Revised Terms of Reference
Fiber optic cabling installation
& Campus Wide Wi-Fi connection for PLM network rehabilitation

I. BACKGROUND

The Pamantasan ng Lungsod ng Maynila (PLM) wants to establish Network Infrastructure facilities that enhanced network operations and integrated its voice & data communication. For many years, said facility has not continuously update and advanced the agency's information processing capability. However, this legacy communication infrastructure which lasted for many years was already outmoded and no longer suffices to the current data transmission requirements and overall network operations of the Agency.

To respond to this, PLM has embarked on the acquisition of a new and responsive Fiber optic cabling infrastructure which will replace the old legacy system. Likewise, it is also imperative for PLM to renovate and attune its existing Data Center which will house the active equipment adhering with the new connectivity standards and best practices. This will also ensure reliability and improve longevity of the network, all its servers and attached devices and network equipment.

Hence, the project for the Fiber Optic Cabling installation and Network Devices for PLM Network Rehabilitation for the Pamantasan ng Lungsod ng Maynila has to be carried out.

II. OBJECTIVE

The Project aims to enhance PLM network cabling infrastructure in both wired and wireless technology and to renovate the existing PLM Data Center to align with its new requirements. The structured cabling system and data center shall:

- Provide user friendly environment with efficient, open to performance upgrade/future expansion and can accommodate efficiently all data transmission service to the workstations;

- Ensure seamless connectivity and real time exchange of information;

- Meet cabling standards and local construction and telecommunications regulations;

- Easy detection/troubleshooting of defective parts; Ensure provision of As Built Structured System Plan/working drawing and printed Test Results.

- Ensure compatibility and allow open design for Wireless Technology (Wi-Fi) access point in the entire Campus.

Data Center

- Meet the current standard architectural and structural components of the Data Center.

- Meet PLM's standard facilities requirements (electrical, mechanical and ICT standards)

- Ensure adequate environment with adherence to globaly recognized best practices and standards.

- Provision of standard plans (as proposed and as built), schematic diagram/designs, layout, working drawings and technical specifications, project Gantt chart, and test results as part of the documentation in hard and e-copy.

The engagement shall also meet the required technical training/briefing for the operations, troubleshooting and maintenance of structured cabling on the safety rules and management of Data Center within 120 calendar days from receipt of the Notice to Proceed, under the duration of Project implementation.

III. QUALIFICATION REQUIREMENTS

a.) The Contractor shall be involved in System Integration and shall have at least 10 years' experience in undertaking similar project. Must attach proof.

b.) The Contractor must have at least Three (3) Certified Engineers who are currently employed in the contractor's company trained and certified in the design and installation of cabling System. Must attach certification.

c.) The Contractor must have Certified Technical Professional for the Network switches offered. Must attach certification. (Vendor-neutral)

d.) The Contractor must have its own test equipment necessary for the commissioning of this Project. Must attach proof of ownership.

e.) Other documentary requirements to be submitted by bidder:

1.) Letter from the Cabling System Manufacturer that it manufactures end-to-end structured cabling system copper and fiber optic cables and their associated connecting hardware which will be used for the Project.

2.) Certification from Manufacturer's main/regional office stating that the contractor is an Authorized Business Partner and Certified Installer of the Brand being offered (switches and cabling). (Purpose for this).

3.) Letter of Warranty from Cabling System Manufacturer stating that the Structured Cabling installed shall be covers a minimum of 20 to 25 years System Warranty. (Purpose for this).

4.) Certification of After Sales Support for the Network equipment indicating the Support, should include on-line, telephone support, on-call, on-site and replacement if the hardware that is defective is under warranty.

5.) Brochures or Technical Data Sheet or equivalent document for the following items/equipment showing compliance with the required Technical Specifications:

5.1) LAN Switches

5.2) Fiber Cable

5.3) Copper Cable Cat6

5.4) other equipment

6.) Proposed Workplan and Detailed Implementation Schedule for the Project covering the whole period. Prospective Bidders are required to conduct site

inspection. This is to ensure the reliability, security and efficiency of the required services that the contractor shall perform. Timeframe should be specified for each activity to be done and shall include Gantt Chart Summary.

7.) Documentation (for both components)

- Proposed Cabling Plan for Structured Cabling and Data Center
- Final Cabling Plan As Built Plan with Line Diagram
- Final Network/Structured Cabling Diagram
- Structured Cabling for MDF/IDF and Backbones to Individual Offices.

g.) The Contractor shall complete the delivery and installation of work within One Hundred Twenty (120) calendar days from the date of receipt of NTP. An official project kickoff shall be called by the assigned Project Manager for the contractor to present how it intends to implement the project. The project kickoff shall be done five days after receipt of the NTP.

h.) The PLM shall meet, orient and coordinate with the winning contractor its rules and regulations during the actual implementation of the Contract.

The completion schedule provided shall be considered extended under the following:

- Delays caused by force majeure or forfeitous events;
- In all cases, the period or number of days of extension shall be agreed upon with the Pamantasan ng Lungsod ng Maynila in writing;
- Claims for time extension of the contract period due to force majeure shall be subject to approval by the Pamantasan ng Lungsod ng Maynila.

Force majeure includes events such as Earthquake, Flood, Typhoon, Cyclone, Revolution, War and other cataclysmic phenomena of nature and misfortune which are beyond human prudence and foresight.

i.) The specifications provided therein are minimum requirements and the bidders may be considered to bid for higher specifications as long as it will fit on the required ABC.

j.) The Contractor shall guarantee that the entire structured cabling and networks are free from all defective workmanship and materials, and will remain so for the period of:

j.1) 20-25 Years of Product Warranty from the Cabling Manufacturer of the Product Offered.

j.2) Three (3) years against failure of components - Network Devices

j.3) Minimum One (1) Year Warranty on Workmanship

PLM shall not be responsible for lack of excess materials and equipment to be supplied by the winning Bidder. It shall be the sole responsibility of the winning bidder to assess and re-assess the Materials to be supplied to the Agency and shall be PLM's property.

PART 1: SCOPE OF WORK

1.01 GENERAL

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

1. Installation, splicing, termination, testing, labeling and documentation of new inter building fiber optic communication cabling between buildings and backbones to wall mounted Access Switches in individual offices as specified and on the drawings.

2. The installation environment, subject to PLM's concurrence, could include tie in and coordination with existing and new optical fiber and copper facilities, underground duct banks, direct-buried conduit, utility tunnel pathways.

3. The Contractor shall be responsible for: placement of cable, installation and attachment of cable to support devices within the utility tunnel system, underground structures, and pole lines, the placement of conduit, the installation of pull-boxes, the furnishings of fiber optic splice closures, and installation of termination hardware, and others as necessary to the completion of the Project or as specified by PLM.

4. The Contractor shall be responsible for providing and installing grounding and bonding materials, duct plugs, and fire stopping materials as required in completing the installation.

5. Other incidental hardware and appliances, necessary for the proper performance and operation of the communication cable system, which are consistent with the practices of cable installation, are to be provided by the Contractor as required to complete the installation.

6. Contractor is responsible to ensure that utility locating has been performed as per the requirements. The Contractor is responsible for any and all damages to any utility caused during construction. In any area where a utility has been located, work activity must be verified through pot holing.

7. Contactor shall install the Rack mounted network Cabinet and Core Switch in Data Center.

8. Contractor shall install the Wall mounted network cabinets and Fiber patch panels on IDFs.

B. The Contractor shall complete all work and turn over a completed and standards compliant optical fiber cabling system to meet the PLM network installation system. The scheduled date for completion and commissioning of optical fiber cabling and associated copper and wireless systems shall incorporate the activation dates for services need to activate all networked services including voice, data, and special systems needed for a Certificate of Occupancy, the testing and operation of Building Monitoring Systems, and Electronic Safety and Security Systems.

1.02 RELATED SECTIONS & REFERENCES

A. The Contractor is held responsible to be knowledgeable with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The Contractor is held responsible and is assumed to possess the working knowledge, manpower, and supplies/materials applicable to the completion of the installation and commissioning as specified in all specifications within the PLM standards specifications and in particular the following:

- Optical Fiber Horizontal
- Grounding and Bonding for Communication Systems.
- Cabinets, Racks, Frames, and Enclosures.
- Termination Blocks and Patch Panels.
- Cable Management.
- Copper Backbone Cabling.
- Optical Fiber Backbone Cabling
- Copper Horizontal Cabling.
- Copper Backbone Cat6 Cabling From IDF to Individual Offices.
- Commissioning, Testing and Acceptance
- Data switches for IDF cabinet per building
- Core switches for Data Center
- 10G SM FOC backbone from MDF to IDF

1.03 QUALITY ASSURANCE

A. PLM will inspect installation in progress. It is the responsibility of the Contractor to schedule regular and milestone inspection times with PLM. It is incumbent upon the Contractor to verify that the installation and material used has been inspected by PLM before it is enclosed within building features, buried, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.

B. The Contractor will provide electronic test results and a 20-year manufacturer's warranty with a copy of the warranty to be submitted to PLM at the completion of work.

1.04 OPTICAL FIBER BACKBONE SYSTEM DESCRIPTION

A. The main Equipment Room (ER) and each Telecommunications Room (TR) shall house both voice and data backbone cabling and active equipment to support networking requirements. The ER in most cases shall be the main point of entry for outside services as well as main distribution point for all backbone cabling. Fiber optic backbone cable shall be employed between the ER and each TR for voice, data and special systems connectivity.

B. Optical fiber inter-building cabling systems vary depending upon system design, but a 6-fiber SMF cable for large buildings and a 6-fiber SMF cable for medium size building is typical. The size of intra building optical fiber cables is typically 6-core SMF cable.

C. Optical Fibers in the backbone shall be terminated using a pigtailed assembly that have incorporated into those assemblies a LC connector that is fusion spliced to the backbone optical fibers, unless otherwise specified and approved by PLM; housed in rack-mount fiber optic enclosures with cable supports.

D. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors and fibers of each installed cable shall be verified useable prior to system acceptance. Any defect in the cabling system installation including, but not limited to, cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced at the contractor's expense in order to ensure 100% useable conductors in all installed cables.

PART 2: PRODUCTS (Core, Distribution and Access switches)

CORE SWITCH (MDF) - Advanced Layer 3 switch series with backplane, stacking, Tunnel Node, low latency and resiliency. Supports Multivendor Security and network management tools and AAA Policy Appliance. Modular line rate 10GbE and 40GbE ports for wireless aggregation. Optimized for innovative SDN applications with OpenFlow support redundant, hot-swappable power supplies and innovative backplane stacking technology delivers resiliency and scalability in a convenient 1U form factor. Advanced Layer 2 and 3 feature set with OSPF, IPv6, IPv4 BGP, Tunnel node, robust QoS, and policy based routing are included with no software licensing. Virtual Router Redundancy Protocol (VRRP) allows groups of two routers to back each other up dynamically to create highly available routed environments in IPv4 and IPv6 networks Nonstop switching and routing improves network availability to better support critical applications, such as unified communication and mobility; traffic will continue to be forwarded during failovers, when the backup member of the stack becomes the commander.

High-performance stacking provides up to 336 Gbps of stacking throughput; each 4-port stacking module can support up to 42 Gbps in each direction per stacking port-Ring, chain, and mesh topologies support up to a 10-member ring or chain and 5-member fully meshed stacks; meshed topologies offer increased resiliency vs. a

standard ring- Virtualized switching provides simplified management as the switches appear as a single chassis when stacked. Can support stacking up to 10 switches.

Warranty and support:

- 5 Years Renewable Warranty
- No add-on licensing- no additional costs for advance routing, switching and VOIP features. Full blown in a box by default
- Firmware are downloadable.
- SDN Ready Open flow 1.3 built-in
- No lock-in proprietary features
- Industry Standard features to support full interoperability multivendor environment

- DISTRIBUTION SWITCH (IDF) - Advanced High Performance stacking—up to 100 Gbps of stacking throughput per switch. Each 2-port stacking module can support up to 25 Gbps in each direction per port. Ring topology—Supports up to 10 member stack- Virtualized Switching Provides simplified management as the switches act as a single chassis when stacked .Virtual Router Redundancy Protocol (VRRP) allows groups of two routers to back each other up dynamically to create highly available routed environments in IPV4 and IPV6 networks .SmartLink provides easy-to-configure link redundancy of active and standby links. Dual Hot Swappable Power Supplies- Increased Resiliency provides secondary power supply to enable complete switch power redundancy in case or power line or supply failure- Increased PoE+ Power provides secondary power supply to increase the total available PoE+ power. Rapid Per-VLAN Spanning Tree (RPVST+) allows each VLAN to build a separate spanning tree to improve link bandwidth usage or equivalent; is compatible with PVST+• GVRP and MVRP allows automatic learning and dynamic assignment of VLANs• VxLAN encapsulation (tunnelling) protocol for overlay network that enables a more scalable virtual network deployment. Static IP routing provides manually configured routing; includes ECMP capability• Routing Information Protocol (RIP) provides RIPv1, RIPv2, and RIPng routing• Access OSPF provides OSPFv2 and OSPFv3 protocols for routing between access and the next layer on the LAN. One OSPF area and up to eight interfaces are supported.• Policy-based routing uses a classifier to select traffic that can be forwarded based on policy set by the network administrator (limited to 16 next-hop routes)

Warranty and support:

- 5 Years Renewable Warranty
- Can Support Zero Touch Provisioning
- Can support up to 10 member stack

- ACCESS SWITCH (Offices) - automatically configures switch for different settings such as VLAN and COS. Defines a set of switch-based policies in areas such as security, authentication, and QoS. A user role can be assigned to a group of users or devices, using local switch configuration allows real-time traffic classification with support for eight priority levels mapped to either two or four queues, and uses weighted deficit round robin (WDRR) or strict priority supports both cloud-based SaaS and on-premise NMS with the same hardware ensuring change management platform without ripping and replacing switching infrastructure provides single IP address management for up to 16 switches. Delivers wire-speed traffic accounting and monitoring, configured by SNMP and CLI with three terminal encrypted receivers. Automates device discovery protocol for easy mapping by network management applications. Provides advanced monitoring and reporting capabilities for statistics, history, alarms, and events. Finds and fixes common network problems automatically, and then informs the administrator. Provides independent primary and secondary operating system files for backup while upgrading. Adds the option to specify the location of switch software via DHCP enables zero-touch configuration for switches uses settings in DHCP to enable ZTP. allows automatic learning and dynamic assignment of VLANs supports up to 9,220-byte frame size to improve the performance of large data transfers; 8- and 24-port Fast Ethernet models automatically support up to 2,000-byte frames with no configuration needed. Prevents particular configured MAC addresses from connecting to the network. Protects the root bridge from malicious attacks or configuration mistakes. Offers intuitive CLI to configure the source-port filter feature, by allowing specified ports to be isolated from all other ports on the switch; the protected port or ports can communicate only with the uplink or shared resources. Blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks. Blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data. Works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing. Allows non-chatty legacy devices to stay authenticated by pinning client MAC addresses to the port until the client's logoff or get disconnected. Defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones. Receives and recognizes CDP packets from Cisco's IP phones for seamless interoperation. Provides easy-to-configure link redundancy of active and standby links Provides a highly integrated, high-performance switch design with a non-blocking architecture. Performance features such as 4 queues QoS, 2x switching capacity and sFlow. Security features such as port and VLAN-based ACLs for more granular security policies.

Warranty and support:

- 256MB flash memory
- 16k MAC addresses.
- Has 2 Gigabit ports for backbone connection
- 5 Years Renewable Warranty

- Wireless Aps – dual band 2.4GHz standards 802.11b/g/n and 5GHz a/x capable, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 ethernet ports, POE port in, signal range of 50meters.

  Warranty and support:

    - 5 Years Renewable Warranty

- FIBER MODULES - 10GBASE-LR SFP Module; supports a link length of 10 kilometers on standard single-mode fiber (SMF, G.652)

  Warranty and support:

    - 5 Years Renewable Warranty

- Wireless AP Controller – Can manage up to at least 256 APs, 2 Gigabit Ethernet interfaces, 2 SFP modules, 2 Transceivers, minimum throughput of 12Gbps.

  Warranty and support:

    - 5 Years Renewable Warranty

2.01 GENERAL

A. The materials and products will reflect the minimum acceptable standards of fabrication and manufacture.

B. All materials and products supplied by the Contractor are to be new, unused, of first quality and in original packaging or shipping containers.

C. Provide materials as approved by PLM.

D. Match optical fiber glass for tie in to existing optical fibers.

2.02 SUBSTITUTIONS

A. Product substitutions are discouraged and may only be resorted to under highly extenuating circumstances. Such shall be managed according to the following guidelines:

  1. All substitutions shall be submitted to and approved by PLM.

  2. Acceptance of substitutions is at PLM's discretion. PLM reserves the right to determine suitability of the substitute product and reject any and all materials submitted for substitution. Submit requests for substitutions in writing to PLM for approval within 14 days of contract award, or sooner if required, to maintain the implementation schedule.

  3. Products rejected or otherwise judged unsatisfactory by PLM will not be authorized for use in completing the work. Any unapproved products discovered as part of the installation will be removed and replaced with UNM IT specified and approved products at the Contractor's expense.

4. Project Drawings may be based on equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the Pamantasan ng Lungson ng Maynila (PLM), including work under other divisions.

2.03 OUTSIDE PLANT FIBER OPTIC CABLE

A. General:

1. Single mode fiber is the standard optical fiber media for backbone installations and optical fibers shall be low water-peak, laser optimized, suitable for CWDM use and complies with the ITU G.562.c/d. standard.

2. The cable types listed herein have been selected based on the typical environments and applications. It is the Contractor's responsibility to verify and submit an RFI on cables specified within that do not meet code or the environmental requirements of the project, environmental or code requirements of the installation before purchasing or providing.

3. When splicing into existing optical fibers the Contractor is to ensure the matching of optical fiber glass to the new and existing fibers and install the same glass type and manufacturer to prevent optical fiber mismatch.

4. Single Mode Optical Fiber Specification

    a. Optical Characteristics – Single-mode fiber optic cable 8.3µm/125µm single-mode low water peak optical fibers.

    b. Attenuation: 0.35dB/km @ 1310 nm; 0.25dB/km @ 1550 nm

5. Mechanical Construction – Armored fiber optic cable for direct-buried and conduit installation. Construction shall include: locatable central strength member or an IT approved equivalent, water swell-able yarn, buffer tubes/fibers, water swell-able tape, ripcord, polyethylene inner jacket, high tensile strength, corrugated steel tape armor (for direct buried applications), Polyethylene outer jacket, UV- stabilized jacket or equivalent. Install interlock optical fiber when specified by UNM IT.

6. Install orange interlock optical fiber for building backbone distribution.

7. Provide optical fiber color codes in compliance with Color TIA/EIA 527-7 and 14.

8. Cable shall be assembled to ensure that no more than 12 fiber strands occupy each buffer tube of like fiber strands

2.04 FIBER OPTIC CONNECTORS

A. Provide for all new fiber optic installations with fusion spliced LC pig tail connectors. The connectors shall be manufactured by the cabling system manufacturer and composed of the same optical fiber glass as used in the optical fiber cable specified by the project.

B. When adding to or modifying existing work coordinate connector type with PLM.

C. Multimode connectors, when specified shall be LC pigtailed connectors. They shall all be fusion spliced unless otherwise specified by PLM.

D. Use PLM approved color code (no exceptions) for coupler panels as follows:

    1. 62.5um couplers – Beige
    2. 50um couplers – Aqua
    3. SM couplers – Blue

2.05 FIBER OPTIC ENCLOSURES

A. Wall mounted 2FT enclosures and Fiber optic enclosure, shall be approved by PLM prior to system design and installation. RFI submittal is required. The enclosure shall be equipped for a fusion spliced pigtail connector installation.

B. Provide wire management approved by PLM to equipment and interconnection enclosures.

C. Rack Mount enclosures shall be approved by PLM prior to system design and installation. RFI submittal is required. The enclosure shall be equipped for pigtail connector splicing and installation.

D. Provide one 1RU wire manager, installed per rack at the top and one 1RU wire manager installed in the middle of the rack coordinated with the FDU installation to provide a crossover pathway for optical fiber jumpers.

E. Provide blank 1RU panel install below the top wire manager.

2.06 OPTICAL FIBER SPLICE CLOSURES

A. All splice closures shall be approved by PLM prior to installation. An RF submittal to PLM is required for all optical fiber splice closures.

B. Provide splice enclosures that are rated for the environment they are to be installed. All closures shall be pressure tested. No encapsulate shall be used on fiber enclosures.

C. Provide Preformed Coyote Fiber Optic Splice Closures Kits or other approved by PLM that are sized as required for the maximum fiber count within the splice case including distribution fibers.

D. Install only the splice enclosure manufacturer's specified splice trays. Splice only 12 fibers per splice tray (no exceptions, unless with written approval prior to installation from the PLM project manager).

E. Splice trays shall be labeled with a permanent label on the front face of each splice tray indicating fiber count.

F. Support all closures with manufacturers approved brackets.

2.07 INNER DUCT

A. Aluminum threaded innerduct couplers shall be used to join two segments of corrugated innerduct together. Non-metallic couplers are not acceptable.

B. All inner ducts shall have a measured pull tape rated for 400 lbs. pulling tensile.

C. Each inner duct run shall be of the same manufacturer, model and size.

D. All runs with cables leaving the building shall be water and gas proof sealed using a method approved by PLM.

E. Inner duct sealing plugs shall be used to seal used and unused inner ducts. Use in conjunction with triplex duct sealing plugs.

2.08 LABELS

A. Plastic cable labels shall be mechanically printed and shall be attached to all fiber optic cables using black UV rated cable ties or stainless steel cable ties within six inches of the splice closure and 6" from all ducts and sleeves.

B. Provide electronically printed, waterproof, self-adhesive, laminated labels installable on the external surface of the outside panel of all FDU's and closures.

2.09 PROPOSED EQUIPMENT DISTRIBUTION LIST

Table 1

Location	Offices	Equipment	Quantity
MDF	ICTO,CPT,CPT-Clinic,PFMO-Fabrication,OSDS,Comp-Lab 1, Comp-Lab 2, Comp-Lab 3, Comp-Lab 4, IER, Eng. Lab Office, Comp-Lab Office	Fiber Patch Panel 54 cores	1
ICTO		Core Switch 24 ports full fiber LC	1
MVP Technology Innovation Center		Distribution Switch 48 ports with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
GV		7KV UPS (Tower type) (MDF)	2
		650 VA UPS (Tower type) (Offices)	14
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	14
		6ft. rack mounted cabinet (Indoor)	1
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	3
		AP Wireless Controller compatible to WIFI APs.	1
ODF 1	Accounting, Budget, OVPFM	Fiber Patch Panel 6 cores	1
Gusaling Atienza Ground Flr.		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Outdoor)	1
		1 KVA UPS (Tower type) (ODF)	1
		650 VA UPS (Tower type) (Offices)	3
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	3
		Data Cabinet 2x1x2 Indoor (Offices)	3
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	1
ODF 2	Cashier, Verena's Café, OUR, OVPPA, AVR, Chapel, Rear Gate	Fiber Patch Panel 6 cores	1
GEE Outside Cashier		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Outdoor)	1
		1 KVA UPS (Tower type) (ODF)	1
		650 VA UPS (Tower type) (Offices)	4
		Data Cabinet 2x1x2 Indoor (Offices)	4
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	4
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	2
ODF 3	OEVP, OVPA, OUSEC, OULC	Fiber Patch Panel 6 cores	1
GEE Outside Office of the Executive Vice President		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	4
		Data Cabinet 2x1x2 Indoor (Offices)	4
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	4
		2x2x2 ft. wall mounted cabinet (Outdoor)	1
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	4
ODF 4	USO, UHS, HRDO/Payroll,	Fiber Patch Panel 6 cores	1

GV Outside University Health Services	PO, OGTS, PRMIG, GSL, NSTP/CWTS, OVPAA, HRDO-Records, CET-Main Office, CET-Grad School, CAUP, COA	24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	16
		Data Cabinet 2x1x2 Indoor (Offices)	16
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	16
		2x2x2 ft. wall mounted cabinet (Indoor)	1
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	4
ODF 5	LIS, Lib-Office, Lib-Circulation, Lib-Basement, PFMO, MILC, CL, CL-Lib, Med-Lib, IAO, CN, BTB, CBGM-ITHM	Fiber Patch Panel 6 cores	1
Library Circulation area		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Indoor)	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	13
		Data Cabinet 2x1x2 Indoor (Offices)	13
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	13
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	5
ODF 6	CS-Science Lab, CET-Civil Eng. Lab, CM	Fiber Patch Panel 6 cores	1
Gusaling Bagatsing Main Entrance		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Indoor)	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	2
		Data Cabinet 2x1x2 Indoor (Offices)	2
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	2
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	2
ODF 7	Gym-Office, Motor Pool, Coppers, PCACS	Fiber Patch Panel 6 cores	1
GYM		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Indoor)	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	1
		Data Cabinet 2x1x2 Indoor (Offices)	1
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	1
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	1
ODF 8	JAA, CBGM, CBGM-IAF, CHASS, CED, CS	Fiber Patch Panel 6 cores	1
Gusaling Lacson Main Entrance 2nd flr. Near stairs		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
		2x2x2 ft. wall mounted cabinet (Indoor)	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	5
		Data Cabinet 2x1x2 Indoor (Offices)	5
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	5

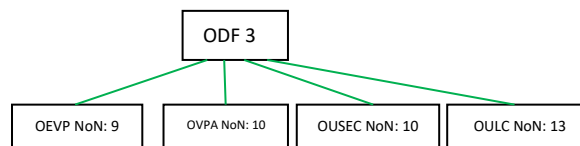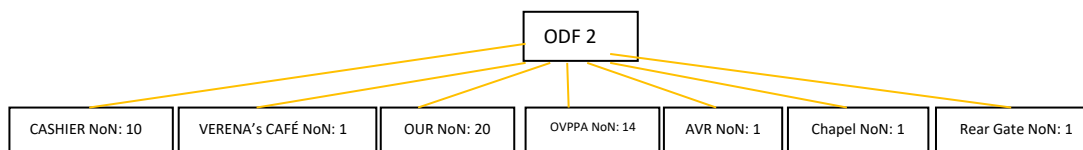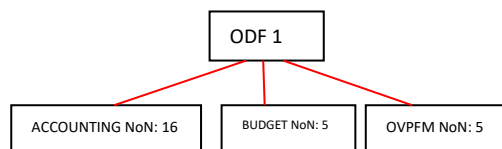|		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	5
ODF 9		Fiber Patch Panel 6 cores	1
Executive Building		24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all POE ports capable	1
	Main Lobby Exe. Bldg., Property, PRMEC, OPRES	2x2x2 ft. wall mounted cabinet (Indoor)	1
		1 KVA UPS (Tower type)	1
		650 VA UPS (Tower type) (Offices)	2
		Data Cabinet 2x1x2 Indoor (Offices)	2
		24 Ports Fast Ethernet Access Switch (Offices) with 2 Gigabit ports	2
		WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	3

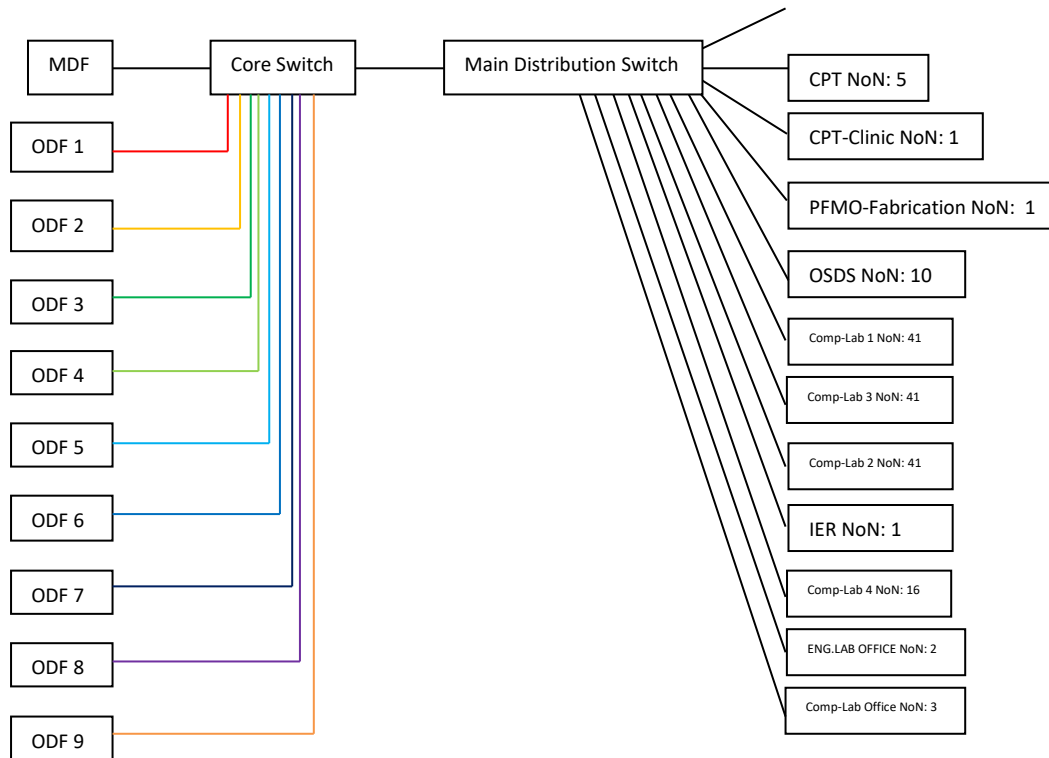## 2.10 PROPOSED MDF/ODF DISTRIBUTION LIST 696 Nodes

Table 2

Table 2		LOCATION					
MDF / ODF number	Building	Main Distribution Frame (MDF) / Optical Distribution Frame (ODF)	Number Of Nodes	Outdoor WiFi Access Point	Number Of IPPABX Devices	Printer Copier/Scanner With IP Address	TOTAL Number of Nodes
MDF	MVP Technology Innovation Center	ICTO Data Center	183	3	10	2	198
ODF 1	Gusaling Atienza	GA Ground Floor	21	1	3	2	27
ODF 2	Gusaling Ejercito Estrada	GEE Outside Cashier Office	37	6	8	3	54
ODF 3	Gusaling Ejercito Estrada	GEE Outside Office of the Executive Vice President	27		9	6	42
ODF 4	Gusaling Villegas	GV Outside University Health Services	115	4	17	11	147
ODF 5	Gusaling Katipunan	Library Circulation area	94	5	8	6	113
ODF 6	Gusaling Bagatsing	Gusaling Bagatsing Main Entrance	7	2	3	1	13
ODF 7	University GYM	GYM	7	1	4	0	12
ODF 8	Gusaling Lacson	Gusaling Lacson Main Entrance 2nd flr near stairs	42	5	7	3	57
ODF 9	Executive Building	Executive bldg. 2nd flr	17	3	8	4	32
	Gusaling Corazon Aquino			1			1
TOTAL :			550	31	77	38	696
GRAND TOTAL :			696				

2.11 Summary List of Equipment

Table 3

Item #	Description / Equipment	Quantity	Location
1	Fiber Patch Panel 54 cores	1	
2	Core Switch 24 ports full fiber LC	1	
3	Distribution Switch 48 ports with at least 2 SFP modules, 2 Transceivers and all PoE ports capable	1	
4	7 KVA UPS Tower Type	2	
5	6ft. Rack mounted cabinet (Indoor)	1	MDF
6	WIFI 2.4GHz standards 802.11b/g/n and 5GHz a/x, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	3	
7	AP Wireless Controller compatible to WIFI APs.	1	
8	Fiber Patch Panel 6 cores	9	
9	24 Ports Distribution Switch with at least 2 SFP modules, 2 transceivers and all PoE ports capable	9	
10	1 KVA UPS Tower Type	9	
11	2x2x2 ft. wall mounted cabinet (3) Indoor, (6) Outdoor	9	ODF 1-9
12	WIFI 2.4GHz standards 802.11b/g/n, 2 Antenna gain dBi, 300Mbit/s data rate, capacity of at least 300 users, Outdoor and weatherproof, 10/100/1000 Ethernet ports, POE port in, signal range of 50meters.	28	
13	Access Switches 24 Ports with 2 gigabit ports	64	
14	Data Cabinet indoor size 2x1x2	64	All Offices
15	650 VA UPS Tower Type	64	

2.12 Proposed Network Diagram

ICTO NoN: 34

Network Topology Diagram

Main Distribution (Top)

MDF — **Core Switch** — **Main Distribution Switch**

Core Switch connects to:
- ODF 1
- ODF 2
- ODF 3
- ODF 4
- ODF 5
- ODF 6
- ODF 7
- ODF 8
- ODF 9

Main Distribution Switch connects to:
- CPT NoN: 5
- CPT-Clinic NoN: 1
- PFMO-Fabrication NoN: 1
- OSDS NoN: 10
- Comp-Lab 1 NoN: 41
- Comp-Lab 3 NoN: 41
- Comp-Lab 2 NoN: 41
- IER NoN: 1
- Comp-Lab 4 NoN: 16
- ENG.LAB OFFICE NoN: 2
- Comp-Lab Office NoN: 3

ODF 1

ODF 1 connects to:
- ACCOUNTING NoN: 16
- BUDGET NoN: 5
- OVPFM NoN: 5

ODF 2

ODF 2 connects to:
- CASHIER NoN: 10
- VERENA's CAFÉ NoN: 1
- OUR NoN: 20
- OVPPA NoN: 14
- AVR NoN: 1
- Chapel NoN: 1
- Rear Gate NoN: 1

ODF 3

ODF 3 connects to:
- OEVP NoN: 9
- OVPA NoN: 10
- OUSEC NoN: 10
- OULC NoN: 13

Bottom Row

- USO NoN: 7
- UHS NoN: 4
- HRDO/PAYROLL NoN: 29
- PO NoN: 14
- OGTS NoN: 6
- PRMIG NoN: 6
- GSLNoN: 3

ODF 4

| NSTP/CWTS NoN: 4 | OVPAA NoN: 11 | HRDO-RECORDS NoN: 3 | CET-MAINOFFICE NoN: 20 | CET-GRAD SCL. NoN: 4 | CAUP NoN: 26 | COA NoN: 6 |

| LIS NoN: 24 | LIB-OFFICE NoN: 7 | LIB-CIRCULATION NoN: 5 | LIB-BASEMENT NoN: 14 | PFMO NoN: 13 | MILC NoN: 2 | CL NoN: 8 |

ODF 5

| CL-LIB NoN: 5 | MED-LIB NoN: 5 | IAO NoN: 9 | CN NoN: 8 | BTB NoN: 1 | CBGM-ITHM NoN:7 |

ODF 6

| CS-Science Lab NoN: 2 | CET-Civil Eng. Lab NoN: 1 | CM NoN: 8 |

ODF 7

| Gym-Office NoN 5 | Motor pool NoN: 2 | Coppers NoN: 3 | PCACS NoN: 1 |

ODF 8

| JAA NoN: 1 | CBGM NoN: 10 | CBGM-IAF NoN: 10 | CHASS NoN: 13 | CED NoN: 11 | CS NoN: 7 |

ODF 9

| Main Lobby Exe. Bldg. NoN: 1 | Property NoN: 14 | PRMEC NoN: 1 | OPRES NoN: 13 |

PART 3: EXECUTION

3.01 OPTICAL FIBER BACKBONE INSTALLATION

A. General

1. This Section describes the installation for the products and materials, as well as methods and PLM Standards associated with the optical fiber backbone installation. These Specifications, along with the Drawings and other PLM supplied specifications shall be provided during the course of the installation.

2. The Contractor is instructed to coordinate his efforts with other trades who may be working within the same vicinity to avoid conflicts, lost time, cleaned environment for splicing and termination and potential injury. PLM will assist in contractor coordination as requested or as required.

3. The Contractor shall install all materials plumb, square and in a workman-like manner.

4. The Contractor shall supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

5. The Contractor shall verify space requirements and locations with the project team and PLM before starting cable installations and terminations proceed.

6. The Contractor shall verify the cable type and jacket rating required for use with PLM before starting the fiber installation.

7. The Contractor shall verify existing cable fill in conduit, raceway or cable tray system prior to quote or bid and before installation of additional cables so as not to exceed 40% cable fill. Contractor will be responsible for installation of additional conduit, raceway or cable tray where additional cables to be added will exceed the 40% cable fill.

8. Should any portion of these Specifications conflict with applicable Codes, the Contractor shall cease work on that particular aspect of the Project and notify PLM immediately.

9. All equipment shall be installed in a neat and professional manner, arranged for convenient operation, testing and future maintenance.

10. All fiber cables shall be installed and terminated / fusion spliced by technicians trained and experienced in the installation and termination of fiber cables.

11. The Contractor shall employ certified system installation technicians and have at least 5 years' experience in the installation of similar and equivalent systems.

12. The Contractor shall supply verification of experience, for this type of work, to PLM for approval before performing any work.

B. Field Conditions:

1. The Contractor shall verify fixed facility locations shown on the Drawings are based upon the latest design information available at the time this Specification was prepared.

2. The Contractor shall conduct field inspections to coordinate, verify and/or determine the actual as-built locations of conduits, manholes, handholes and all other special facilities that affect the installation, prior to commencing the installation in any area.

3. All ER/TR's and underground structures including utility tunnels, conduit and manhole systems, handholes and related fixtures shall be kept as clean as possible during installation. Labor required for any cleaning work shall be included in the quote or bid and provided by the Contractor.

C. Pre Cable Installation:

1. Ensure the correct product(s) for the project have been received by the Contractor are compliant to the project's product specification and have approved for installation by PLM. The Contractor should verify part numbers and footages on cable reel shipping labels, bills of lading, invoices, etc., shall be compared to the original order upon receipt and before installation.

2. The Contractor shall inspect fiber optic cable reels for damage upon receipt from the shipper and verify the receipt of the specified product before installation.

3. The contractor should verify the length of the cable both visually and by the results of the OTDR test to verify the project requirements prior to installation.

4. The Contractor will retain the manufacturer's test data and provide it, along with all other specified test documentation to PLM at the completion of the Project.

5. All cable that does not meet the project or required PLM specification or approved by PLM shall be removed and replaced at the contractor's expense.

D. Optical Fiber Installation Within Ductbanks & Innerducts

1. PLM designated conduits. If field conditions prohibit the use of the designated duct, inner duct or multi-cell/sub duct, the Contractor is to contact PLM for instructions prior to installation.

2. If existing multi-cell or innerduct duct specified is available, install one fiber cable in each sub-duct.

3. If cable is already installed within a duct without innerduct the Contractor is to contact PLM for direction.

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

5. Install measured pull tapes with a minimum of 400 lb pulling tensile in conduits when installing cables or innerduct into occupied conduits.

E. Installation of Optical Fiber within the ER/TR

1. Upon entering the ER/TR the backbone fiber optic cable shall be routed on cable tray to the designated rack location.

2. At least 25 feet of slack cable shall be included and stored as specified and approved by PLM. A minimum of 2 times the diameter of the cable minimum bend radius shall be maintained. Cable slack in the TRs shall be contained and routed in the cable tray. Do not coil the cable to achieve the service loop. Store slack as approved by PLM.

    F. Splicing & Termination

1. The contractor is responsible to ensure that all outages associated with active cable and equipment is coordinated and approved by PLM.

2. Fusion spice optical fibers in accordance to the approved fusion splicer, optical fiber and enclosure manufacturer's methods, procedures and instructions to ensure warranty compliance.

3. All optical fiber shall be neatly and efficiently dressed into splice tray management and the contractor is to ensure that splices are accessible without damage to the optical fibers or splices.

4. The contractor is to ensure that all splice trays are labeled and properly optical fibers, trays secured.

5. The contractor shall test and call for splice inspections of all optical fiber splices before closing cable splice enclosures.

3.02 FIBER OPTIC CABLE TESTING

    A. Scope of Work

1. Work covered by this Paragraph shall consist of furnishing labor, equipment and supplies unless otherwise specified, and in performing the following operations recognized as necessary for the successful testing and verification of the installation of the Fiber Optic cable plant described on the Drawings and required by these specifications.

2. Notify the PLM 48 hours in advance when work, technicians and equipment are prepared for acceptance tests and inspections. Coordinate a meeting with PLM personnel to discuss the required testing procedures, required performance, test equipment, documentation, etc. to verify to PLM a complete understanding of project requirements.

3. Provide technicians are trained and certified in the use of the test equipment used for the testing operations associated with the specified work.

4. Maintain test equipment to manufacturers' requirements, and ensure that all equipment is calibrated according to the manufacturer's requirements. Provide a copy of the current calibration certificate associated with all test equipment associated with the contracted work.

B. Testing

1. Verify through visual inspection using an optical fiber test scope all fiber optic cable terminations, splices and connecting cables for defects and cleanness.

2. The fiber optic cables shall be tested utilizing a power meter and stabilized light source capable of testing at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode. Contractor shall complete a fiber optic post installation report at the time of testing containing meter readings at both 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode in one direction (TR to outlet) on each fiber, actual loss and other pertinent data regarding the cables tested, including model and serial number of test equipment, cable part #, installed fiber length, building span loss at 850 nm and1300 nm for multimode and 1310nm and 1550nm for single-mode and date tested. Testing required is 100%.

   a. Place a printed copy and provide and electronic copy on a CD of the test results from the tester in a 3-ring binder, proceeded by a tabbed divider and label as "Backbone Fiber":

   b. Span loss calculations are required on the final test sheet for loss at 850 nm an 1300 nm for multimode and 1310nm and 1550nm for Single-mode
   (D = Length x L = Fiber Loss) + (C x # connectors Loss) + (# Splices Loss)

3. Maximum Acceptable Connector Loss Values

Fiber Type	Test Wavelength	Mated Pair Connector Loss (each including fusion splice)
Single-mode	1310nm	0.5 dB
Single-mode	1550nm	0.5 dB

4. Acceptable Fiber Type Test Wavelength Fusion Splice Loss (each)

Fiber Type	Test Wavelength	Splice Loss (each)
50/125 Multimode	850nm	0.25 dB
50/125 Multimode	1300nm	0.25 dB
62.5/125 Multimode	850nm	0.25 dB
62.5/125 Multimode	1300nm	0.25 dB

| Single-mode | 1310nm | 0.25 dB |
| Single-mode | 1550nm | 0.25 dB |

5. Testing requirements for Attenuation and Reflection

   a. Acceptable attenuation shall be calculated based upon on connector, type, number of splices and optical fiber length and shall comply with TIA/EIA 526. Attenuation shall not exceed the specified perimeters established by the manufacturer and the requirements of this section

   b. Reflection test perimeter shall not exceed > - 40 db per connector or splice.

6. The total optical fiber segment performance shall not exceed the summation of all the manufacturers components specified performance parameters (Loss Budget) and/ or the combined loss values of components in Section 2.04 of this document.

7. Verify through bi-directional dual frequency power meter testing the attenuation and power loss of each point to point fiber optic strand and connectors.

8. Test all inter/intra building optical fiber segments using an OTDR with launch and receiving cables on each end during each test operation.

9. All optical fiber testing shall utilize the manufacturers specified and approved test jumpers and adapters.

10. Optical fiber cable that is left un-terminated at both ends shall be tested using a launch cable and bare fiber adapter.

11. Fiber optic cable that is left un-terminated at one end shall be tested at the connector end using an OTDR.

12. Submit all test results using LinkWare (or other wised approved software by PLM) electronic disk formatted test results including trace and length reports directly from the test equipment to PLM - ICTO immediately upon completion of the testing.

13. The Contractor is responsible for ensuring that PLM has all necessary software and training required to view and interpret the submitted test results.

3.03 LABELING

A. Fiber Color Code approved for sequencing follows:

Number	Color
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

3.04 AS-BUILT INFORMATION

A. Contractor shall provide as-built information to PLM to accompany all test result information.

B. As-built information shall be in electronic format in AutoCAD, the most current version...Indicate location of all outlets, distribution cable trays, junction boxes, FDU with configuration, optical fiber cable equipment rack layout with cable designators and counts and all additions and deletions pertaining to the backbone optical fiber cabling system.

C. Contractor shall provide one set of preliminary as-build information, splice diagrams and test results including all test result information 30 days prior to occupancy to ensure the scheduled installation and activation of PLM equipment and services.

D. Failure of the contractor to provide the required as-built information in a timely manner for PLM to prepare cutover information may cause an installation delay for the project due to the contractors not meeting these requirements. The delivery of the as-built documentation needs to be coordinated with PLM as a project milestone.

E. Partial as-builds shall be submitted as additional cabling is completed to meet installation schedules.

F. The Contractor shall provide at substantial completion a list of all uncompleted work and a punch list of open items to the PLM Manager at substantial completion and prior to scheduled activations.

G. If construction drawings are not utilized, contractor shall provide all telecommunications location information on an accurate and electronic formatted scaled floor plan preapproved by PLM.

H. Partial as-builds shall be submitted as additional cabling is completed to meet installation schedules. The Contractor shall provide one set of preliminary as-build information, equipment layouts including elevations and test results to meet the schedule requirements of the PLM equipment installation and activation.

I. The final as-built shall be submitted with all corrections made no later than 30 days after cabling installation is completed.

3.05 SYSTEM WARRANTY

A. Contractor shall provide a 20-year extended manufacturer's warranty in addition to the contractor's warranty provided to the project. The warranty shall be titled to the PLM. The warranty shall begin at the system acceptance date and remain in effect for a period of 20 years from that date.

B. The umbrella warranty provided for the optical fiber backbone cabling system shall be issued by the manufacture of the cabling system. The contractor shall provide to PLM any additional warranties from partners in addition to the cabling system warranty, i.e. cable manufacturer, contractor warranties.

C. All installed systems must conform to the manufacturer's official published specifications. Any exceptions agreed to by the contractor and the manufacturer shall be approved by PLM. The contractor shall submit in writing and obtain approval from PLM for all exceptions pertaining to the cabling system's warranty prior to the request being submitted to the manufacturer.

D. The warranty shall include a warranty of the applications published by the manufacturer at the time of the warranty application. The contractor is to provide to PLM a list of these applications.

E. The contractor will provide PLM with a copy of the warranty application at the time of submittal to the manufacturer.

F. Contractor shall perform all labeling requirements and provide testing documentation for verification and submittal to the manufacturer and PLM - ICTO. A copy of the warranty application and all documentation and test results shall be submitted simultaneously to PLM - ICTO and the manufacturer.

G. Contractor shall submit for the warranty all cable records to reflect moves and changes as built.

H. The contractor shall include and schedule PLM - ICTO in all site surveys and inspections that relate to the warranty application or processes.