for the proper operation and maintenance of the equipment.
- 6.2.2. All wiring added to existing forms shall be neatly dressed and properly secured.
- 6.2.3. All ending stitches shall be trimmed of excess twine.
- 6.2.4. Forms designed for hinged equipment shall be capable of accomplishing movement without twisting or damage to the form.

7. Connecting

7.1. General Requirements

- 7.1.1. All connections made over solder or on terminals with soldered connections shall be soldered.
- 7.1.2. Connections made with untinned wire do not require soldering, simply because they are untinned or not plated.
- 7.1.3. All DC/grounding wire connections terminated under screw heads shall be made with an approved ring connector. "Fork" connectors are not allowed for DC power terminations.
- 7.1.4. Stranded wire shall be tinned to the extent of forming a solid conductor-end prior to being inserted into any threaded compression connector.
- 7.1.5. All single-hole and two-hole terminations for power and bonding/grounding shall require the use of a lock washer, except where double or locking nuts are standard. Use shake proof (star) lock washers under mounting screws and split ring lock washers with bolts and nuts. Lock washers shall not be placed between the connecting terminal and the contact surface.
- 7.1.6. All terminals, lugs, and connection points shall be free of contamination and previous connecting materials; i.e., corrosion, paint, grease, dirt, etc.
- 7.1.7. Plated surfaces, such as silver or lead-plated copper, etc., are plated to prevent oxidation and reduce contact resistance and, therefore, shall not be sanded or abraded. If cleaning is required, wipe with a dry cloth.
- 7.1.8. All types of connections shall be secure (tight) and shall conform to manufacturer's torque requirements where specified.

7.2. Crimp Compression Connectors, Splices, and Taps

- 7.2.1. All crimp compression connections using the various types of approved commercial connectors shall be properly made with the number of crimps being determined by the manufacturers' requirements pertaining to the wire gauge, type of wire, type of lug, and the crimp compression tool used.
- 7.2.2. The connector specified or used shall determine the crimp compression tool and die set combination required. Wires shall be inserted to the full depth of the lug. The wire shall be inserted to within 1/8 inch of the inspection hole for wire sizes No. 2 AWG and smaller and within 1/4 inch for wire sizes No. 1/0 AWG and larger.
- 7.2.3. The space between the wire insulation and the bodies of connectors and lugs shall be kept to a maximum of one eighth of an inch. Field prepared connections must use transparent (clear) heat shrinkable tubing when insulation is required to protect the connector from shorting and/or the connector barrel extends beyond the edge of a protective cover. The use of any other color of heat shrinkable tubing is prohibited. Reference Figure 7-1 below:

Figure 7-1: Ground Collection Bar Terminations



- 7.2.4. All connections shall be accessible for inspection. Power conductor H-taps shall be taped with plastic electrical tape, have covers applied, and the covers secured with 9 cord. Ground connections made with C-taps/H-taps do not require protective covers.
- 7.2.5. All connections shall be free of sharp edges, fins, or burrs caused by the crimping process. Crimps shall not extend onto the tang area. Individual crimps may not be re-crimped after initial application. Only one wire shall be crimped in a connector barrel.
- 7.2.6. Compression crimps shall be permitted on solid wire, 16 gauge and smaller, and on solid No. 2 AWG tinned copper conductors used specifically for internal connections to the ring ground system. Connectors used on solid No. 2 AWG shall be specifically intended for use on solid wire.
- 7.2.7. Parallel H-tap or C-tap connector covers for battery and battery return cables shall be secured with No. 9 cord. The crimped connectors will be wrapped in plastic electrical tape prior to the covers being installed. Parallel connectors shall not be located on cable rack cross-straps, stringers, vertical runs or any other metallic object, which will cause pressure to be exerted on its protective cover. Parallel connectors shall be located (and staggered) within the space between cable rack cross-straps when run on the lowest cable layer and are permitted on the cable rack.
- 7.2.8. Parallel connectors that have a different voltage potential than frame ground shall be plastic taped to prevent accidental contact to ground.
- 7.2.9. Butt or reducing splices for power connections are required to be insulated with clear heat shrinkable tubing. Butt or reducing splices for grounding connections are not required to be insulated.

7.3. Fiber Optic Cable / Fiber Optic Jumper Testing

- 7.3.1. Installers shall always clean all fiber connectors thoroughly before making the connection with the mating adapter of an FDP. Very small particles can permanently damage the end of the mating fiber inside the patch panel, which makes regular cleaning imperative.
- 7.3.2. When cleaning a paired cable connector (bulkhead mating adapter), always clean the mating adapter first. Specially built fiber cleaning sticks come in 2.5mm and 1.25mm versions. They are designed for dry cleaning fiber optic connector mating sleeves, bulkhead adapters and receptacles. Semi-Automated fiber cleaning tools are also available for this purpose. Do not clean bulkhead receptacles without a means of inspection following the cleaning. The attempted cleaning could easily make the condition worse.
- 7.3.3. Proper use of fiber cleaning kits is essential for fiber jumper preparation prior to connecting to the equipment or FDP. A Type A Fiber Cleaning Kit shall be used for all SC, ST, FC (2.5mm) fiber connectors. A Type B Fiber Cleaning Kit shall be used for all LC or MU (1.25mm) fiber connectors.
- 7.3.4. All fiber connections shall be inspected prior to connecting to the equipment or FDP. At a minimum a Fiber Scope shall be used to verify that both Zone A (Core) and Zone B (Ferrule) are clear of debris prior to making a connection to the equipment or FDP.
- 7.3.5. In order to minimize the possibility of incorrect fiber optic cable / jumper termination, the Installer will perform, at a minimum, a basic continuity test on installed fiber optic cables & jumpers with an Optical Loss Meter (OLM). This device is also referred to as a "light meter." Fiber optic cables within a stored program control system (e.g., electronic

switching) that are tested by manufacturer's requirements, are exempt from this procedure.

- 7.3.6. Unconnected fiber connectors, including but not limited to equipment ports, fiber patch cord connectors, and FDP bulk head connectors, shall always have dust caps installed.
- 7.3.7. Unused dust caps shall be stored in a re-sealable bag to prevent dust accumulation.

8. Power

8.1. General Requirements

- 8.1.1. All connectors, wiring, conduit, fixtures, etc. shall meet the requirements of the National Electric Code (NEC), National Electrical Manufacturer's Association (NEMA), and Underwriters' Laboratories (UL).
- 8.1.2. Installers engaged in the installation, removal, or modification of live power equipment shall protect exposed live conductors, busbars, adjacent equipment, etc. with power insulating blankets. Materials other than power insulating blankets shall not be used.
- 8.1.3. No work shall be performed on LIVE AC Circuits by anyone other than a Qualified Electrician. Since most AC circuits and some DC circuits can be worked on with the energy removed, the MOP shall contain the reason for working on any live AC circuits. For AC circuits that can be de-energized, lock-out / tag-out procedures must be followed.

8.2. Primary and Secondary Distribution

- 8.2.1. Run all leads in continuous lengths per job specification. The use of "in-line" drop splices or H-tap connections does constitute "continuous length" runs.
- 8.2.2. DC wire for distribution and grounding shall be TelcoFlex II, rated for 600 volts, copper conductor, Class 1 flexible strand without braid non-halogenated wire. This requirement applies to all DC power conductors that are 14 AWG and larger. The color of -48V & RTN (DC) power leads is typically gray (with a blue tracer for non-halogenated without a cotton braid cover) or black (with a red tracer for non-halogenated without a cotton braid cover). Grounding conductors shall be green (and can be made with a yellow tracer, which is required, for non-halogenated without a cotton braid cover) or bare.

Note: All Telcoflex wire does not require a cotton braid or to be fiber-wrapped (due to "cold flow") at lacing points on cable rack straps. Also, it is not required that this cable be tinned when it is run outside the power room, since there are no halogenic or sulfuric compounds to oxidize and corrode the copper. Unfused power leads must be tinned.

- 8.2.3. All battery and battery return cables shall be run closely coupled and in pairs (except for at the termination ends, and for return conductors running past remote ground windows, which must be paired back on themselves).
- 8.2.4. Power cables (Battery and Battery Return) run on panned racks shall be paired and secured together at 24- inch intervals. ("Paired" is defined as placing these cables above/below or at the side of each other and securing with a No. 9 cord lock stitch such as would be done when sewing on power cable rack with existing conductors).
- 8.2.5. Where space does not permit the addition of a separate, dedicated power cable rack, power cables protected with 70 amp or less fuses / breakers may be run on cable racks if they are sized at No. 4/0 AWG or smaller. All power cables larger than No. 4/0 AWG regardless of fuse / breaker size shall be run on dedicated FUSED POWER CABLE ONLY

cable racks or standoffs as approved by the individual POI design. The placement of any type of cable used for anything other than power on FUSED POWER CABLE ONLY racks or standoffs is prohibited.

- 8.2.6. Primary DC power distribution cable shall be run on a dedicated DC power cable rack or standoff as approved in the individual POI design. Primary DC power distribution is defined as leads from the power plant to the BDFB or the power distribution frame dedicated to a switch. Secondary DC power distribution is defined as power from the BDFB to the equipment. Primary and secondary power leads are not to be segregated and can be run commingled on the same dedicated power cable rack.
- 8.2.7. When secondary power cable is tapped down for entry into equipment frames, taps shall be placed on the cable rack between cable rack straps, and staggered above or within six feet of either side of the frame, bay, or cabinet.
- 8.2.8. All tap connections shall be accessible for inspection. Connections that are taped and have covers applied shall be considered accessible. Heat shrinkable tubing, other than clear, is not considered accessible.
- 8.2.9. Main conductors and feeders in the plant should be sized for the ultimate capacity of the plant.
- 8.2.10. Unfused Cables from chargers to batteries and from batteries to discharge panels or bus assemblies shall be on a separate cable rack from all other cables. Power conductors that run from the battery string to the power board are considered unfused leads.

8.3. Battery Primary Conductors

- 8.3.1. On new installations of primary DC power, the cable shall not share a cable rack with any other type cable and shall be run on dedicated DC power cable rack or standoffs as approved on the individual POP design.
- 8.3.2. All battery and battery return cables shall be run closely coupled and in pairs with the following exceptions:
 - This "pairing" requirement does not apply to cabling between the power plant and batteries and/or primary distribution board, or the cable within a few feet of the return bus of a secondary distribution center — e.g. BDFB.
 - Between the bays and/or battery stands, internal to the power plant, paired battery and return are preferred. However, unpaired leads are allowed internal to the power plant under the following conditions: They are run as closely as possible; No other cables are placed between them; and No non-referenced (ungrounded) equipment is within ten (10) feet.
 - The battery return leads are not to be confused with the grounding conductors and shall not be marked or otherwise identified with the color green. Nor should they be colored red unless that is the color from the manufacturer in a winning harness.
 - Should it be required to run DC conductors inside of a conduit then both the battery and battery return shall be paired within the same conduit.

8.4. Busbars

- 8.4.1. Busbars shall be free of sharp edges, burrs, corrosion, etc. and shall be copper or tin-plated copper.
- 8.4.2. Busbars shall be properly supported per drawings/records and insulated from surrounding metal work.

- 8.4.3. A metallic coating or plating is sometimes used on busbars to reduce the resistance of the connecting joints. These contact surfaces should be cleaned with a clean, dry cloth to remove grease and other foreign matter, but should not be sanded or the surface otherwise scratched. Non-plated copper bars shall have connection points cleaned. See Section 3.6, "Bolts, Nuts, Screws and Threaded Rod Guidelines," and Section 7, "Connecting."
- 8.4.4. Install a pal nut or locknut on each busbar clamp bolt. Verify that regular nuts are tight before applying the pal nuts or locknuts. Reference Figure 7-1: Ground Collection Bar Terminations.
- 8.4.5. Ferrous bolts, screws, nuts, washers, busbar supports and clips used in fastening copper to copper, or combinations of metals shall be zinc or cadmium plated; however, copper, copper plated, tin-plated copper and stainless steel parts may be used as per the approved individual POP design.
- 8.4.6. Busbars which are located external to an equipment framework enclosure, and have a potential different than the surrounding or supporting metal work shall be protected from short circuits by means of an insulated removable cover.
- 8.4.7. Busbars requiring protective covers:
 - All battery busbars and splice plates not located within a framework enclosure.
 - Battery return splice plates where the potential of the plates are associated with an isolated ground plane, but are physically located and/or supported from ironwork associated with the integrated ground plane.
- 8.4.8. Busbars that do not require protective covers:
 - All bus bars or splice plates located on a battery stand unless they present a safety or service hazard.
 - Battery return distribution bars located above a BDFB. Even if the power source feeding the BDFB is used to power a SPCS, the BDFB should appear subsequent to the Ground Window; therefore, contact between the return bus bar and surrounding metalwork would not constitute a single point ground violation.
 - Busbars used as the Main Grounding Bar (MGB). This is the point of interface between the two ground planes (commonly referred to as the Ground Window). Therefore, accidental and / or additional contact with either ground member would have minimal effect.
 - Busbars that are used as a grouping point to bond integrated ground members together or to the MGB when required.
- 8.4.9. All busbars shall be a minimum of 3 inches from any metal objects. Where this separation cannot be achieved, insulation must be provided between the busbar and the metallic object.
- 8.4.10. All busbars shall be installed so as to afford ready access to the connecting surface (minimum of 4 inches of clearance).

8.5. Power Connections

- 8.5.1. Electrical resistance shall be kept as low as practicable.
- 8.5.2. Contact surfaces shall be cleaned so that direct metal to metal contact is made. Nonconductive coatings (such as paint, lacquer and enamel) on equipment shall be completely removed under the entire contact surface to assure good electrical continuity. Copper bars may require the use of low abrasive pads to remove oxidation.

- 8.5.3. Plated surfaces, such as silver or lead plated copper, etc., are plated to prevent oxidation and reduce contact resistance and, therefore, should never be sanded or abraded. If cleaning is required, wipe with a dry cloth.
- 8.5.4. Mating surfaces shall be flat to ensure maximum cross-sectional area contact.
- 8.5.5. A non-oxidizing agent shall be applied to inhibit corrosion on all battery, battery return, and grounding connections, i.e. at all contact points, bolts, washers, nuts, "H" taps, "C" taps, lugs and other items. This non-oxidizing agent is an insulator, so only a thin coat should be applied.
- 8.5.6. All pressure or clamping devices shall be tight.
- 8.5.7. DC power, return, and bonding/grounding lead connections shall have lock washers installed to ensure secure connections. Use shake proof (star) lock washers under mounting screws and split ring lock washers with bolts and nuts, except where double or locking nuts are standard. Lock washers shall not be placed between the connecting terminal and the contact surface.
- 8.5.8. Connections that require annual re-torquing routines shall not be used. Battery inter-cell connectors are exempt from this requirement since they require annual re-torquing.
- 8.5.9. Attach only one lead to a punching, lug or connector that is designed to accommodate one lead.
- 8.5.10. Attach only one connector with the same mounting screw(s) or bolt(s) unless specified in the associated equipment AMC configuration. Frame ground connectors, chassis, shield, and equipment bonds shall not be stacked one on top of the other under the same mounting hardware.
- 8.5.11. Any connector drilled with two holes shall be secured using both holes.
- 8.5.12. On BDFB and Power Boards all alarm wiring for power fuses and associated alarm fuses shall be connected initially whether the locations are to be fused or to be made spare.
- 8.5.13. Stranded cables shall retain all of their strands at the point of termination.
- 8.5.14. All connectors with a potential other than ground shall be protected if they extend out beyond a protective cover and if they are within 3 inches of any differing potential. Suitable protection shall be clear heat shrinkable tubing or one wrap of sheet fiber paper.
- 8.5.15. DC power connections for supply and return shall use irreversible crimp-type copper connections, wire wraps, or latching "plugs". Aluminum connectors shall not be used, and set-screw connections are not allowed. DC power connections to non-service-affecting equipment (e.g., indicating lights, alarm equipment) are exempt from this requirement.
- 8.5.16. Internal to the supplier's equipment, power connections types are the prerogative of the equipment manufacturer.
- 8.5.17. DC power connections between the source fuse panel and the shelf can be a one-hole or two-hole crimp, wire wrapped, or latching "plug" depending on equipment design.
- 8.5.18. All connections to a battery return busbar must be a two-hole crimp only. These connections should be stacked (one above and one below the return busbar) to conserve space. Exceptions to the "two-hole" requirement are allowed for battery return busbars in DC plants rated at 50 Amperes or less.
- 8.5.19. All connections (nuts and bolts) made to battery posts, terminal plates, and inter cell connectors shall be made with silicone bronze (preferred), stainless steel, lead, or lead-coated copper. All compression type lugs are required to have inspection holes.
- 8.5.20. There will be no connectors varnished, lacquered or painted, during or after installation.

- 8.5.21. Heat shrink tubing that does not provide a hermetically sealed connection will not be allowed. Only clear heat shrink tubing may be used.
- 8.5.22. The integrity/quality of a crimp connection is dependent upon the following:
- The correct size connector for the particular wire size(s) involved;
 - Insulation removed so that the wire extends the full length of the barrel or groove;
 - Preparation of the wire end and connector as required;
 - The use of a non-oxidizing agent on the wire and in the connector as required;
 - Full insertion of the wire into the connector. The wire shall be inserted to within 1/8 inch of the inspection hole for wire sizes No. 2 AWG and smaller and within 1/4 inch for wire sizes No. 1/0 AWG and larger;
 - Compress the connector the correct amount and in the proper sequence using the lug manufacturer's recommended tool and die set.
- 8.5.23. Mechanical connectors shall not be used in DC power distribution and grounding systems.
- 8.5.24. All electrical connections shall be smooth and treated with a non-oxidizing agent.
- 8.5.25. Parallel taps for branching or frame entry on power and grounding conductors shall be equal to or smaller than the feeder conductor being tapped.
- 8.5.26. Battery and battery return connections made with H-taps require the connection to be taped, a cover applied, and secured with No. 9 cord.
- 8.6. Fuse Bays, BDFB's, Power Boards, etc.
- 8.6.1. All fuses and circuit breakers shall be of the proper type and capacity specified in job drawings/records and shall be in compliance with manufacturers' design specifications. **Cable ampacity shall equal or exceed the protecting device size.** When manufacturers specify multiple loads (A&B, etc.) they shall be fused from different power board feeders. Fuses shall be installed or breakers turned on at the completion of the job to identify the correct polarity of the connection at the fuse panel, and test records shall be provided.
- 8.6.2. Lock Out/Tag Out warning labels shall be used on all DC circuits that are connected to the distribution source and are not energized at the time of termination.
- 8.6.3. All cartridge, knife type fuses, and fuse reducers being installed shall be cleaned and lubricated with a non-oxidizing agent.
- 8.6.4. A non-oxidizing agent shall be applied to inhibit corrosion on all battery, battery return, and grounding connections.
- 8.6.5. Dummy fuses shall be installed where fuse holders depend on the dummy fuse as tensioning agents. Dummy fuses are not required at all unassigned fuse locations.
- 8.6.6. Fuse reducers shall not be used in "dead front" fuse panels. Dead front is defined as having no exposed electrical potential. Fuse reducers shall not be used to reduce the fuse size more than once (double reducers).
- 8.6.7. All unassigned circuit fuses, their designations/pins, and associated alarm fuses shall be removed. Dedicated alarm fuse designation pins may remain in place.
- 8.6.8. All "live front" power distribution bays designed to have front protective covers, shall have those covers installed. Live front is defined as having exposed electrical potential.
- 8.6.9. All unequipped fuse/breaker block positions or panels shall have blank panels installed. No holes shall be permitted.
- 8.6.10. The largest fuse permitted in a BDFB is 100 Amps, and only if the BDFB will accept that size of fuse (in some cases, use of these larger fuses may require sparing of the next and/or previous position due to heat per the manufacturer requirements).

- 8.6.11. No cable larger than a No.1/0 AWG shall be terminated to a BDFB fuse position. Larger distribution cables shall be tapped down to a maximum of a No. 1/0 AWG before entering the BDFB. For miscellaneous-mounted fuse panels in relay racks, no cable larger than a No. 4 AWG shall be terminated on the rear entry of the panel (unless the source amperage and/or manufacturer's specifications warrants a larger size).
- 8.6.12. When power cables are tapped down in size for entry, taps shall be placed within six feet of the entry point into the BDFB (15' for PBDs). Taps shall be staggered to prevent pileups (reducing splices do not have to be staggered).
- 8.6.13. All tap connections shall be accessible for inspection. Connections that are taped and have covers applied shall be considered to be accessible. Heat shrinkable tubing, other than clear, is not considered to be accessible.
- 8.6.14. Equipment loads on a BDFB feeder, shall never exceed 50% of their fused value.
- 8.6.15. Only DC type fuses and breakers shall be used for DC circuits. Only AC type fuses and breakers shall be used for AC circuits.
- 8.6.16. No circuits shall be energized without both ends of the circuit identified and connected.
- 8.6.17. When 500V-rated insulation (minimum) is **not** used on conductive members of differing potentials, those conductors must be separated by at least 2 inches of air space.

8.7. Fuse Contact Preparation and Protection

- 8.7.1. Fuse ferrules, blades, and contact area of their associated clips shall be coated with a thin film of a non-oxidizing agent.

8.8. Wire Information Table

- 8.8.1. The cable is sized by the Installer for ampacity and voltage drop. The Installer is responsible for verifying that the circuit protection device is sized correctly for the cable. Refer to Table 8-1 below for Cable Sizing information.

Table 8-1: Cable Sizing

Wire Size	Cable / Wire Information				
	AMPS*	Circular Mills	Weight Per Ft.	Diameter over Insulation	Bend Radius
14 AWG	15	4,110	0.026#	0.19"	1.71"
12 AWG	20	6,530	0.035#	0.21"	1.89"
10 AWG	30	10,380	0.049#	0.24"	2.16"
8 AWG	40	16,510	0.084#	0.31"	2.79"
6 AWG	55	26,240	0.126#	0.40"	3.60"
4 AWG	70	41,740	0.190#	0.45"	4.05"
2 AWG	95	66,360	0.275#	0.51"	4.59"
1/0	150	105,600	0.443#	0.63"	5.67"
2/0	175	133,100	0.540#	0.68"	6.12"
4/0	230	211,600	0.814#	0.75"	6.75"
350 KCM	310	350,000	1.310#	0.98"	8.82"
500 KCM	380	500,000	1.815#	1.12"	10.08"
750 KCM	475	750,000	2.700#	1.34"	12.06"
1/0 FLEX	150	111,100	0.510#	0.66"	5.94"
2/0 FLEX	175	131,300	0.630#	0.72"	6.48"
4/0 FLEX	230	222,200	0.890#	0.84"	7.56"
350 KCM FLEX	310	373,700	1.490#	1.07"	9.63"
350 KCM FLEX	380	535,300	2.000#	1.24"	11.16"
350 KCM FLEX	475	777,700	2.900#	1.54"	13.86"

9. Batteries

9.1. Installation and Storage Requirements for Lead Acid Batteries

- 9.1.1. The recommended storage temperature is 59 degrees Fahrenheit, but the extreme allowable temperature is 32 degrees to 122 degrees Fahrenheit.
- 9.1.2. When batteries are not installed in the cabinet they must be placed on a barrier between the battery and the concrete floor. Never store batteries directly on concrete. Inspect for defective cables, loose connections, corroded cable connectors or battery terminals, cracked cases or covers, loose clamps or terminal posts.

10. Bonding and Grounding

10.1. General Requirements

- 10.1.1. All grounding conductors shall be run exposed and supported to existing cable rack, hangers, or suitable framework using nylon/plastic tie wraps or No. 9 cord.
- 10.1.2. Grounding conductors No. 1/0 AWG and smaller may be secured directly to the side of cable racks, or run along walls and secured at 18" intervals.

- 10.1.3. Grounding conductors larger than No. 1/0 AWG shall be suspended on and secured to cable hangers or run along walls and secured at 18" intervals. Cable hangers shall be placed at 18" intervals.
- 10.1.4. Grounding conductors shall not be run within cable racks or attached to AC conduit.
- 10.1.5. All connections shall be made with a crimp compression parallel copper connector (C-tap or H-tap) or a two-hole crimp compression copper / tinned copper connector. Two-hole crimp connectors shall be secured with an approved lock washer placed between the connector and the head of the screw or nut.
- 10.1.6. Grounding conductors, bonds and taps to ground conductors shall be preferably arranged to flow fault currents in the direction of the OPGPB or ground source. This rule does not apply to busbar assemblies.
- 10.1.7. 180 degree bends in grounding conductors are not permitted.
- 10.1.8. Minimum bending radius of a grounding conductor is 12 inches.
- 10.1.9. All shielded cable and wire shall be grounded at one end or as directed in the job specification, drawing/record, or manufacturers' specification.
- 10.1.10. All chassis, shield, and equipment ground bonds may be made using either a single or two-hole ring crimp connector which will be secured with an approved lock washer placed between the connector and the head of the screw or nut, not between the connector and the contact surface. Use of a single or two-hole ring connector is dependent on the equipment design.
- 10.1.11. Frame ground connectors, chassis, shield, and equipment bonds shall not be stacked one on top of the other under the same mounting hardware.
- 10.1.12. A grounding conductor shall not be secured or supported by metallic clamps which completely encircle the conductor.
- 10.1.13. Stranded RHW or XHHW type insulated copper wire, where the insulation is colored green, is the standard interior POI grounding conductor (AC grounding conductors are typically green THWN). (In accordance with the NEC, wires other than "grounding" conductors shall not be colored green, with the exception of manufacturer wiring inside a bay or shelf. For example, the "grounded" -48 VDC battery return conductor[s] shall have insulation colored gray or black. Although green coloration is recommended for smaller wires, including chassis grounds, it is not required.) Alternately, bare copper wire (stranded or solid) is also allowable in some situations.
- 10.1.14. Attachments to raceways shall only be made per NEC 300.11B.
- 10.1.15. Ground conductors shall be run so that they are visible from the floor.
- 10.1.16. Ground conductors shall be run so that they may be accessible throughout their expected life.

10.2. Grounding Frames, Bays and Cabinets

- 10.2.1. All frames, bays, and cabinets shall be individually grounded with a minimum No. 6 AWG green covered RHW, XHHW or bare AWG copper stranded wire.
- 10.2.2. All ground connections shall be secure.
- 10.2.3. All contact surfaces shall be cleaned and treated with a non-oxidizing agent.
- 10.2.4. Frame support pipes shall not be used for frame grounds. If necessary, the installer shall contact the Installation Supervisor to arrange for the necessary material to provide a proper No. 2 AWG stranded, insulated, copper conductor, supported on hangers, extending the full length of the lineup.

- 10.2.5. Frame, bay and/or stand extension supports (extenders) shall be bonded to the frame with a minimum No. 6 AWG conductor that shall not contain bends exceeding 90 degrees.

10.3. Equipment Chassis Shield and Quiet Grounding Connections

- 10.3.1. Chassis and shield grounds may be made using single-hole crimped compression connectors or by manufactures specifications. If a manufacturer provides a termination for a chassis, shield, or quiet ground, that bond shall be made. NEBS tested self-tapping screws and/or tooth- type lock washers are also approved for chassis grounding connections.
- 10.3.2. All shielded cable and wire intended to be provided with a quiet/shield ground, shall have its shield bonded to ground on one end or the other, but not on both ends unless specified by standard or manufacturers drawing. See Section 2, "General Requirements."

Appendix F: Conditional Acceptance Testing

As applicable to Scope B equipment and installation

1. Conditional Acceptance Tests (Component-Level):

- a. OPM or representative and/or the Network Operator will have the option of attending all Component Level testing activities. The Contractor must provide OPM with 7 days' notice prior to commencing Conditional Acceptance Testing on specific infrastructure and components.
- b. After or during the installation of components in the field, Conditional Acceptance Tests must commence. All tests must be documented with Acceptance Test Results (ATR) forms. The tests must verify that:
 - i. The components delivered to the field meet agreed specifications.
 - ii. Installation was executed in accordance with the agreed design and construction specifications.
 - iii. Layer 0/1 specifications are met.
- c. The Conditional Acceptance Tests (Component-Level) are divided into the following functional areas:
 - i. Facilities / ISP
 1. Electrical/Power Plant Site Test – This test confirms that the electrical systems, including where applicable DC power units and generator failovers, are installed to specification and operating as per each applicable design package.
 2. Environmental Controls Site Test – This test confirms that the existing or upgraded HVAC subsystems are installed and/or operating as per each applicable design package.
 3. ISP Cabling Site Acceptance – This acceptance ensures that the inside cable plant and cable entrance are installed as per each applicable design package.
 4. OOB Site Test – This test confirms that Out Of Band connectivity is functioning as per each applicable design package (where applicable).
 5. Site Monitoring Test – This test confirms that all environment and security sensors at a specific site are installed and operating as per each applicable design package.
 6. Collocation Site Acceptance Procedure – This inspection based acceptance procedure verifies that a specific site's collocation facilities and ISP infrastructure is in place and performs as per each applicable design package.
 7. Customer Premise Site Acceptance Procedure – This inspection based acceptance procedure verifies that a specific customer premise facilities and ISP infrastructure is in place and performs as per each applicable design package.
 - ii. Electronics
 1. Installed Electronics Acceptance Test – Each electronics component installed shall have a Power On Self-Test (POST), commissioned configuration inspection, and physical installation inspection performed. The details of

acceptance tests for each element must be determined during the detailed design phase.

2. POP Electronics Acceptance Test – This inspection and test based acceptance verifies all electronics at each POP are in place and performs as per each applicable commissioning design package.
3. Customer Prem. (ONT) Electronics Acceptance Test – This inspection and test based acceptance verifies all electronics at each customer premise are in place and performs as per each applicable commissioning design package.

2. Conditional Acceptance Tests (Link-Level):

- a. OPM or representative and/or the Network Operator will have the option of attending all Link Level testing activities. The Contractor must provide OPM with 7 days' notice prior to commencing Conditional Acceptance Testing on specific link performance parameters.
- b. Link Performance Testing validates that all of the logical transport links, which include the electronics hardware and fiber infrastructure, meet the performance specifications detailed in the agreed Network design and base-lined during Lab System Prototype Tests. This test validates the ability of the underlying infrastructure to deliver the performance on a link-by-link basis. The results must be documented with Acceptance Test Results (ATR) forms. Please see below for an overview of the Link Performance Testing:

- i. Fiber Link Performance Test – Each fiber span, (Primary POP to Carrier network (backhaul), POP-POP if multiple POP's, including each span to customer premise equipment POP-Cust Prem), as defined in the applicable design document(s), will require the following tests at a minimum:
 1. Link Optical Power
 2. Ping Test
 3. EtherBert
 4. Fiber OTDR and Power Meter Tests OLT to ONT Bi-directional

3. Conditional Acceptance Tests (System-Level):

- a. The Conditional Acceptance Tests (System-Level) verify that the performance of the system will meet the agreed service performance metrics. The acceptance procedures within this test also compile all required test results and acceptance documents into formal system acceptance packages.
- b. OPM and the Network Operator can optionally attend all Phase 4 testing activities. The Contractor must provide OWNER with 14 days' notice prior to commencing.
- c. Conditional Acceptance Testing (System-Level) must minimally include the following:
 - i. Network System Acceptance Package - This inspection based acceptance procedure verifies that all backbone fiber infrastructure, and documentation is in place as per the system design and testing requirements.
 - ii. Local Access Fiber System Acceptance Package - This inspection based acceptance procedure verifies that all Local fiber infrastructure and documentation is in place as per the system design and testing requirements.
 - iii. POP Acceptance Procedure – This inspection based acceptance procedure verifies that all POP infrastructure and documentation is in place as per the system design and testing requirements.

- iv. Transport Link System Acceptance Procedure – This inspection based acceptance procedure verifies that all Transport Links in the System have passed all applicable testing as per the testing requirements.
- v. Network System Acceptance Tests – These tests will verify network services are functional from the POP to a selected sample of specific end-points on the system (typically customer premise points). These tests measure Throughput, Latency, Jitter, and Packet Loss. The exact details of the Network System Acceptance Tests will be determined during the design phase. OPM will approve the proposed tests at their sole discretion.

Appendix G: Cable and Wire Lacing Techniques

Figure A-1: Starting Stitch

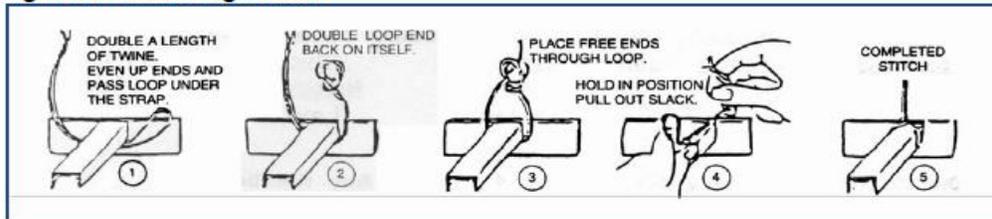


Figure A-2: Kansas City Stitch

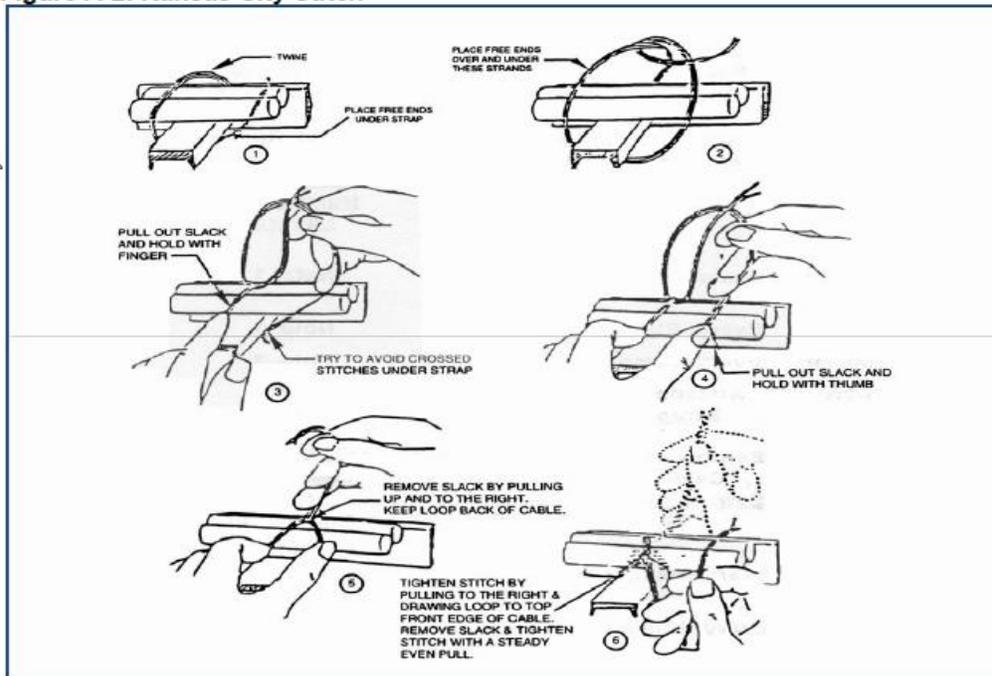


Figure A-3: Sowing First Layer Stitch

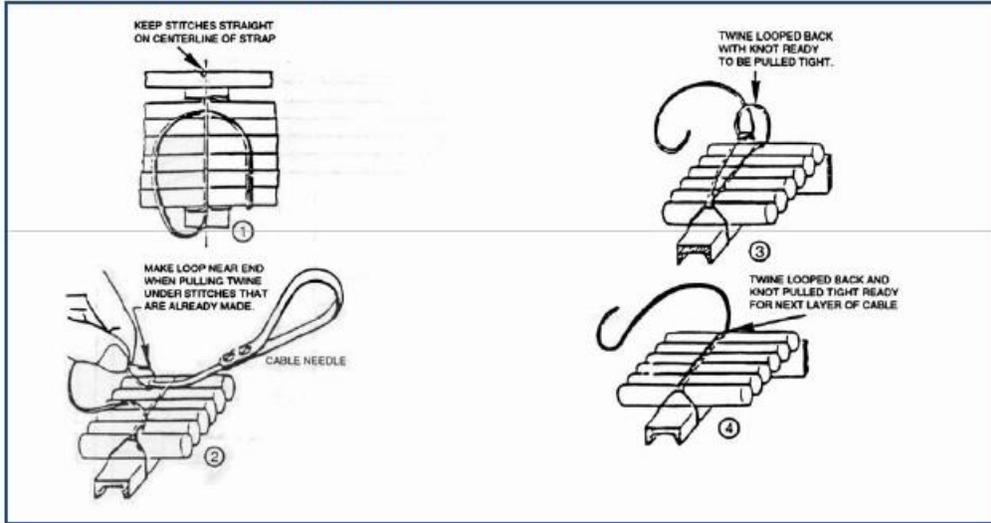


Figure A-4: Sowing Second Layer Stitch

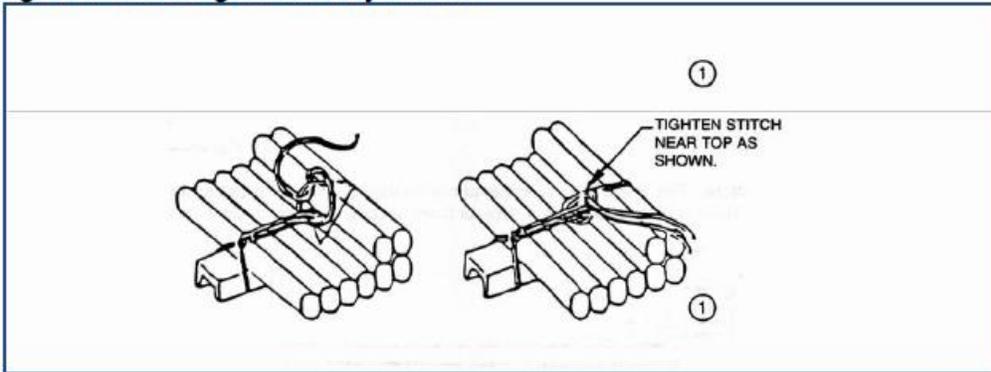


Figure A-5: Sowing and Support Cables at Cable Rack Turns

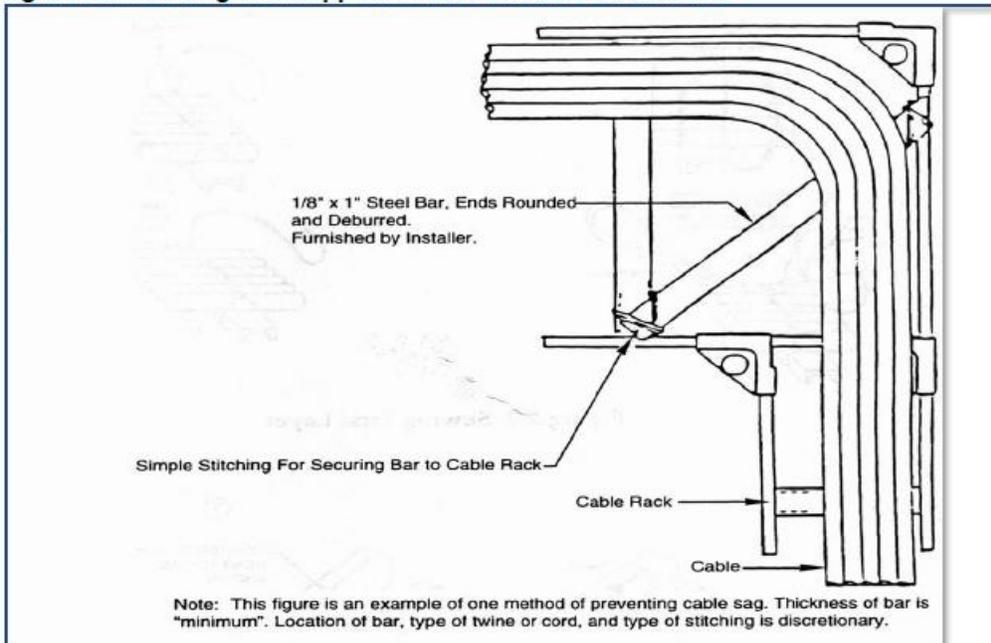


Figure A-6: Securing Cable to Support Using Kansas City Stitch

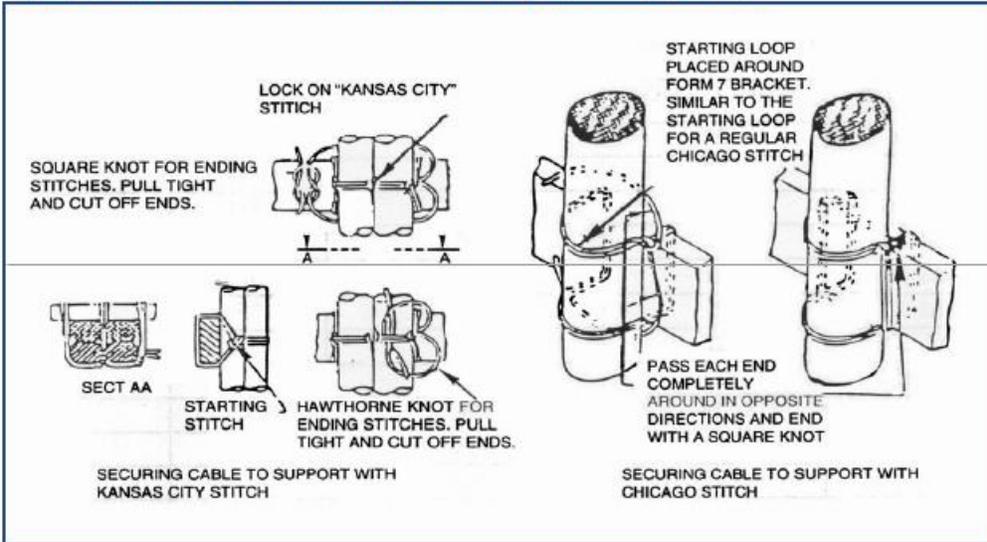


Figure A-7: Lacing Splice

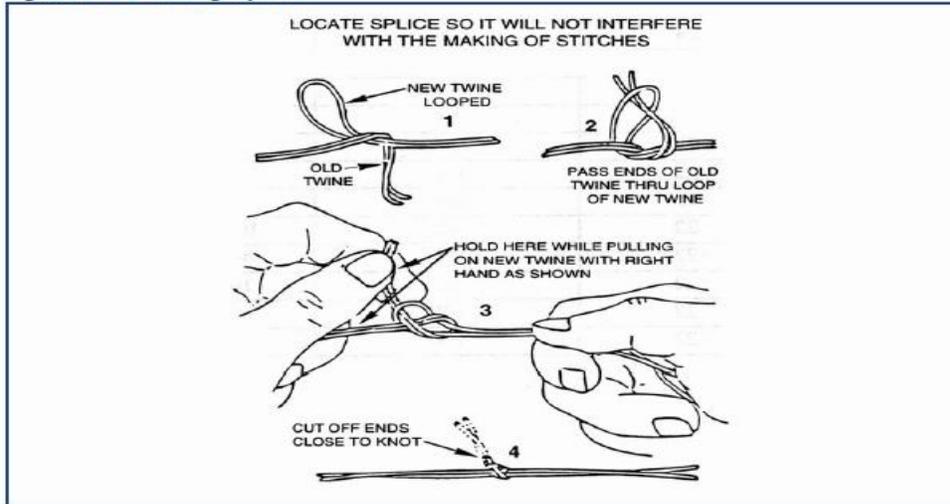


Figure A-8: Chicago Stitch used to Sew Cables Together

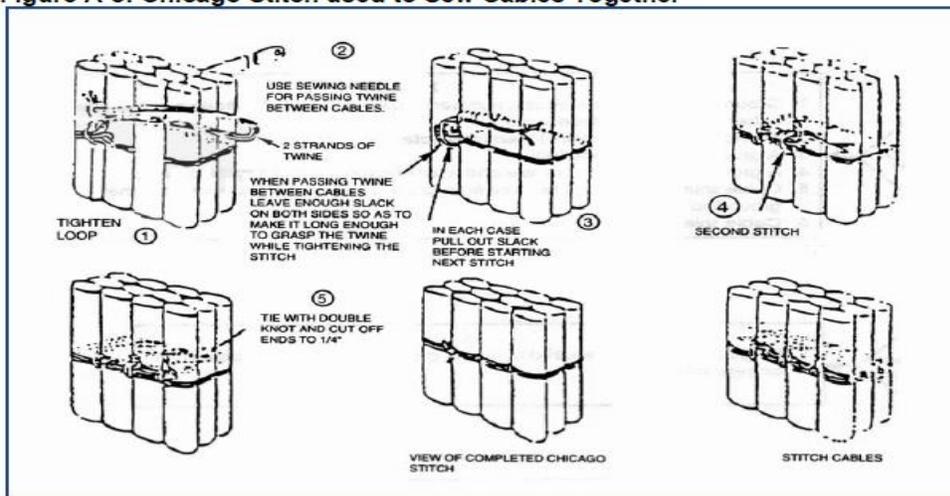
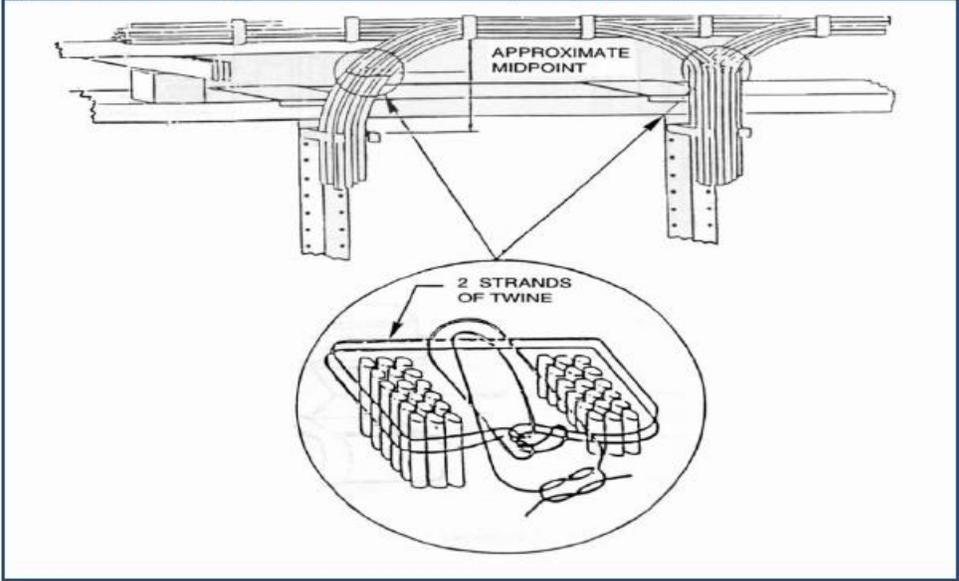


Figure A-9: Banding of Cables with 9-Wire (or equivalent)



Appendix H: Network Equipment Labeling and Naming Standards

DC POWER & GROUNDING LABEL STANDARDS:

Labeller: Brother P-Touch Electronic Labeller, Model PT2300/2310 or approved equal.
Label Type: Brother P-Touch Label Tape (TZ), 18mm, Black on White, Model TZ-241 or approved equal.
Flag Marker Tie: Panduit "Pan-Ty" Flag Marker Tie PLF Series, Model PLF1MA or approved equal.

Labeller Settings: Font 1
Size 6
Width Medium
Style Normal
Alignment Centre
Caps On

Standards: 4 line label standard (see examples below)
5 digit equipment bay numbering mandatory (see examples below)
"TO" and "FR" format mandatory. "TO" equals far end and "FR" equals near end (see examples below).
Install labels approximately 50mm from the termination point.
Install labels so text is right side up and clearly visible.
Electronic labels to be affixed to matte finish side of Flag Marker Ties (not the gloss finish side).
New electronic labels must never be affixed directly over old electronic labels.
Damaged electronic labels must be replaced so all text is clearly legible.
Electronic labels must be trimmed to fit surface of Flag Marker Ties.

Example DC Power & Ground Labels

Example Device: Ciena OME 6500, Device Name: CLLIxxxxxx

<i>-48V A-Side Feeder Conductor</i>	<i>+Rtn A-Side Feeder Conductor</i>	<i>PS Ground Conductor</i>
TO: CLLI xxxxxx FUSE PNL -48V BRKR Ax (20A) FR: CLLIXXXXXX PS1 A FEED -48V	TO: CLLIxxxxxx FUSE PNL +RTN BRKR Ax (20A) FR: CLLIXXXXXX PS1 A FEED +RTN	TO: 100.03 GND BAR FR: 100.03 CLLIXXXXXX PS1 GND
TO: CLLIXXXXXX PS1 A FEED -48V FR: CLLIxxxxxx FUSE PNL -48V BRKR Ax (20A)	TO: CLLIXXXXXX PS1 A FEED +RTN FR: CLLIxxxxxx FUSE PNL +RTN BRKR Bx (20A)	TO: 100.03 CLLIXXXXXX PS1 GND FR: 100.03 GND BAR
<i>-48V B-Side Feeder Conductor</i>	<i>+Rtn B-Side Feeder Conductor</i>	<i>Chassis Ground Conductor</i>
TO: CLLIxxxxxx FUSE PNL -48V BRKR Bx (20A) FR: CLLIXXXXXX PS1 B FEED -48V	TO: CLLIxxxxxx FUSE PNL +RTN BRKR Bx (20A) FR: CLLIXXXXXX PS1 B FEED +RTN	TO: 100.03 GND BAR FR: 100.03 CLLIXXXXXX CHASSIS GND
TO: CLLIXXXXXX PS1 B FEED -48V FR: CLLIxxxxxx FUSE PNL -48V BRKR Bx (20A)	TO: CLLIXXXXXX PS1 B FEED +RTN FR: CLLIxxxxxx FUSE PNL +RTN BRKR Bx (20A)	TO: 100.03 CLLIXXXXXX CHASSIS GND FR: 100.03 GND BAR

COMMUNICATIONS CABLING LABEL STANDARDS:

Labeller: Brother P-Touch Electronic Labeller, Model PT2300/2310 or approved equal.
Label Type: Brother P-Touch Label Tape (TZ), 18mm, Black on White, Model TZ-241 or approved equal.
Printable Label: Panduit "Ink Jet/Laser Printable Labels" p/n #LJSL7-Y3-1 or approved equal.

Labeller Settings: Font 1
Size 6
Width Medium
Style Normal
Alignment Centre
Caps On

Standards: 4 line label standard (see examples below).
5-digit equipment bay numbering mandatory (see examples below).
"TO" and "FR" format mandatory. "TO" equals far end and "FR" equals near end (see examples below).
Install labels approximately 50mm from the termination point.
Install labels so text is right side up and clearly visible.
Electronic label to be affixed (centered) onto white portion of Ink Jet/Laser Printable label (see examples below).
Ink Jet/Laser Printable label to be neatly wrapped around (rolled tag) end of Communication cables.
New electronic labels must never be affixed directly over old electronic labels.
Damaged electronic labels must be replaced so all text is clearly legible.
Electronic labels must be trimmed to fit white portion of Ink Jet/Laser Printable label.

Copper and Fiber Patch Cable Example:

Ex. Switch located in Bay 100.04 connecting to Server port in Bay 100.03.

(Server port to Switch port)

Example Server port =SPFDMAATPPTSV001-(port) 1

Example Switch CLI + port = SPFDMAATPPSWT001-1-(port)1

Bay 100.04 Label Information

TO: 100.03
SPFDMAATPPTSV001-1
FR: 100.04
SPFDMAATPPSWT001-1

Bay 100.03 Label Information

TO: 100.04
SPFDMAATPPSWT001-1
FR: 100.03
SPFDMAATPPTSV001-1

ADDITIONAL LABEL STANDARDS:

SIZES AND PLACEMENT OF CHARACTERS				
Equipment Type	Size	Font	Front (Top)	Rear (Bottom)
Frame, Bay, or Cabinet Base, End Guard/Shield, Main Bus and Ground Bars	5/8, 3/4, or 1 inch	60, 72 or 96	X	X
Frame, Bay, or Cabinet Upright / Cable Duct, Virtual CLEC Frame Designation	3/8, 5/8, or 3/4 inch	36, 60 or 72	X	X
Mounting Plates / Shelf / Panel / Unit	3/8 inch	36	X	X
Electronic Components / Connectors / Jack / Plug	1/8 or 3/16 inch	12 or 18		
Fuse / Breaker Panels and Individually-Mounted Fuse / Breaker Blocks	3/16 inch	18	X	See Note 3
Modular Fuse Blocks, Individual Fuse / Breaker on a Panel	1/8 inch	12	X	See Note 3
Fuse Record Book Covers, Detachable Fuse Assignment Record Sheets	3/8 inch	36	X	
Rectifiers, Converters, Inverters, etc. Group, Load, and Voltage	3/8, 5/8, 3/4 inch	36, 60 or 72	X	
Frame Blocks and Covers	3/8 inch	36	X	
Group / Frame / Equipment	3/8 inch	36	X	
Unit / Bank / Shelf / Etc.	3/16 inch	18	X	
Block Layout	1/8 inch	12	X	

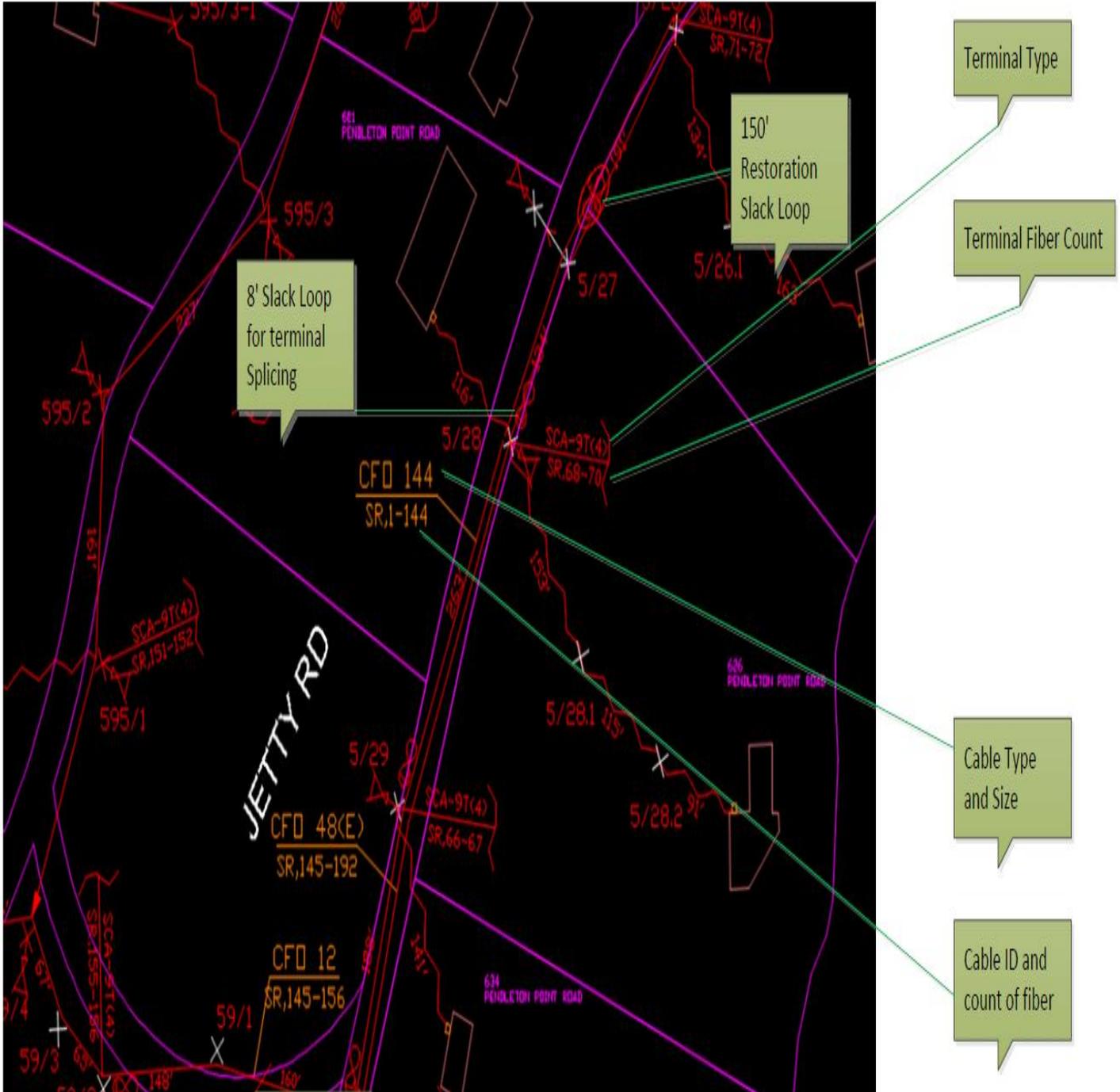
Notes:

1. Manufacturer's design or recommendations for their equipment shall take precedence over these recommendations.
2. Conversion table for "Inch" and "Font":

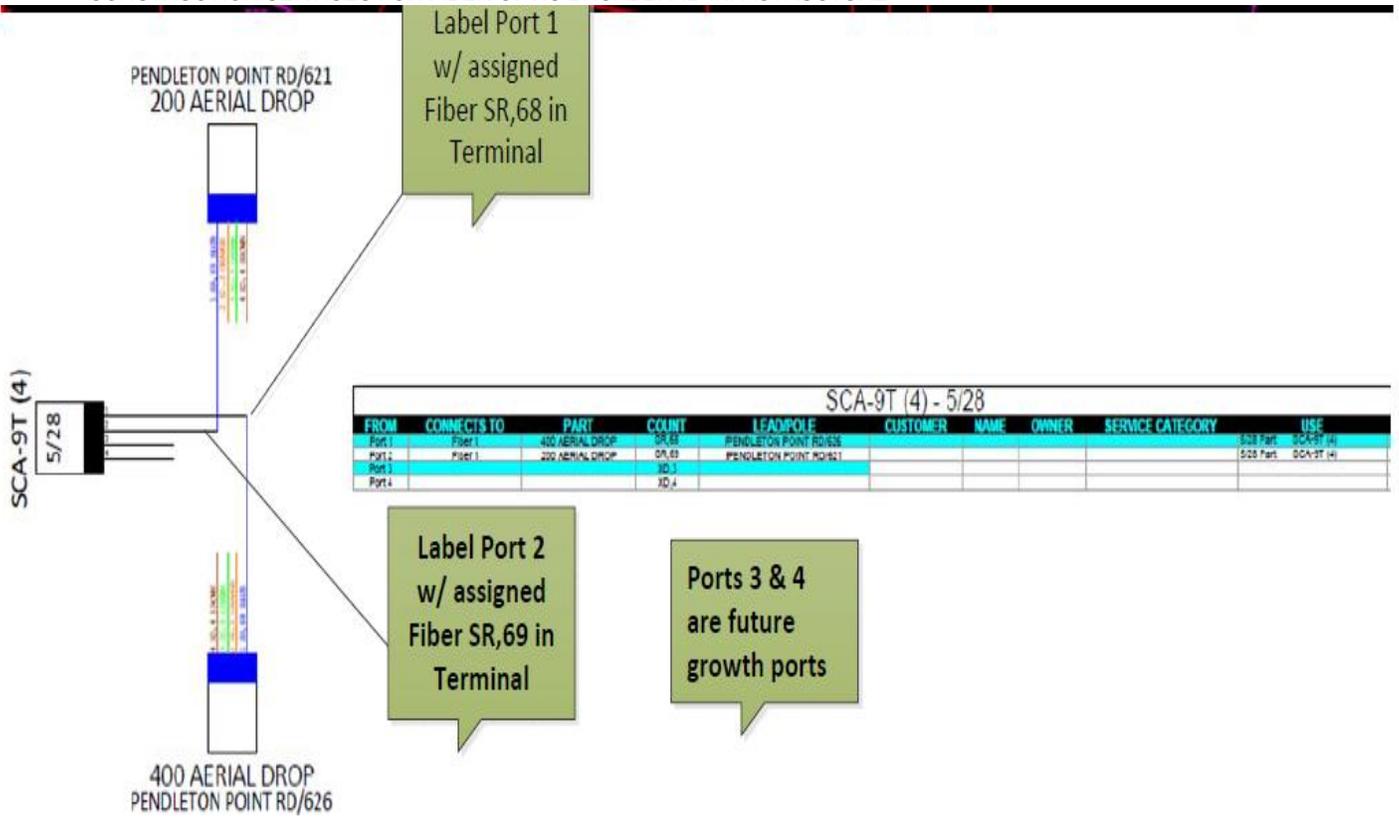
Inch	Font	Inch	Font
1/16	6	3/8	36
1/8	12	1/2	48
3/16	18	5/8	60
1/4	24	3/4	72
5/16	30	1	96

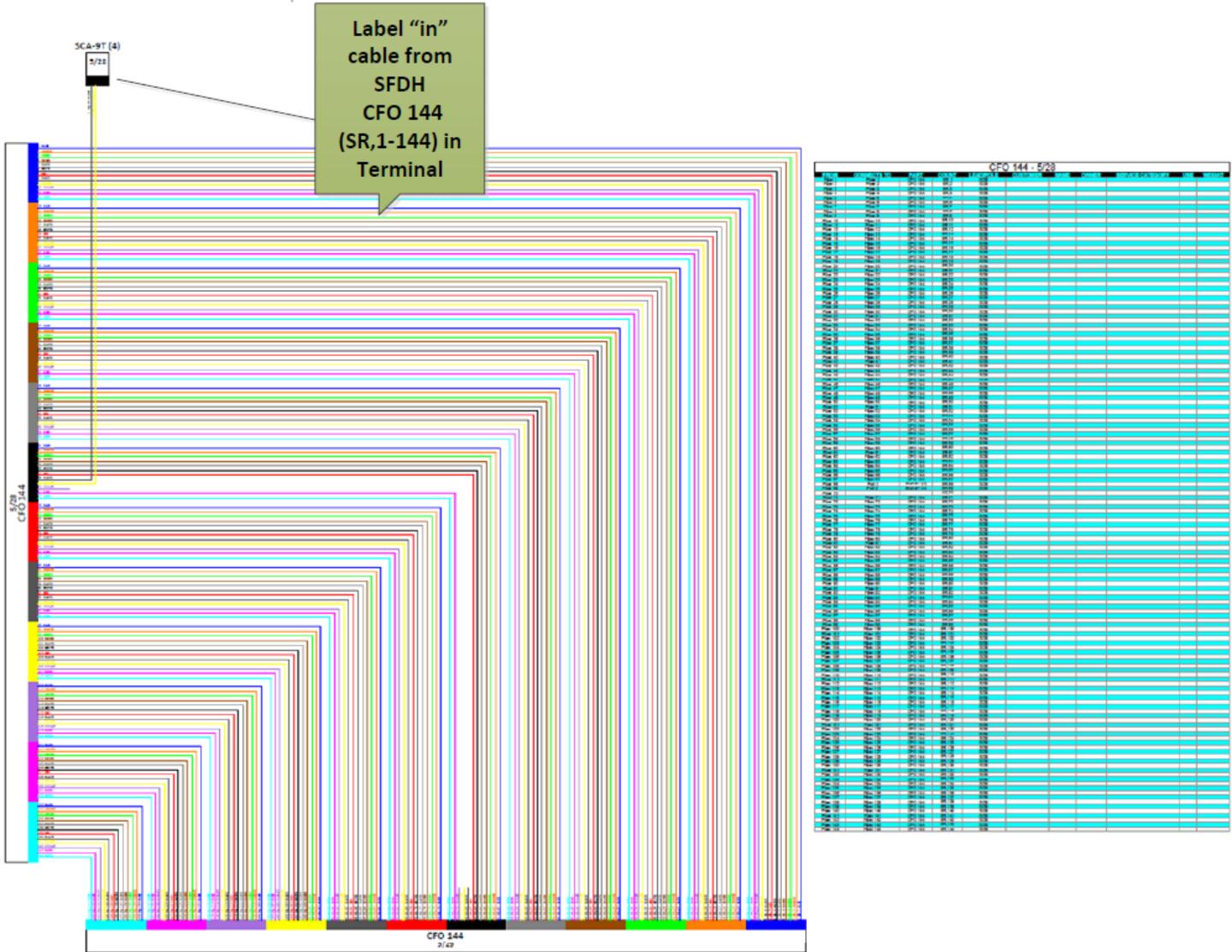
3. Circuit blocks shall be designated at a minimum of every other row. Punching designations shall be designated once at circuit # 1's location and at any change in circuit type. Circuit designations shall be aligned with the terminal they designate. Terminal designations shall be 1/8 inch or 12 points maximum and may be adjusted down in size to allow for additional information. All designations shall be legible.

Appendix I: Outside Plant Labeling and Naming Standards



REQUEST FOR PROPOSALS
RFP No. ISL-2017-01
CONSTRUCTION SERVICES FOR FIBER OPTIC BROADBAND INFRASTRUCTURE





Appendix J: Acronyms and Definitions

REQUEST FOR PROPOSALS
RFP No. ISL-2017-01
CONSTRUCTION SERVICES FOR FIBER OPTIC BROADBAND INFRASTRUCTURE

Acronyms

AC	Alternating Current	MGB	Main Grounding Bus
ACEG	AC Equipment Ground	MOP	Method Of Procedure
AMP	Ampere	MT	Miscellaneous Trunk
APCL	Approved Product Classification List	NE	Network Element
AWG	American Wire Gauge	NEBS	Network Equipment Building Standards
BDCBB	Battery Distribution Control Breaker Board	NEC	National Electrical Code
BDFB	Battery Distribution Fuse Bay	NEMA	National Electrical Manufacturers' Association
CAR	Corrective Action Report	NFPA	National Fire Protection Association
CEC	Controlled Environment Cabinet	NMA	Network Monitoring and Analysis
CEF	Cable Entrance Facility	NROC	Network Reliability Operations Center
CEV	Controlled Environment Vault	OFNP	Optical Fiber Nonconductive Plenum
CFR	Code of Federal Regulations	OFNR	Optical Fiber Nonconductive Riser
CLEC	Competitive Local Exchange Carrier	OLM	Optical Loss Meter
CMGB	Collocator's Main Ground Bus	OPGP	Office Principle Ground Point
CN	Change Notice	OPGPB	Office Principle Ground Point Bus
CO	POI	OSHA	Occupational Safety & Health Administration
CO	POI Ground	OSP	Outside Plant
GRD		PB	Power Board/Bay
COE	POI Equipment	PDB	Power Distribution Board
COEIT	POI Equipment Installation Technician	PBD	Power Board/Bay Distribution
COEFM	POI Equipment Facility Management	PCB	Polychlorinated Biphenyl's
COGB	POI Grounding Bus bar	PCN	Product Change Notice
CSPEC	Common Systems Power & Space, Environment, POI	PDF	Power Distribution Frame
DC	Direct Current	PID	Part Identification
DCS	Digital Cross-Connection System	PPE	Personal Protective Equipment
DF	Distributing Frame	PVC	Polyvinyl Chloride
DNA	Do Not Assign	QP	G4S Procurement
DSX	Digital System Cross Connect	RC	Recording Code
DWP	Design Work Package	RMA	Returned Materials Authorization
EMT	Electrical Metallic Tubing	RR	Relay Rack
ESD	Electrostatic Discharge	SME	Subject Matter Expert
EPA	Environmental Protection Agency	SPCS	Stored Program Control System
FB	Fuse Bay	SPG	Single Point Ground
FDX	Fiber Distribution Cross Connect	SPGB	Signal Point Ground Bus Bay
FMT	Flexible Metallic Tubing	TEO	Telephone Equipment Order
GRD	Ground	UE	Universal Enclosure
HEPA	High Efficiency Particulate Arrester	UL	Underwriters Laboratory
HVAC	Heating, Ventilation and Air Conditioning	V	Volt
kcmil	Thousand Circular Mills	VRLA	Valve Regulated Lead Acid Battery
MGB	Main Grounding Bus		
MOP	Method Of Procedure		
MT	Miscellaneous Trunk		
NE	Network Element		

Definitions

Fiber Optic Jumper: A fiber optic conductor used to connect equipment and entrance cable on a distributing frame. Also, a fiber optic patch cable or conductor used to establish a circuit, often temporarily, for testing or diagnostics.

Fiber Optic Patch Cord: Single fiber cables with connectors on each end used to join communication circuits at a cross-connect point, Fiber Distribution Frame (FDF) or Next Generation Frame (NGF).

Tinned Wire: Copper wire that has been coated during manufacture with a layer of tin or solder to prevent corrosion and simplify soldering of connections.

REQUEST FOR PROPOSALS
RFP No. ISL-2017-01
CONSTRUCTION SERVICES FOR FIBER OPTIC BROADBAND INFRASTRUCTURE

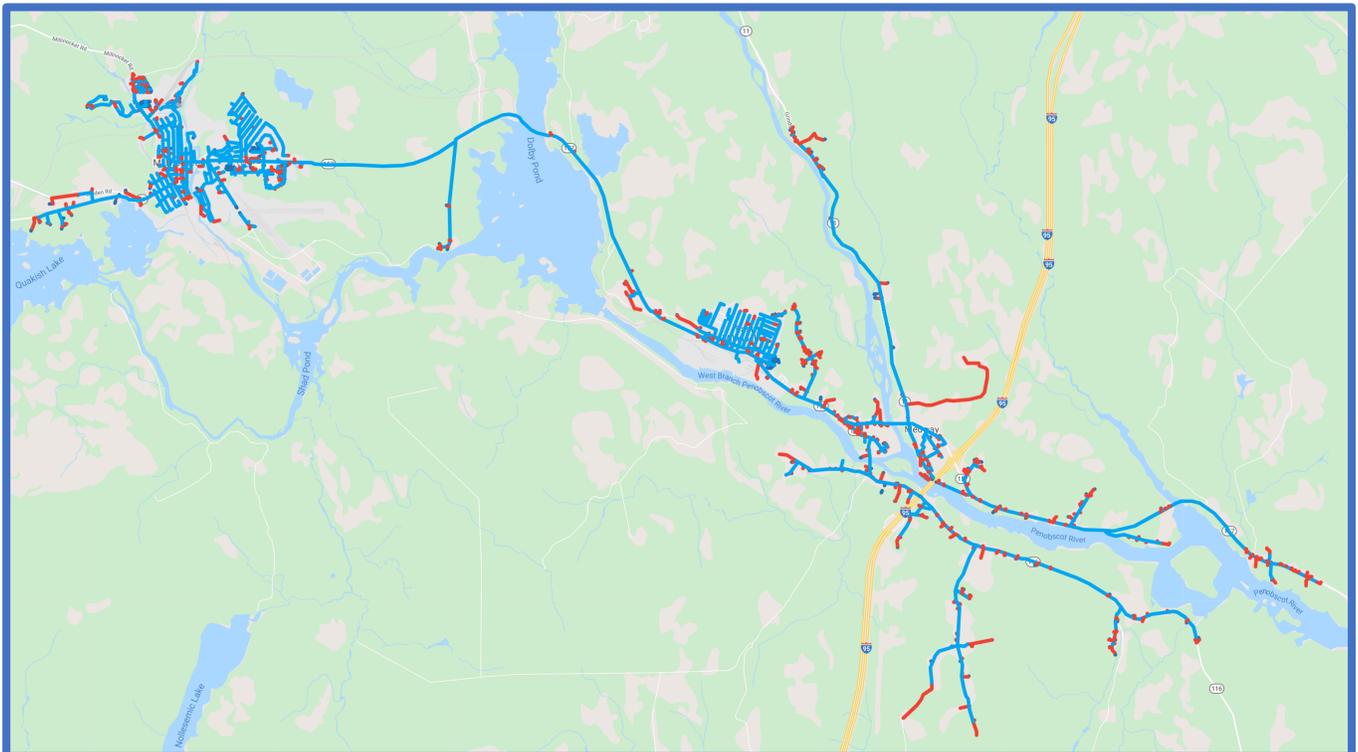
Commissioning: Process by which equipment, facility, or plant (which is installed, or is complete or near completion) is tested to verify if it functions according to its design objectives or specifications. After installation is finished, the equipment is powered up and tested in a standalone environment. Also, the latest software version and settings are confirmed and loaded into the equipment configuration.

Integration: Is the act of bringing together smaller components into a single system and tested to confirm the system functions as one. After the equipment is commissioned, the network elements need to be connected to the network, integrated and tested to become a functional part of the network.



Casco Bay Advisors, LLC
Broadband/Telecom Consulting

Request for Proposal Fiber Optic Construction Services & Network Operator Services



Katahdin Broadband *the Towns of* Millinocket – East Millinocket - Medway

Prepared by
Casco Bay Advisors, LLC

JANUARY 18, 2020



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1 Overview

1.1 General Information

Katahdin Broadband (Katahdin) is a collaboration between the Towns of Millinocket, East Millinocket and Medway located in Penobscot County, Maine, each of which has jointly formed the Katahdin Region Broadband Utility (KRBU) under the authority of Maine statute (30-A MRSA 2203.9). Katahdin is seeking a fiber optic construction firm (Construction Contractor) to construct a Fiber-to-the-Premise (FTTP) Network (Network) and a Network Operator to operate the Network to serve virtually all potential subscriber locations within the limits of each Town. The Network has been engineered to be operated as either an open access dark fiber network or as a single provider network.

Bidders are invited to submit proposals for both the Construction Contractor scope of work and Network Operator scope of work as a combined proposal, or individually for either scope of work. Bidders are also invited to propose alternative bids that may not necessarily be anticipated in this RFP.

For bids consisting of teams of firms, one firm must identify itself as the Principal. The Principal shall be responsible for the scope of work proposed, as well as insurance and bonding.

1.2 RFP Schedule

All deadlines are 4:00 PM Eastern Time on the date listed.

RFP Schedule	
RFP Released	January 18, 2021
Pre-Bid Meeting via Zoom at 2:00 PM	January 25, 2021
Questions due	January 29, 2021
Notification of Intent to Respond (Mandatory)	February 1, 2021
Responses to Questions Posted Online	February 5, 2021
RFP Responses due	March 1, 2021
Finalists Named (Expected)	March 15, 2021
Bid Award Announced (Expected)	March 29, 2021



2 Background

Katahdin intends to build, own and operate a 75-mile FTTP network to serve 3,678 potential subscriber locations and 4,052 potential subscribers across the 3 Towns. The network is intended to be configured as a Gigabit Passive Optical Network (GPON), with optional Active Ethernet (AE) where demand dictates.

Network Strand		
	Feet	Miles
Millinocket	178,777	33.9
East Millinocket	66,883	12.7
Medway	150,151	28.4
Total	395,811	75.0

Network Node Locations		
FDH	(600 block) Main St	Millinocket
Central Office	125 Main St	East Millinocket
FDH	25 School St	Medway

The Central Office (CO) will be centrally located in East Millinocket on town-owned land behind the Public Safety building. A Fiber Distribution Hub (FDH) location has been identified for each Millinocket and Medway. A dedicated fiber has

been engineered from each potential subscriber location to the respective network node for each Town, with close to 20% extra capacity for future growth and other future applications. There is sufficient space within each FDH structure to upgrade to a full central office if deemed appropriate.

2.1 Katahdin Demographics

The engineering effort has identified 3,678 potential subscriber locations with a total of 4,052 potential subscribers (includes multi-tenant) for an average density of 55 potential subscribers per mile.

Demographics							
	2010 Census				2020 Field Audit		
	Population	Families	Households	Housing Units	Potential Subscriber Locations	Potential Subscribers	Potential Subscribers per Mile
Millinocket	4,506	1,305	2,167	2,586	2,268	2,563	77
East Millinocket	1,723	492	768	871	787	850	67
Medway	1,349	400	576	658	623	639	22
Total	7,578	2,197	3,511	4,115	3,678	4,052	55



2.2 Project Implementation – Division of Responsibility

Project Implementation - Division of Responsibility	
Contractor	Scope of Work
Construction	Outside Plant - Construction
	Presubscribed Subscriber Drop Installation (<i>termination & activation by network operator</i>)
	Fiber Testing
	Fiber Optic Splicing
	On-call Restoration and Outside Plant Maintenance for 3 years post construction
Network Operator	Central Office GPON Equipment and Internet Connectivity - Installation & Turn-up
	Splice Diagrams
	Subscriber Drop Termination (<i>drop install by construction contractor</i>)
	ONT Installation & Subscriber Activation
	Sales & Marketing
	Customer Service, Billing, Collections, Equipment Maintenance
Owners Project Manager	RFP Process Administration
	Utility Pole Make-ready Project Management
	Construction Oversight & Project Management
	Construction Inspection
	Central Office & FDH Site Development - Project Management
	Central Office & FDH Structure - Acquisition & Delivery
	Subscriber Presubscription - Process Management
	Network Operator Oversight & Coordination

Casco Bay Advisors, LLC (Casco Bay) is Katahdin’s engineering vendor. The scope of work for each Contractor is further described below.

2.2.1 Construction Contractor

The Construction Contractor will be responsible for deployment of all outside plant assets, splicing and fiber optic testing, from the Fiber Termination Panel (FTP) in the CO, to installation of presubscribed customer drops delivered to the exterior of the subscriber location (*the Network Operator will be responsible for pulling the drop into the subscriber location*).

The Construction Contractor will be responsible for testing each fiber on the reel before deployment and testing of each fiber after deployment and splicing.

The Construction Contractor shall include a pricing proposal for on-call restoration and maintenance for all outside plant for a period of 3-years post construction.



2.2.2 Network Operator

The Network Operator will be responsible for:

- Acquisition, installation and turn-up of all GPON equipment within the CO and at the subscriber location
- Termination of the subscriber drop at the subscriber location, installation of the ONT and service activation
- Creation of splice diagrams at each splice point to be provided to the Construction Contractor prior to construction
- Marketing, sales, customer service, billing, collections and equipment maintenance

2.2.3 Owners Project Manager

The Owners Project Manager (OPM) will be responsible for:

- Administration of the RFP process
- Utility pole make-ready project management (*application submission, joint-ride-out, and project management of make-ready process to pole license issuance*)
- Outside Plant construction oversight, status reporting and issue resolution
- Inspection of outside plant construction, creation of punch-lists and validation of completion
- Project management of CO and FDH site development
- Project management of CO and FDH structure acquisition, delivery and placement
- Coordination and administration of subscriber presubscription process and coordination with Construction Contractor for installation of drops to presubscribed subscriber locations
- Oversight and coordination with Network Operator through project completion

2.3 Project Commencement

Based on the responses to this RFP and the expense of its OPM contract; Katahdin will seek approval to proceed with the project at its member annual or special Town Meetings, to be schedule no later than April 30, 2021. **Contracts arising from this RFP will be conditionally awarded and executed, with payment and performance obligations subject to Town Meeting approval of the contract price.**



3 General Information

3.1 Response Information

3.1.1 Single Point of Contact

All communications concerning this Request for Proposal (RFP) are to be sent by email to:

Kyle Leathers
Town of East Millinocket
53 Main St
East Millinocket, ME 04430
KatahdinBroadband@gmail.com

3.1.2 Mandatory Pre-Bid Meeting

Each Proposer to this RFP must attend the mandatory pre-bid meeting via Zoom at the date/time listed in Section 1.2. Those wishing to attend the pre-bid meeting should email the Single Point of Contact for the Zoom link. Katahdin disclaims any and all responsibility for injury to Proposers, their agents or others while examining the site or at any other time. Proposers are responsible for all of their costs in preparing and submitting proposals hereunder.

3.1.3 Questions and Answers

Questions about the RFP and the proposal contents need to be in writing and submitted to the Single Point of Contact on or before the date listed in Section 1.2. All questions and answers will be answered in writing and posted to the Katahdin website at a location to be determined.

3.1.4 Revisions to RFP

If Katahdin determines that it is necessary to revise any part of this RFP, or if additional data is necessary to clarify any of its provisions, a supplement will be posted to the Katahdin website. Katahdin reserves the right to amend the RFP at any time prior to the deadline for submission of responses and will notify all bidders who are on the mandatory pre-bid meeting attendance sheet.

3.1.5 Bid Deposit

All bidders responding to the Construction Contractor scope of work must submit a bid deposit in an amount equal to 5% of the bid amount in the form of a bid bond or certified check made payable to Katahdin Region Broadband Utility. Bid deposits shall be returned upon the signing of a contract, which shall be signed, if at all, no later than (90) days after the opening of bids, and also shall be



returned in the event that Katahdin rejects all bids. Should a bidder withdraw its proposal prior to the signing of a contract between the successful bidder and Katahdin, the bidder's deposit shall be forfeited to Katahdin.

3.1.6 Proposal Deadline

Please provide Katahdin with an original plus eight (8) copies of the firm's proposal in a sealed envelope, marked "Katahdin Broadband Proposal", addressed to Katahdin's Single Point of Contact on or before the date and time listed in Section 1.2. Proposals must be submitted in hardcopy form and supplemented with an electronic copy within the sealed bid envelope. Proposals received after that date and time will not be considered.

3.1.7 Bid Opening

Bids shall be opened by the Katahdin Single Point of Contact, or their designee, in public at a stated location and specific time to be determined, but no later than seven (7) calendar days after the Proposal Deadline. A tabulation of all received bids will be made available for public inspection.

3.2 Other Preparation Information

3.2.1 Proposal Acceptance

Katahdin reserves the right to accept or reject any or all proposals, in whole or in part, as deemed to be in the best interest of Katahdin. Katahdin may elect to negotiate with multiple entities prior to making final decisions.

3.2.2 Business Good Standing

To be awarded a contract by Katahdin, a Respondent must demonstrate that it is authorized to conduct business in Maine as evidenced by a certificate of good standing from the Maine Secretary of State's Office.

3.2.3 Costs of Preparation

The Respondent shall be solely responsible for all expenses incurred in the preparation of a response to this RFP and shall be responsible for all expenses associated with any presentations or demonstrations associated with this request and/or any proposals made.



3.2.4 Other Response Information

Unless otherwise specified in the RFP, all communications responses, and documentation must be in English, and all cost proposals or figures in U.S. currency. All responses must be submitted in accordance with the specific terms of this RFP.

Katahdin may provide reasonable accommodations, including providing material in an alternative format, for qualified Respondents with disabilities or other hardships. Respondents requiring accommodations shall submit requests in writing, with supporting documentation justifying the accommodations, to Katahdin.

3.3 Contract Award Information

Katahdin may award one or more contracts and reserves the right to make additional awards to the same bidder at any time during the contract term if such award is deemed to be in the best interest of Katahdin.

3.4 Contract Evaluation

Katahdin intends to evaluate all submitted proposals as quickly as possible. Upon completion of the evaluation process, Katahdin may select one or more Construction Contractors with which to simultaneously execute contracts, based on the evaluation findings and other criteria deemed relevant for ensuring that the decision made is in the best interest of Katahdin.

3.5 Standard Terms and Conditions

The successful Proposer(s) shall be required to sign a Contract with Katahdin. Bidders shall provide a template of such proposed contract as part of their proposal.

3.6 Public Records

The successful response will become part of the contract file and will become a matter of public record as will all other responses received.



4 Information on the Network

4.1 Proposed Network

Construction drawings (maps) of the proposed network are contained as individual PDF files as Attachments to this RFP. Drawings are separated by each Town and are further separated into three (3) separate packages including Strand, Backbone/Lateral and Subscriber drops. Site development construction drawings for the Central Office are also included for reference but are not part of this RFP. The construction drawings are formatted on 17" x 22" pages, at a 1:2400 scale (1" = 200') but can also be provided in other scales and page sizes upon request.

4.2 Pole Attachment Licensing

At the time of this RFP issuance, while the utility pole data (*coordinates, owner IDs, street and town*) has been collected, Katahdin has not commenced the process of licensing pole attachments on the utility poles. At the time of contract negotiations between Katahdin and Construction Contractor, Katahdin will advise as to status.



5 Construction Contractor - Scope of Work

5.1 Construction Scope

The network is designed as three (3) distinct networks, one each for the Towns of Millinocket, East Millinocket and Medway, with a fiber dedicated to each potential subscriber location, plus a design goal of 20% excess capacity for future growth. The Central Office (CO) is located in East Millinocket, central to the overall serving geography with a Fiber Distribution Hub (FDH) in Millinocket and another in Medway. 32:1 PON splitters will be located in the FDH locations as well as the CO with Passive Optical Network (PON) backhaul fibers from the FDHs to the CO. The fiber design is comprised of SMF-28e+ fiber for all of the fiber routes.

The FDH locations are passive locations without optical/electronics with Optical Line Termination (OLT) electronics located in the CO. The network is designed to be configured and operated as either a non-discriminatory open-access network to facilitate use by an unlimited quantity of competitive Internet Service Providers (ISPs) or as a closed single-provider network.

The CO and FDH locations are each designed as 10' x 16' prefabricated concrete shelters supplied and installed by the Owners Project Manager (OPM) under a separate contract.

Strand has been designed as either "network strand" or "drop strand". Network strand has been defined as strand to a serving pole where two (2) or more potential subscriber are served, with 100% of the network strand to be constructed as part of this scope of work. Drop strand is designed for those potential subscriber serving poles where there is only one (1) potential subscriber location served. Drop strand should be included in the respondents pricing on a unit basis and will only be constructed as part of this scope of work if the potential subscriber contracts for service during a presubscription phase completed prior to the commencement of construction. Drop strand is illustrated on the strand maps in Section 9 – Attachments, in the color red.

Down guys and anchors are to be placed in accordance with the engineering design and the pole attachment licenses issued by Consolidated Communications and Central Maine Power. Placement of down guys and anchors should be included in the respondents pricing on a unit basis. Actual quantities of down guys and anchors will not be known until final make-ready quotes are received from the pole owners.

Each of the backbone and lateral fiber cables have been sized to reflect with the maximum fiber quantity necessary to serve the potential subscriber locations passed, plus 20%, increasing in count from the far end to the FDH or CO, without regard to the quantity of butt splicing required. Bidders are encouraged to consider value engineering opportunities by increasing the fiber counts on certain segments in order to reduce the amount of butt splicing required depending upon their own costs to splice versus increased cable count costs.



All serving terminals will be placed eighteen (18) inches to the right of the serving pole. The only exceptions will be dead end poles and road crossings, where the terminal will be placed eighteen (18) inches to the left of the serving pole. During the construction process, all terminal locations will require sixty-five (65) feet of slack to enable all splicing to occur on the ground. Remaining slack not used for splicing will be lashed to the strand with one or more snowshoes. All terminals will require proper labeling inside the terminal, such as fiber direction, cables, fiber assignments, etc. Outside plant labeling and naming standards will be developed by the Network Operator in collaboration with the Construction Contractor and OPM.

Each distinct network is subdivided and organized into geographic zones with a maximum 576 count fiber cable serving each zone (*zone boundaries are illustrated on the maps contained in Section 9 – Attachments*). The table below itemizes each zone with the zone name, quantity of potential subscribers and the cable count serving each zone. In some cases, multiple zones are combined into a single 576 count cable.

Katahdin Broadband - Backbone Zones										
Millinocket Zones										
Name	Subs	Cable Count	Capacity	To	Add'l Subs	Total Subs	Cable Count	Capacity	To	From
Bates	258	288	112%	Bates/Bowdoin Cabinet	25	507	576	114%	FDH	West
Bowdoin	224	288	129%							
Penobscot	267	288	108%	Water/Central Cabinet	0	434	576	133%	FDH	West
Water St	35	48	137%							
Aroostook	132	168	127%							
Poplar	253	288	114%	Maine/Central Cabinet	14	457	576	126%	FDH	West
Katahdin	190	216	114%							
Medway Rd	244	288	118%	n/a	0	244	288	118%	FDH	West
Cottage	487	576	118%		0	487	576	118%	FDH	East
Main St	373	576	122%	n/a	0	472	576	122%	CO	East
FDH to CO	99									
Totals	2562	3024	118%		39	2601	3168	122%		
East Millinocket Zones										
Name	Subs	Cable Count	Capacity	To	Add'l Subs	Total Subs	Cable Count	Capacity	To	From
Main St (west)	11	120	109%	n/a	0	110	120	109%	CO	South
Millinocket FDH to CO	99									
Main St (east)	113	192	119%	n/a	0	161	192	119%	CO	South
Medway FDH to CO	48									
East Side	478	576	121%	n/a	0	478	576	121%	CO	North
West Side	249	288	116%	n/a	0	249	288	116%	CO	North
Totals	998	1176	118%		0	998	1176	118%		
Medway Zones										
Name	Subs	Cable Count	Capacity	To	Add'l Subs	Total Subs	Cable Count	Capacity	To	From
Medway Rd / Main St	251	288	115%		0	251	288	115%	FDH	East
Pattagumpus	246	288	117%		0	246	288	117%	FDH	East
Medway Rd / Pattagumpus	77	96	125%		0	77	96	125%	FDH	East
Wilderness Dr	52	120	120%		0	100	120	120%	CO	West
FDH to CO	48									
Totals	674	792	118%		0	674	792	118%		



Each restoration slack loop is to be one-hundred and fifty (150) feet in length and placed per the design. Slack loops have been strategically placed throughout the network where sufficient terminal slack is not available for use in the event of restoration efforts. There is a specific slack symbol within the design maps to identify proper placement.

Presubscribed subscriber drops will be installed and spliced at the serving terminal with the subscriber end of the drop coiled and temporarily attached to the subscriber structure for the Network Operator to terminate at the Network Operator installed Optical Network Terminal (ONT). Placement of subscriber drops should be included in the respondents pricing on a unit basis and will only be constructed as part of this scope of work if the potential subscriber contracts for service during a presubscription phase completed prior to the commencement of construction.

5.2 Installation Materials

The construction phase of this project will consist of all materials. The Construction Contractor shall be responsible for procuring both major and minor materials, and providing warranty for all of the major materials, which are listed in Appendix B: Bill of Materials – Network Construction, or their functional equivalents. Any and all substitutes made to the bill of materials must meet or exceed warranty specifications of the materials listed in Appendix B.

For reference purposes only, we have included the Bill of Materials for the CO, FDH locations, GPON Equipment and Fiber Termination and Cross-connect in Appendix C - G.

The Construction Contractor is held responsible for all materials through Katahdin's acceptance of the network. If the materials supplied by the Construction Contractor are found to be defective, or do not conform to the specifications upon testing, Katahdin reserves the right to have the Construction Contractor immediately replace the materials at the Construction Contractor's expense, and through its procurement process. Excess materials purchased but not used during the construction will be property of Katahdin upon acceptance of the network.

5.3 Staging Areas

The staging area for the outside plant construction will be at the Public Safety building in East Millinocket, adjacent to the CO location at 125 Main Street. An additional staging area in Millinocket can be provided if appropriate. Temporary security fencing should be included in the bidder's price as a separate line item.



5.4 Installation Requirements

The Construction Contractor shall be experienced in outside plant facilities installation on utility poles and conduits. The Construction Contractor shall install fiber optic cable and associated items according to the following:

1. As designed in Section 9 – Attachments 1 – 9.
2. All fiber optic cable to be installed along the aerial pole line and in conduit shall be outside plant fiber optic cables as listed in Appendix B.
3. All fiber optic cable shall be installed as per manufacturer’s best practices and tensioned as per manufacturer’s specifications.
4. The Construction Contractor is responsible for installing all necessary pole hardware suitable for the provided cable.
5. High visibility cable tags or markings containing the Katahdin contact information shall be installed at every pole, splice enclosure and riser guard, and be visible while standing on the ground.
6. All fiber optic cable installed, or to be installed in a building must be riser rated cable.
7. Industry approved cable lubrication shall be used as required during the cable placement in innerduct or conduits.
8. All conduits shall be weather sealed at both ends.
9. Serving terminals are to be installed approximately 18 inches to the right of the pole, and drop ports are to be installed on the left side of the terminal.
10. A 65-foot slack loop shall be placed at all serving terminal locations for splicing. The remaining slack not used for splicing is to be over-lashed to the strand and supported by snowshoe(s).
11. Labeling of the cable sizes and direction is required. All fiber strands spliced will be tagged and identified per terminal splice design.

The Construction Contractor shall follow the cable manufacturer’s installation recommendations and guidelines. At a minimum, fiber optic cables shall be installed and tested in accordance with NECA/FOA 301, *Standard for Installing and Testing Fiber Optic Cables*.

All Work shall conform to the current National Electrical Code, National Electrical Safety Code and all state and local codes and ordinances. ANSI/TIA/EIA Standards shall be adhered to during all installation activities.

5.5 Splicing Requirements

1. All fibers and connector assemblies shall be fusion spliced.
 - a. All splices are to be organized and secured within an approved fiber optic splice closure.
 - b. The Construction Contractor shall follow the manufacturer’s recommended cable preparation and routing procedures for cable entry into the provided fiber optic splice closure.



2. All splicing shall be completed as per splice details provided prior to the start of construction for each identified splice location. Any changes shall be approved by the OPM prior to completion.
3. The Construction Contractor shall maintain a Splice Log Book for each splice enclosure.
 - a. Each splice enclosure will have a unique identifier as per the design prints and shall be large enough to be visible from the ground.
 - b. The Splice Log Book shall include a copy of the original splice detail sheet, a red-lined copy of the as-built detail, LID readings from the fusion splicer, Optical Time Domain Reflectometer (OTDR) test results of the fibers spliced at that location, pictures of the organization and layout of the interior of the enclosure, and pictures of the enclosure on the cable or strand.
 - c. The Splice Log Book shall also include any additional pertinent information not listed.
 - d. The Splice Log Book shall be delivered to the OPM electronically upon request and at the end of the project.
4. All splicing shall be monitored with an OTDR and tested to ensure acceptable splice loss values are achieved.
5. Labeling of cable sizes and direction is required. All fiber strands spliced will be tagged and identified per terminal splice design.
6. All tools and equipment used shall be in excellent working order.
 - a. The Construction Contractor's cleaving, splicing and cable preparation equipment will be reviewed and approved by the OPM prior to the beginning of any splicing work.
 - b. All splicing equipment shall be calibrated within 6-months of use on this project. Certificates of calibration for splice equipment shall be submitted to the OPM for review and approval.

5.6 Testing Requirements

1. The Construction Contractor shall test all optical fiber cables upon receipt at the project site prior to installation.
2. Optical fiber cables shall be tested while on reels with an OTDR to verify the cable length and locate cable defects, splices, and abnormalities, recording the loss value of each.
3. The Construction Contractor shall compare all pre-installation reel test data with factory results provided by the cable manufacturer and report any deficiencies to the OPM.
4. The Construction Contractor shall retain pre-installation reel test data and include in the record with as-built data.
5. All completed fiber spans shall be acceptance tested to determine cable length and splice attenuation using an OTDR. Each strand shall be tested bi-directionally @ 1310nm and 1550nm.
6. Each strand shall be tested for end-to-end dB loss and continuity using a Single mode light source and power meter @ 1310nm and 1550nm.
7. Optical fiber end-to-end link tests shall be performed in accordance with TIA/EIA-568-B.1 and TIA/EIA-568-B.3.



8. The Construction Contractor shall prepare loss budget calculations for each circuit. The loss budget shall itemize expected dB loss. The following formulas shall be used:

- i. Measuring at a wavelength of 1310 nm:
 - ii. _____ km X .35 dB/km = _____
 - iii. _____ SC connectors X 0.4 dB/mated pair = _____
 - iv. _____ Splices X 0.05 dB = _____
 - v. _____ Total maximum (end-to-end) loss = _____

- vi. Measuring at a wavelength of 1550 nm:
 - vii. _____ km X .25 dB/km = _____
 - viii. _____ SC connectors X 0.4 dB/mated pair = _____
 - ix. _____ Splices X 0.05 dB = _____
 - x. _____ Total maximum (end-to-end) loss = _____

9. Strands shall meet current EIA/TIZ-568 specifications.

10. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

11. The Construction Contractor shall correct any fiber strands that demonstrate excessive attenuation due to breaks, bends, bad splices, defective connectors and bad installation practices.

12. The Construction Contractor shall submit test results in electronic format and in hard copy to the OPM for acceptance and sign off. The Construction Contractor shall perform any repair required by the OPM to correct any deficiencies, at no additional cost to Katahdin.

5.7 Documentation Requirements

The Construction Contractor will provide an as-built package by updating the network design using the VETRO Fibermap Fiber Management and Design system (VETRO) at the completion of this project. This package shall include at a minimum the following items:

- Updated splice documentation consisting of:
 - Network
 - FDHs
 - CO
 - Splice cases
 - Terminals
- Fiber span footages
- Terminal splice locations
- Strand grounding locations
- Slack loop locations



- Routes of all strand/cables installed

The Construction Contractor shall also provide:

- Test results for optical fiber testing
- Warranty Package to include dates (Product Warranty)
- Certificate of Acceptance (pre- and post-installation)
- Summary sheet of test results for quick reference

5.8 Job Completion

Job completion of the network construction occurs when the Construction Contractor:

1. Submits last invoice
2. Notifies the OPM that construction is complete
3. Final inspection has occurred
4. All punch list items have been completed
5. All equipment and materials warranties have been transferred to Katahdin
6. All construction materials and fiber reels have been returned to the staging area with a list of remaining items
7. All the documentation for the project is submitted

5.9 Safety Requirements

The Construction Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions to reasonably protect the public and private property in connection with the performance of the work covered by the contract.

The Construction Contractor shall take the necessary precautions and bear the sole responsibility for the safety of the methods employed in performing the work. The Construction Contractor shall at all times comply with the regulations set forth by Federal, State or local laws, rules, and regulations concerning "OSHA" and all applicable state labor laws, regulations and standards.

5.10 Warranty Requirements

1. The Construction Contractor shall warrant that all materials furnished shall be new, and free from defects.
2. The Construction Contractor shall warrant that the materials and workmanship used in the installation are as herein specified and shall provide all material and labor required to make good any defects due to faulty materials or workmanship which becomes apparent within a one-year period from completion.



3. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives, as well as misrepresentations of such data. When the products have been installed in accordance to the manufacturer’s published or written instructions and recommendations, and such products fail, then the Construction Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to Katahdin.
4. Warranty information is required for all materials supplied by the Construction Contractor.
5. Damage by vandals, fire, traffic accidents or “acts of God” is excluded from warranty.

5.11 Schedule Requirements

The contract period is expected to begin on or around October 2021 and extend through the close-out of the project in July 2022

	Date
Selection Notification	<i>See Section 1.2</i>
Contract Execution	30 days after notification
Begin Construction	when utility pole make-ready is complete
Complete Construction	9 months after begin construction
OPM's Acceptance of System	Coincident with construction complete



6 Network Operator / Single Provider - Scope of Work

6.1 Pre-operation Support

With the Network Operator responsible for all aspects of the continuing operation of the Network, it is imperative the Network Operator have the opportunity to collaborate with Katahdin, the OPM and the Construction Contractor as decisions are made that will impact the operation of the Network. For this Pre-operation Support phase of the Scope of Work, bidders should expect to provide support services on a time and expense basis, provide a schedule of hourly rates and provide an estimate of the overall cost of providing such support. The type of support services anticipated are described below.

6.1.1 Collaboration with Construction Contractor and OPM

The Network Operator will be expected to review all Construction Contractor change orders and provide comments and/or recommendations to the OPM regarding change order requests.

6.1.2 Collaboration with Katahdin and OPM during Presubscription

A subscriber presubscription period of at least 90 days will be conducted prior to construction commencement in an effort to maximize the quantity of subscriber drops installed as part of the initial Construction contract. The Network Operator will be expected to collaborate with Katahdin and the OPM to develop a marketing plan and participate in the marketing efforts of the presubscription period.

6.1.3 Splice documentation

While the Construction Contractor will be responsible for all splicing up to and including the presubscribed subscriber drops, the Network Operator will be required to provide instructions to the Construction Contractor regarding the splice plan and documentation requirements for each splice point. The Network Operator will be required to configure the splicing plan within Katahdin's instance of its VETRO Fibermap Fiber Management and Design system (VETRO).



6.2 Product

6.2.1 Internet

All Broadband Internet service shall be configured as 1Gbps symmetrical service for all subscribers. The Network Operator shall have capability to provide virtual local area network (VLAN) per subscriber or equivalent protections for the separation of subscribers traffic from inappropriate interception.

6.2.2 IP Address and Domain Name Service

The Network Operator shall have the capacity to provide subscribers with dynamic addressing by default, and a permanent static IP address if requested by the subscriber. The Network Operator shall have the ability to manage DNS in such a way that all assigned IP addresses have fully consistent forward and reverse lookups.

6.2.3 Net Neutrality

The Network Operator shall demonstrate understanding and commitment to abiding by the provisions in Maine revised statutes Sec. 1. 35-A MRSA c. 94 – BROADBAND INTERNET ACCESS SERVICE CUSTOMER PRIVACY and Sec. 1. 5 MRSA c. 143 §1541-B-NET NEUTRALITY and shall assure all regulatory agency compliance.

6.2.4 Voice Telephone Service

Voice telephone service, voicemail and optional calling features shall be provided as an optional service in addition to the Broadband Internet service. Voice services will not be offered on a standalone basis. Voice service shall include the capacity to provide “Plain Old Telephone Service” (POTS) connectivity utilizing the subscriber’s built-in connections for premise copper wire connections and retention of existing telephone numbers. The Network Operator shall have the ability to manage routing of telephone calls throughout the public switched telephone network (PSTN) and interconnection points of the PSTN.

6.2.5 Additional Services

The Network Operator may be required to offer additional services as may be mutually agreed by Katahdin and the Network Operator on a case-by-case basis.



6.3 Presubscription Turn-up

During the Outside Plant construction phase performed by the Construction Contractor, the Network Operator will be responsible for providing and installing the Central Office equipment necessary to activate the subscriber services, termination of the drops installed by the Construction Contractor, and installation, activation and testing of the customer premise equipment. Those responsibilities are further described below.

6.3.1 Central Office equipment

The OPM will be responsible for managing the acquisition, delivery and placement of the Central Office and FDH structures and all peripheral equipment, including but not limited to, frames and ironwork, DC power distribution panels, rectifiers, batteries, transfer switches, generator and fiber management / cross-connect frames. The Network Operator will be responsible for providing and installing the ADTRAN TA5000 Multi Service Access Platform, or equivalent.

6.3.2 Internet Capacity

The Network Operator will be responsible for providing at least two (2) diverse bandwidth paths with sufficient upstream/peering capacity to handle the load of the Network, including voice services, on either path, as well as any equipment required to facilitate such capacity. *(Note: The Maine Fiber Company 3-Ring Binder Network, owned and operated by FirstLight passes through each member community providing a readily available diverse and redundant infrastructure to facilitate this capability.)*

6.3.3 Customer Premise Equipment

The Network Operator will be responsible for providing, installing, activating and testing all materials installed at the presubscribed subscriber location, including termination of the drop installed by the Construction Contractor. Those responsibilities are further described below. Any service or equipment provided beyond the ONT Network Interface Device (NID) is not included in this Scope of Work for the Network Operator, and if offered by the Network Operator, shall not be performed under the terms of the Network Operator contract.

6.3.3.1 Drop termination

The Construction Contractor will be responsible for placing and splicing all presubscribed drop cables and coiling sufficient drop cable slack as specified by the Network Operator on the side of the subscriber structure. The Network Operator will be responsible for terminating the drop cable into either an exterior or interior ONT configuration.



6.3.3.2 *ONT installation*

The majority of ONT installations are intended to be installed on the exterior of the structure. Exceptions to this policy with the ONT installed on the inside of the structure will be made on a case-by-case basis by the OPM or Katahdin. All subscribers who subscribe to voice services shall have a battery backup installed on the interior of the structure. Wireless routers will be provided as an option.

6.3.3.3 *Service activation and testing*

The Network Operator will be responsible for all service activation and testing.

6.4 Network Operation – Post Construction

At the completion of the Construction Contractors scope of work, the operation of the Network will be the responsibility of the Network Operator. For purposes of this RFP, it is assumed that many of the presubscribed customers will have been activated prior to completion by the Construction Contractor and the remainder of the presubscribed customers will be activated as soon as possible after the commencement of operation of the Network by the Network Operator. Following is an itemization of responsibilities of the Network Operator post construction.

6.4.1 Marketing & Sales

The Network Operator will be responsible for all marketing and sales of Broadband Internet and telephone services. The Network Operator shall make full efforts to market and sell Internet and optional services on the Network to all potential subscribers within the service territory. It is expected that the Network Operator will begin marketing and sales efforts after the completion of the presubscription period.

6.4.2 Service Activation

The Network Operator will be responsible for activation of all services in the same manner as described in the Presubscription Turn-up process described in Section 6.3 above. The Network Operator will also be responsible for installation of subscriber drop cables not installed as part of the Presubscription drops by the Construction Contractor after the initial construction has been completed.

6.4.3 Billing & Collections

The Network Operator will be responsible for all billing and collections and ensure proper billing and collections. Flexible methods of monthly billing and payment shall be offered. Billing methods shall include paper statements sent via US Mail and statements sent by electronic means. Payment



methods shall be accepted by US Mail, credit or debit card and automatic checking account withdrawals.

6.4.4 Credit Checks

The Network Operator will be required to perform credit checks, as needed, before contracting subscribers for service.

6.4.5 Subscriber - Service Level Agreements

The Network Operator shall provide (*defined in collaboration with Katahdin*) clearly defined service level agreements as part of subscriber contracts, covering every aspect of subscriber service, usage and billing, including an acceptable use policy.

6.4.6 Network Operator – Service Level Agreement

The Network Operator will be required to enter into a Service Level Agreement (SLA) with Katahdin, which shall be negotiated as part of the Network Operator contract. Such SLA will include subscriber satisfaction and network performance metrics.

6.4.7 Network Monitoring

The Network Operator will be responsible for providing 24 hour per day / 7 day per week proactive monitoring of the network.

6.4.8 Repair & Restoration

The Network Operator will be responsible for providing 24 hour per day / 7 day per week, timely and efficient subscriber troubleshooting and technical support.

6.4.9 Outside Plant Maintenance Coordination

The Network Operator will be responsible for coordinating all Outside Plant maintenance, repair, pole transfers and pole attachment rearrangements.

6.4.10 VETRO

The Network has been engineered using VETRO FiberMap (VETRO). All splice documentation and as-built information is required to be updated by the Construction Contractor within this application. The Network Operator will be required to maintain the Network within this application.



6.4.11 Backups

The Network Operator will be responsible for maintaining backup configurations of all network elements and provide such backups to Katahdin on a monthly basis or as otherwise agreed, in a format approved by Katahdin.



7 Network Operator / Open Access - Scope of Work

As an alternative to the “Network Operator / Single Provider – Scope of Work” described in Section 6 above, Katahdin would like to compare that approach to a model where the Network is operated as an Open-Access / Non-Discriminatory Network, where more than one service provider and ideally multiple service providers would be able to utilize the network. This concept has the potential to enable greater competition for subscribers, thereby potentially lowering retail pricing and generating improved customer satisfaction. The subsections below itemize the scope of work in the same manner as the Network Operator / Single Provider – Scope of Work in Section 6 above.

7.1 Pre-operation Support

With the Network Operator responsible for all aspects of the continuing operation of the Network, it is imperative the Network Operator have the opportunity to collaborate with Katahdin, the OPM and the Construction Contractor as decisions are made that will impact the operation of the Network. For this Pre-operation Support phase of the Scope of Work, bidders should expect to provide support services on a time and expense basis, provide a schedule of hourly rates and provide an estimate of the overall cost of providing such support. The type of support services anticipated are described below.

7.1.1 Collaboration with Construction Contractor and OPM

The Network Operator will be expected to review all Construction Contractor change orders and provide comments and/or recommendations to the OPM regarding change order requests.

7.1.2 Collaboration with Katahdin, Service Providers and OPM during Presubscription

Katahdin expects to collaborate with service providers who are interested in utilizing the Network to conduct a subscriber presubscription period of at least 90 days prior to construction commencement in an effort to maximize the quantity of subscriber drops installed as part of the initial Construction contract. The Network Operator will be expected to collaborate with Katahdin and the OPM to support the marketing of services by the service providers during this presubscription period.

7.1.3 Splice documentation

While the Construction Contractor will be responsible for all splicing up to and including the presubscribed subscriber drops, the Network Operator will be required to provide instructions to the Construction Contractor regarding the splice plan and documentation requirements for each splice point. The Network Operator will be required to configure the splicing plan within Katahdin’s instance of its VETRO Fibermap Fiber Management and Design system (VETRO).



7.2 Product

The only product that will be offered under the Open-Access model will be the provision of dark fibers between the Central Office and the subscriber location. Service providers will be required to provide their own equipment at both the Central Office location and the subscriber location.

7.2.1 Dark Fiber

The Network Operator will be responsible for completing any cross-connects in the Central Office or FDH locations, as well as any necessary field splices that may be required.

7.2.2 Drop Cables

The Network Operator will be responsible for placing any drop cables to subscriber locations that have not been installed during the presubscription process.

7.2.3 Central Office Equipment Space & Power

No determination has been made at this time as to whether service providers may house their equipment inside the Central Office or will be required to provide their own equipment in outside plant cabinets or structures alongside the Central Office. In either scenario, the Network Operator will be responsible for facilitating either arrangement on an hourly rate basis.

7.2.4 Service activation & Testing

The Network Operator will be responsible for testing the dark fiber before hand-off to the service provider.

7.3 Network Operation – Post Construction

At the completion of the Construction Contractors scope of work, the operation of the Network will be the responsibility of the Network Operator. For purposes of this RFP, it is assumed that many of the presubscribed customers will have been activated prior to completion by the Construction Contractor and the remainder of the presubscribed customers will be activated as soon as possible after the commencement of operation of the Network by the Network Operator. Following is an itemization of responsibilities of the Network Operator post construction.

7.3.1 Service Activation & Testing

The Network Operator will be responsible for activation of all services in the same manner as described in Section 7.2.4 above. The Network Operator will also be responsible for installation of subscriber



drop cables not installed as part of the Presubscription drops by the Construction Contractor after the initial construction has been completed.

7.3.2 Billing & Collections

The Network Operator will be responsible for all billing and collections. Flexible methods of monthly billing and payment shall be offered. Billing methods shall include paper statements sent via US Mail and statements sent by electronic means. Payment methods shall be accepted by US Mail, credit or debit card.

7.3.3 Network Operator – Service Level Agreement

The Network Operator will be required to enter into a Service Level Agreement (SLA) with Katahdin, which shall be negotiated as part of the Network Operator contract. Such SLA will include service provider satisfaction and network performance metrics.

7.3.4 Repair & Restoration

The Network Operator will be responsible for providing 24 hour per day / 7 day per week, timely and efficient service provider troubleshooting and technical support.

7.3.5 Outside Plant Maintenance Coordination

The Network Operator will be responsible for coordinating all Outside Plant maintenance, repair, pole transfers and pole attachment rearrangements.

7.3.6 VETRO

The Network has been engineered using VETRO FiberMap (VETRO). All splice documentation and as-built information is required to be updated by the Construction Contractor within this application. The Network Operator will be required to maintain the Network within this application.

7.3.7 Backups

The Network Operator will be responsible for maintaining backup configurations of all network elements and provide such backups to Katahdin on a monthly basis or as otherwise agreed, in a format approved by Katahdin.



8 Proposal Requirements

Each Proposal must answer each of the following sections to be considered for evaluation. If a Respondent fails to meet any material terms, conditions, requirements or procedures, its response may be deemed unresponsive and disqualified.

8.1 Company Information

1. Provide your company information, including legal name, state of incorporation, year of incorporation, type of entity, all contact information, and a list of affiliated companies or other names you have done business as.
2. Please identify whether you are currently authorized to operate in the State of Maine and whether you maintain a physical presence within the state.
3. What other states or locations, if any, do you maintain an office or operations?
4. How many employees comprise your workforce: a) full time; b) part time; c) contract?
5. Please identify awards or recognition received by your company in the past 3 years.
6. Please list any licenses, certifications or accreditations awarded to your company.
7. Are you currently under contract or negotiations for a contract with the State of Maine? Any other state or municipality? Please list.
8. If selected as a vendor of choice, how soon can your company begin providing construction services for Katahdin?
9. Please provide evidence that you are capable of complying with the bond and insurance requirements of this project.

8.2 Industry Experience

Please provide the following for your company and all sub-Construction Contractors:

1. Please provide three (3) customer/client references including name, email, address, project timeline, and description of work
2. Please list the training certifications that your technicians hold and any experience with standards such as NECA 301 Standard and OTDR/loss testing.
3. Please provide your company's safety program, as well as any OSHA reportables within the past 3 years.
4. Which activities of the Scope of Work will your company sub-contract?
5. Are your technicians trained and experienced with NECA 301 standards?
6. Are your technicians trained in OTDR/Loss testing?
7. Do your technicians hold certifications for splicing?



8.3 Insurance Requirements

Proof of insurance is required upon notification of award. The successful bidder shall provide proof of workers compensation insurance, comprehensive general liability insurance, and comprehensive automobile insurance in their response.

8.4 Conformance to Requirements

Please identify how your company will conform to all requirements identified in the Scope of Work. Please identify any subsections you do not believe you can or will conform to. Please identify any particular subsections that you do not believe are necessary or will change your proposal.

8.5 Value Engineering

Respondents are invited and encouraged to submit an alternative design or operating model on all or part of this RFP for Katahdin's review that provides equal or greater function at lower cost.

8.6 Project Management

1. List what primary tools, equipment, software and hardware you use for project management.
2. Identify how you make your work effective and efficient.
3. Describe your recommended project management approach for coordination and communication.

8.7 Schedule Requirements

Describe the schedule you will meet for this project. Also, specifically describe how you intend to meet that schedule and what kind of guarantees or assurances you can provide.

8.8 Approvals and Certifications

Affirm that your proposal to the RFP will be valid for all parts of the network identified even if some of that work must be completed by a subcontractor.

8.9 Safety

The Construction Contractor and Network Operator shall provide all safeguards, safety devices and protective equipment and take any other needed actions to reasonably protect the public and private property connection with the performance of the work covered by the contract.



8.10 Warranty

Please describe how you will meet the minimum warranty requirements specified and appropriate within the document. Description must meet minimum requirements, but additional items or lengths of time will be viewed favorably.

8.11 Pricing

Please provide proposed pricing for the work described in the Scope of Work. Katahdin is a non-profit 501(c)3 organized and existing under the laws of the State of Maine. Our sales tax exemption number will be provided to the selected Contractors.

The table below provides a suggested format and components for pricing. If bidders have a proposed alternative format you would like to suggest, please submit the proposed format as a question prior to the question deadline identified in Section 1.2.

Suggested Pricing Breakdown	
	Pricing Type
Construction Contractor	
Fixed fee for entire project except the items noted below	Fixed
Down guy - installed	per unit
Anchor - installed	per unit
Drop cables - installed	per unit or per foot
Drop Risers - installed	per unit
Drop Duct - installed	per unit or per foot
Network Operator / Single Provider	
Pre-operation Support	Hourly per function
Splice documentation	per unit
Monthly or annual base operating fee	Fixed
Monthly per subscriber fee	per unit
Drop cables - installed	per unit or per foot
Drop Risers - installed	per unit
Drop Duct - installed	per unit or per foot
Exterior ONT installed	per unit
Interior ONT installed	per unit
Battery backup installed	per unit
Network Operator / Open Access Provider	
Pre-operation Support	Hourly per function
Splice documentation	per unit
Monthly or annual base operating fee	Fixed
Monthly per subscriber fee	per unit
Drop cables - installed	per unit or per foot
Drop Risers - installed	per unit
Drop Duct - installed	per unit or per foot
Service Provider access oversight	Hourly per function



9 Proposal Evaluation Criteria

Katahdin will review the RFP responses in accordance with the submittal requirements and using the criteria generally described as follows. Criteria are not necessarily listed in order of importance.

1. The thoroughness and comprehensiveness of each response.
2. The ability to meet the construction requirements, network installation and testing requirements.
3. The qualifications, experience and knowledge of the Respondent and the proposed project personnel.
4. Ability to meet schedules and deadlines.
5. Price of the work.
6. Familiarity with the proposed project areas and areas of similar geography.
7. Ability to work in a safe manner.
8. Ability to control and minimize costs as demonstrated in the response and through experience in prior projects.



10 Appendix

10.1 Appendix A:

Reserved



10.2 Appendix B: Bill of Materials - Network Construction

Network Construction - Bill of Materials						
	Units	Millinocket	East Millinocket	Medway	Total	Description
Strand-Network	Feet	178,777	66,883	150,151	395,811	1/4 EHS Galvanized strand including all associated hardware, lashing, down guys and anchors
	Miles	33.9	12.7	28.4	75.0	
Strand-Drop	Feet	23,235	10,541	59,268	93,044	1/4 EHS Galvanized strand including all associated hardware, lashing, down guys and anchors
	Miles	4.4	2.0	11.2	17.6	
Duct-2 inch (Drop)	Feet	12,751	3,307	8,218	24,276	Bidder to specify
Duct-2 inch	Feet	6,193	2,070	409	8,672	
Duct-4 inch	Feet	240	1,369	952	2,561	
Riser-2 inch	Qty	172	53	111	336	
Riser-4 inch	Qty	4	6	8	18	Galvanized steel
Pedestal	Qty	24	10	0	34	Bidder to specify
Splice Case / Fiber Access Terminal	Qty	354	121	174	649	Bidder to specify
Splice Cabinet or Splice Case	Qty	3	0	0	3	Bidder to specify
6 Count Fiber	Feet	11,913	714	17,046	29,673	Corning SF-28e+, Loose Tube, Gel-Filled, dielectric, 12F per tube
12 Count Fiber	Feet	37,659	15,506	27,998	81,163	
24 Count Fiber	Feet	38,497	8,071	31,672	78,240	
36 Count Fiber	Feet	13,630	3,695	19,382	36,707	
48 Count Fiber	Feet	13,659	8,762	19,516	41,937	
60 Count Fiber	Feet	6,568	3,618	6,688	16,874	
72 Count Fiber	Feet	5,448	1,773	7,746	14,967	
96 Count Fiber	Feet	5,146	1,413	6,893	13,452	
120 Count Fiber	Feet	25,849	17,467	3,435	46,751	
144 Count Fiber	Feet	6,634	3,292	3,187	13,113	
168 Count Fiber	Feet	3,305	2,193	6,960	12,458	
180 Count Fiber	Feet	0	1,390	0	1,390	
192 Count Fiber	Feet	853	0	0	853	
216 Count Fiber	Feet	1,077	0	6,633	7,710	
288 Count Fiber	Feet	10,943	1,696	13,437	26,076	
576 Count Fiber	Feet	17,598	3,849	0	21,447	
1 Count Drop Fiber	Feet	363,188	136,753	193,270	693,211	Bidder to specify
2 Count Drop Fiber	Feet	4,036	1,300	0	5,336	
4 Count Drop Fiber	Feet	8,772	213	0	8,985	
6 Count Drop Fiber	Feet	6,092	5,551	2,286	13,929	
8 Count Drop Fiber	Feet	1,057	0	0	1,057	
12 Count Drop Fiber	Feet	398	0	6,850	7,248	
Slack Loops		443	150	202	795	Bidder to specify
Snow Shoes		886	300	404	1,590	
Fiber Identification Tags	Qty	1,512	560	1,140	3,212	Bidder to specify



10.3 Appendix C: Bill of Materials - Millinocket FDH

STRUCTURE DESIGN LOADS:

- Floor Load: 250 psf
- Roof Load: 100 psf
- Walls: 150 mph

BUILDING SIZE:

- Outside (Nominal): 10'-0" W x 16'-0" L x 10'-6" H
- Outside (Overall): 10'-6" W x 17'-6" x 10'-6" H
- Equipment Room: 9'-0" W x 15'-0" L x 9'-0" H (Nominal)
- Estimated Module Weight: 45,000 lbs.

SHELL:

- Floor: 5 3/4" Solid concrete floor
- Walls: 4" Solid concrete
- Roof: Solid concrete 4" at eave and 5 1/2" at ridge
- Design: Step-joint design
- Tie down: (4) Tie down plates
- Bolts: Painted bolts to replace lifting lugs
- Concrete: 5000 psi lightweight concrete
- Reinforcing: Steel #4 and #6 bars, 60,000 psi (Grade 60 ASTM-615)
- Ratings: Walls to 2 hour fire rated
- Ballistics: Tested for UL-752, Level IV (HPR-30.06 point blank range)

EXTERIOR FINISH:

- Walls: Washed exposed aggregate and sealed, Brown
- Roof: Trowel surface and sealed, broom finish

INTERIOR FINISH:

- Floor: Covered with 1/8" x 12" x 12" white commercial tile and a 4" base cove
- Interior Walls: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)
- Ceiling: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)

INSULATION:

- Exterior Walls: R-11 Rigid Polyisocyanurate Insulation
- Ceiling: R-19 Rigid Polyisocyanurate Insulation



DOORS:

- Quantity/Size: (1) 3'-0" x 7'-0"
- Door Type: 18 ga. Insulated metal door, painted to match exterior finish
- Frame Type: 16 ga. Painted galvanized metal frame
- Lockset: Best brand deadbolt with cylinder, passage lever set (Class 1)
- Hinges: NRP-SS hinges
- Weather Strip: Magnetic weather stripping
- Threshold: Saddle type threshold, mill finish aluminum
- Door Sweep: Neoprene style, mill finish aluminum
- Anti-pick Plate: Latch Guard or equal
- Closer : Hydraulic door closer with hold-open
- Drip Cap: Drip cap, mill finish aluminum

VENTILATION / HEATING:

- Exhaust Fan: 12" Exhaust Fan with Damper and Exterior Weather hood
- Intake Damper: 16" Intake Damper with Motorized Damper and Exterior Weather Hood
- Thermostat: High/Low Temp Thermostat
- Heater: Baseboard or Unit Heater

ELECTRICAL:

- Service: 120/240V single phase
- Panel: (1) 200 Amp Panel with main breaker
- Receptacles: (4) 120V 20A Duplex, Leviton CR20-I
- Note: All electrical conduits to be galvanized EMT and fittings to be compression type. No set screw type permitted. Horizontal runs of EMT to be installed 7'-6" aff whenever possible. All flex conduit to be seal tight type. Wire-way, conduit and/or drop box will be properly de-rated for compliance with current adopted edition of NEC code.

LIGHTING:

- Interior: (4) 4 ft., 2 bulb LED light fixtures
- Exterior: (1) 12W LED Wall Pack with Photocell
- Emergency: (1) Dual Head Emergency Light (Battery Operated)
- Wall Switch: (2) 20A Double switch

GROUNDING:

- One (1) 4" x 20" master ground bar
- #2 Lineup feeders with #6 taps to Racks

CABLE LADDER:

- (A/R) 12" wide x 1.5" high Cable Ladder, Gold Chromate

FIBER EQUIPMENT:



- (A/R) Horizontal Fiber Guide/Trough, Commscope, Yellow
- (3) Fiber Frames, Clearfield FXDS 7ftx19in frame, 2 doors, 2 interbay, No spools
- (6) Bulkhead Lit, FXDS 576 PON
- (12) Tie Kit, FXDS 12 SCA Trimmed to cassette height
- (10) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Left Exit
- (10) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Right Exit
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC SC/APC, Left Exit
- (4) Fiber Entrance Cabinets, 288 Single Single/ 1152 Mass Fusion
- (48) Splice Tray 24HSF/96MF
- (99) 1x32 Splitter with Yellow 2MM Riser Rated Bend Insensitive Fiber Terminated with SC/APC
- (650) 3 Meter SC-SC Jumpers
- (650) 5 Meter SC-SC Jumpers

MISCELLANEOUS:

- One (1) Alarm Package - Smoke, High/Low Temperature, Door Contact
 - Dry contact relays wired to 66 punch down block
- One (1) First Aid Kit, #4EY88
- One (1) Fire Extinguisher, 10 lb. C02, #4T889
- One (1) Telco Board, 4' x 4' plywood painted white
- One (1) Wall pocket for storage of documentation
- One (1) Complete set of construction drawings



10.4 Appendix D: Bill of Materials - Medway FDH

STRUCTURE DESIGN LOADS:

- Floor Load: 250 psf
- Roof Load: 100 psf
- Walls: 150 mph

BUILDING SIZE:

- Outside (Nominal): 10'-0" W x 16'-0" L x 10'-6" H
- Outside (Overall): 10'-6" W x 17'-6" x 10'-6" H
- Equipment Room: 9'-0" W x 15'-0" L x 9'-0" H (Nominal)
- Estimated Module Weight: 45,000 lbs.

SHELL:

- Floor: 5 3/4" Solid concrete floor
- Walls: 4" Solid concrete
- Roof: Solid concrete 4" at eave and 5 1/2" at ridge
- Design: Step-joint design
- Tie down: (4) Tie down plates
- Bolts: Painted bolts to replace lifting lugs
- Concrete: 5000 psi lightweight concrete
- Reinforcing: Steel #4 and #6 bars, 60,000 psi (Grade 60 ASTM-615)
- Ratings: Walls to 2 hour fire rated
- Ballistics: Tested for UL-752, Level IV (HPR-30.06 point blank range)

EXTERIOR FINISH:

- Walls: Washed exposed aggregate and sealed, Brown
- Roof: Trowel surface and sealed, broom finish

INTERIOR FINISH:

- Floor: Covered with 1/8" x 12" x 12" white commercial tile and a 4" base cove
- Interior Walls: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)
- Ceiling: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)

INSULATION:

- Exterior Walls: R-11 Rigid Polyisocyanurate Insulation
- Ceiling: R-19 Rigid Polyisocyanurate Insulation



DOORS:

- Quantity/Size: (1) 3'-0" x 7'-0"
- Door Type: 18 ga. Insulated metal door, painted to match exterior finish
- Frame Type: 16 ga. Painted galvanized metal frame
- Lockset: Best brand deadbolt with cylinder, passage lever set (Class 1)
- Hinges: NRP-SS hinges
- Weather Strip: Magnetic weather stripping
- Threshold: Saddle type threshold, mill finish aluminum
- Door Sweep: Neoprene style, mill finish aluminum
- Anti-pick Plate: Latch Guard or equal
- Closer : Hydraulic door closer with hold-open
- Drip Cap: Drip cap, mill finish aluminum

VENTILATION / HEATING:

- Exhaust Fan: 12" Exhaust Fan with Damper and Exterior Weather hood
- Intake Damper: 16" Intake Damper with Motorized Damper and Exterior Weather Hood
- Thermostat: High/Low Temp Thermostat
- Heater: Baseboard or Unit Heater

ELECTRICAL:

- Service: 120/240V single phase
- Panel: (1) 200 Amp Panel with main breaker
- Receptacles: (4) 120V 20A Duplex, Leviton CR20-I
- Note: All electrical conduits to be galvanized EMT and fittings to be compression type. No set screw type permitted. Horizontal runs of EMT to be installed 7'-6" aff whenever possible. All flex conduit to be seal tight type. Wire-way, conduit and/or drop box will be properly de-rated for compliance with current adopted edition of NEC code.

LIGHTING:

- Interior: (4) 4 ft., 2 bulb LED light fixtures
- Exterior: (1) 12W LED Wall Pack with Photocell
- Emergency: (1) Dual Head Emergency Light (Battery Operated)
- Wall Switch: (2) 20A Double switch

GROUNDING:

- One (1) 4" x 20" master ground bar
- #2 Lineup feeders with #6 taps to Racks

CABLE LADDER:

- (A/R) 12" wide x 1.5" high Cable Ladder, Gold Chromate

FIBER EQUIPMENT:



- (A/R) Horizontal Fiber Guide/Trough, Commscope, Yellow
- (1) Fiber Frame, Clearfield FXDS 7ftx19in frame, 2 doors, 2 interbay, No spools
- (2) Bulkhead Lit, FXDS 576 PON
- (4) Tie Kit, FXDS 12 SCA Trimmed to cassette height
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Left Exit
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Right Exit
- (1) Blue Cassettes, Patch Only 1x120 Fiber, 50ft IFC SC/APC, Left Exit
- (1) Blue Cassettes, Patch Only 1x96 Fiber, 50ft IFC SC/APC, Left Exit
- (4) Fiber Entrance Cabinets, 288 Single Single/ 1152 Mass Fusion
- (36) Splice Tray 24HSF/96MF
- (36) 1x32 Splitter with Yellow 2MM Riser Rated Bend Insensitive Fiber Terminated with SC/APC
- (175) 3 Meter SC-SC Jumpers
- (175) 5 Meter SC-SC Jumpers

MISCELLANEOUS:

- One (1) Alarm Package - Smoke, High/Low Temperature, Door Contact
 - Dry contact relays wired to 66 punch down block
- One (1) First Aid Kit, #4EY88
- One (1) Fire Extinguisher, 10 lb. C02, #4T889
- One (1) Telco Board, 4' x 4' plywood painted white
- One (1) Wall pocket for storage of documentation
- One (1) Complete set of construction drawings



10.5 Appendix E: Bill of Materials - Central Office Structure

STRUCTURE DESIGN LOADS:

- Floor Load: 250 psf
- Roof Load: 100 psf
- Walls: 150 mph

BUILDING SIZE:

- Outside (Nominal): 10'-0" W x 16'-0" L x 10'-6" H
- Outside (Overall): 10'-6" W x 17'-6" x 10'-6" H
- Equipment Room: 9'-0" W x 15'-0" L x 9'-0" H (Nominal)
- Estimated Module Weight: 45,000 lbs.

SHELL:

- Floor: 5 3/4" Solid concrete floor
- Walls: 4" Solid concrete
- Roof: Solid concrete 4" at eave and 5 1/2" at ridge
- Design: Step-joint design
- Tie down: (4) Tie down plates
- Bolts: Painted bolts to replace lifting lugs
- Concrete: 5000 psi lightweight concrete
- Reinforcing: Steel #4 and #6 bars, 60,000 psi (Grade 60 ASTM-615)
- Ratings: Walls to 2 hour fire rated
- Ballistics: Tested for UL-752, Level IV (HPR-30.06 point blank range)

EXTERIOR FINISH:

- Walls: Washed exposed aggregate and sealed, Brown
- Roof: Trowel surface and sealed, broom finish

INTERIOR FINISH:

- Floor: Covered with 1/8" x 12" x 12" white commercial tile and a 4" base cove
- Interior Walls: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)
- Ceiling: 5/8" APA Rated OSB covered with white embossed fiberglass reinforced plastic (FRP)

INSULATION:

- Exterior Walls: R-11 Rigid Polyisocyanurate Insulation
- Ceiling: R-19 Rigid Polyisocyanurate Insulation



DOORS:

- Quantity/Size: (1) 3'-0" x 7'-0"
- Door Type: 18 ga. Insulated metal door, painted to match exterior finish
- Frame Type: 16 ga. Painted galvanized metal frame
- Lockset: Best brand deadbolt with cylinder, passage lever set (Class 1)
- Hinges: NRP-SS hinges
- Weather Strip: Magnetic weather stripping
- Threshold: Saddle type threshold, mill finish aluminum
- Door Sweep: Neoprene style, mill finish aluminum
- Anti-pick Plate: Latch Guard or equal
- Closer : Hydraulic door closer with hold-open
- Drip Cap: Drip cap, mill finish aluminum

AIR CONDITIONING/HEATING:

- Quantity: 1
- Type: Wall Mount Unit, BARD
- Model Number: 230/208V 1-phase 2 Ton unit with integrated 5kW heat strips, time delay anti-short cycle timer, high and low pressure switch, low ambient control, and a one year parts and labor guarantee
- Temp. Control: Digital Auto-Changeover Thermostat

ELECTRICAL:

- Service: 120/240V single phase
- Generator Receptacle: Appleton AJA20034-200RS
- Manual Transfer Switch: Double Pole Double Throw Switch, Ronk 7215
- Auto Transfer Switch: 200A, 2 Pole 120/240V single phase, 2-Wire Start, Nema 1 Enclosure
- Surge Suppression: Type 1 MOV, Raycap B82XPR
Type 2 MOV, Raycap B82XRR
- Panel: (1) 200 Amp Panel with main breaker
- Receptacles: (4) 120V 20A Duplex, Leviton CR20-I
(4) 120V 20A Twist-locks
- GFCI Receptacle: (1) Weatherproof GFCI receptacle on own circuit, mounted in the vicinity of the HVAC unit
- Note: All electrical conduits to be galvanized EMT and fittings to be compression type. No set screw type permitted. Horizontal runs of EMT to be installed 7'-6" aff whenever possible. All flex conduit to be seal tight type. Wire-way, conduit and/or drop box will be properly de-rated for compliance with current adopted edition of NEC code.

LIGHTING:

- Interior: (4) 4 ft., 2 bulb LED light fixtures
- Exterior: (1) 12W LED Wall Pack with Photocell



- Emergency: (1) Dual Head Emergency Light (Battery Operated)
- Wall Switch: (2) 20A Double switch

GROUNDING:

- One (1) 4" x 20" master ground bar
- #2 Lineup feeders with #6 taps to relay racks
- Dedicated grounds to DC plant positive bar

CABLE LADDER:

- (A/R) 12" wide x 1.5" high Cable Ladder, Gold Chromate

FIBER EQUIPMENT:

- (A/R) Horizontal Fiber Guide/Trough, Commscope, Yellow
- (A/R) Vertical Fiber Management between Fiber Frames
- (A/R) Vertical Fiber Management for OLT Rack
- (2) Fiber Frames, Clearfield FXDS 7ftx19in frame, 2 doors, 2 interbay, No spools
- (3) Bulkhead Lit, FXDS 576 PON
- (6) Tie Kit, FXDS 12 SCA Trimmed to cassette height
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Left Exit
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC Ribbon SC/APC, Right Exit
- (3) Blue Cassettes, Patch Only 1x144 Fiber, 50ft IFC SC/APC, Left Exit
- (4) Fiber Entrance Cabinets, 288 Single Single/ 1152 Mass Fusion
- (36) Splice Tray 24HSF/96MF
- (38) 1x32 Splitter with Yellow 2MM Riser Rated Bend Insensitive Fiber Terminated with SC/APC
- (1) Blue Cassettes, Patch Only 1x144 Fiber, 50ft, IFC SC/APC, Right Exit
- (2) Blue Cassettes, Patch Only 1x144 Fiber, 50ft, IFC SC/APC, Left Exit
- (1) Blue Cassettes, Patch Only 1x120 Fiber, 50ft IFC SC/APC, Left Exit
- (1) Blue Cassettes, Patch Only 1x48 Fiber, 50ft IFC SC/APC, Right Exit
- (250) 3 Meter SC-SC Jumpers
- (250) 5 Meter SC-SC Jumpers

DC RECTIFIER PLANT

- CC9I-ANN-VC Compact Power Shelf/ Rear wire, 200amp max
- 48V Negative output polarity
- 23" Rack / 2 RU / Mid mount / System Depth 15"
- Individual AC Input (LL AC Cord)
- Four (4) Rectifier positions
- Four (4) Distribution Circuit breaker positions (CBB Style) ¼" 20 Stud 5/8" Center
- Twenty (20) Distribution GMT Fuse positions
- BC20000-A01-10VC 48V, System controller w/Ethernet, next-gen, w/CLEI



- Three (3) V1250A-VC Rectifiers, 1400W, 53.5V, 25A

BATTERIES AND RACK

- Five (5) Strings of 170AH batteries, Enersys SBS170F, 48V, Cabled back to DC Plant
- One (1) (NMI-184) NEBS seismic 5 Tier Rack, prewired 4/0ga, 100Amp 1 Pole Breaker 48Vdc

OLT RACK

- (1) 23" x 7' Relay Rack

FUSE PANELS

- (2) Telect HPGMT20 fuse panels (in OLT Rack and DC Rectifier Rack)

MISCELLANEOUS:

- One (1) Alarm Package - Smoke, High/Low Temperature, Door Contact
 - Dry contact relays wired to 66 punch down block
- One (1) First Aid Kit, #4EY88
- One (1) Fire Extinguisher, 10 lb. CO2, #4T889
- One (1) Telco Board, 4' x 4' plywood painted white
- One (1) Wall pocket for storage of documentation
- One (1) Complete set of construction drawings



10.6 Appendix F: Bill of Materials - Fiber Termination & Cross-connect

This Bill of Materials is included to provide specific part number for reference only. All parts are included in the Bill of Materials for each prefabricated structure (see Appendix C-E)

Clearfield - Fiber Termination & Cross-connect Bill of Materials			
Location	Part #	Qty	Description
MILLINOCKET	010502-PON INSERT ONLY	3	FXDS FRAME KIT 7FT X 19IN FRAME. 2 DOORS (DUAL) 2 INTERBAY NO SPOOLS.ISO PAD, FLOOR MOUNTING KIT
MILLINOCKET	10263	6	BULKHEAD LIT, FXDS 576 PON
MILLINOCKET	FMA-XXX-64	12	TIE KIT, FXDS 12 SCA TRIMMED TO CASSETTE HEIGHT
MILLINOCKET	EVL-144-C2A-050F	10	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC RIBBON SC/APC, LEFT EXIT
MILLINOCKET	EVR-144-C2A-050F	10	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC RIBBON SC/APC, RIGHT EXIT
MILLINOCKET	EVL-144-C1A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, LEFT EXIT
MILLINOCKET	9894	4	FIBER ENTERANCE CABINET 288 SINGLE SINGLE/ 1152 MASS FUSION
MILLINOCKET	19339	48	SPLICE TRAY 24HSF/96MF
MILLINOCKET	KYA-CAA	99	1X32 SPLITTER WITH YELLOW 2MM RISER RATED BEND INSENSITIVE FIBER TERMINATED WITH SC/APC
EAST MILLINOCKET CO	010502-PON INSERT ONLY	2	FXDS FRAME KIT 7FT X 19IN FRAME. 2 DOORS (DUAL) 2 INTERBAY NO SPOOLS.ISO PAD, FLOOR MOUNTING KIT
EAST MILLINOCKET CO	10263	3	BULKHEAD LIT, FXDS 576 PON
EAST MILLINOCKET CO	FMA-XXX-64	6	TIE KIT, FXDS 12 SCA TRIMMED TO CASSETTE HEIGHT
EAST MILLINOCKET CO	EVL-144-C2A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC RIBBON SC/APC, LEFT EXIT
EAST MILLINOCKET CO	EVR-144-C2A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC RIBBON SC/APC, RIGHT EXIT
EAST MILLINOCKET CO	EVL-144-C1A-050F	3	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, LEFT EXIT
EAST MILLINOCKET CO	9894	4	FIBER ENTERANCE CABINET 288 SINGLE SINGLE/ 1152 MASS FUSION
EAST MILLINOCKET CO	19339	36	SPLICE TRAY 24HSF/96MF
EAST MILLINOCKET CO	KYA-CAA	38	1X32 SPLITTER WITH YELLOW 2MM RISER RATED BEND INSENSITIVE FIBER TERMINATED WITH SC/APC
EAST MILLINOCKET CO	EVR-144-C1A-050F	1	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, RIGHT EXIT
EAST MILLINOCKET CO	EVL-144-C1A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, RIGHT EXIT
EAST MILLINOCKET CO	EVL-120-C1A-050F	1	BLUE CASSETTES, PATCH ONLY 1X120 FIBER, 50FT IFC SC/APC, LEFT EXIT
EAST MILLINOCKET CO	EVR-048-C1A-050F	1	BLUE CASSETTES, PATCH ONLY 1X120 FIBER, 50FT IFC SC/APC, LEFT EXIT
MEDWAY FDH	010502-PON INSERT ONLY	1	FXDS FRAME KIT 7FT X 19IN FRAME. 2 DOORS (DUAL) 2 INTERBAY NO SPOOLS.ISO PAD, FLOOR MOUNTING KIT
MEDWAY FDH	10263	2	BULKHEAD LIT, FXDS 576 PON
MEDWAY FDH	FMA-XXX-64	4	TIE KIT, FXDS 12 SCA TRIMMED TO CASSETTE HEIGHT
MEDWAY FDH	EVL-144-C1A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, LEFT EXIT
MEDWAY FDH	EVR-144-C1A-050F	2	BLUE CASSETTES, PATCH ONLY 1X144 FIBER, 50FT IFC SC/APC, RIGHT EXIT
MEDWAY FDH	EVL-120-C1A-050F	1	BLUE CASSETTES, PATCH ONLY 1X120 FIBER, 50FT IFC SC/APC, LEFT EXIT
MEDWAY FDH	EVL-096-C1A-050F	1	BLUE CASSETTES, PATCH ONLY 1X96 FIBER, 50FT IFC SC/APC, LEFT EXIT
MEDWAY FDH	9894	3	FIBER ENTERANCE CABINET 288 SINGLE SINGLE/ 1152 MASS FUSION
MEDWAY FDH	19339	36	SPLICE TRAY 24HSF/96MF
MEDWAY FDH	KYA-CAA	36	1X32 SPLITTER WITH YELLOW 2MM RISER RATED BEND INSENSITIVE FIBER TERMINATED WITH SC/APC



10.7 Appendix G: Bill of Materials - GPON Equipment

Marketshare			Adtran TA5000 Multi Service Access Platform - Bill of Materials			
40%	50%	60%				
QTY	QTY	QTY	MODEL	PART NUMBER	DESCRIPTION	
1	1	1	TA5000 2xSM41 SMIO4 BRG HF	41875K4011F2HF	TA 5000 Bundle consisting of one 9 RU chassis (1187001F2), one high-flow rear fan (1187080G3), one filter (1187081G1), and one SMIO4 (1187055F1). This bundle also includes one SCM (1187011F3), two 4x10GE Switch Modules (1187041F1), and one Fiber Manager (1187940G1). This bundle also includes one single-wide Access Module front blank (1187921E1), ten double-wide Access Module front blanks (1187922E1), ten double-wide Access Module Input/Output rear blanks (1187923G1), and one single-wide Access Module Input/Output rear blank (1187925G1).	
7	8	10	TA 5000 GPON OLT 8X SFP BUNDLE (GEN 1)	4187503G1	TA 5000 GPON OLT Bundle that includes one 8-port GPON OLT (1187503F1) and eight 30km GPON B+ SFPs (1442530G1). This bundle does not contain the chassis, commons, etc.	
Uplink Optics choose 2 of one type						
2	2	2	SFP+ 10G 1310NM SMF 10KM	1442410G1	The 1310NM 10Gbps SFP+ is a 10 Gigabit Ethernet "Small Form Factor Pluggable" that operates on the 1310NM wavelength. It operates on single mode fiber and uses LC fiber connectors. It has a maximum range of 10 KM.	
0	0	0	SFP+ 10G 1310NM SMF 20KM	1442420G1	The 1310NM 10Gbps SFP+ is a 10 Gigabit Ethernet "Small Form Factor Pluggable" that operates on the 1310NM wavelength. It operates on single mode fiber and uses LC fiber connectors. It has a maximum range of 20 KM.	
0	0	0	SFP+ 11.3G 1550NM SMF 40KM	1442440F1	SFP+ 11.3G 40km 1550nm	
ONT incl Voice and 1Gig Ethernet						
1621	2026	2431	TA 411 Micro ONT SFU	1287787F1	Total Access 411 Micro ONT includes 1-10/100/1000 and 1-POTS port. - Dual mode GPON/AE support. For UPS use P/N 1287405F1.	
1621	2026	2431	401/411 ONT FIBER TRAY	1287410F1	The 401/411 Micro ONT Fiber Tray and Wall Mounting Bracket is used for 401 GigE Micro ONT (11321713F1) or 411 POTS + 1 GigE Micro ONT (1287787F1) and to store excess incoming fiber	
1621	2026	2431	Micro ONT UPS	1287406F1	Micro ONT LI-ION UPS for the TA 301, 311, 401, 411.	



11 Attachments – Construction Plans

- 11.1 Attachment 1: Millinocket_Strand_Map.pdf
- 11.2 Attachment 2: Millinocket_Backbone_Lateral_Map.pdf
- 11.3 Attachment 3: Millinocket_Drop_Map.pdf
- 11.4 Attachment 4: East_Millinocket_Strand_Map.pdf
- 11.5 Attachment 5: East_Millinocket_Backbone_Lateral_Map.pdf
- 11.6 Attachment 6: East_Millinocket_Drop_Map.pdf
- 11.7 Attachment 7: Medway_Strand_Map.pdf
- 11.8 Attachment 8: Medway_Backbone_Lateral_Map.pdf
- 11.9 Attachment 9: Medway_Drop_Map.pdf
- 11.10 Attachment 10: Central_Office_Site_Development_Plans.pdf