



University of New Mexico Information Technology Services
Design Guidelines for Information Technology Infrastructure & Facilities
2022 Edition

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UNIVERSITY OF NEW MEXICO DESIGN GUIDELINES FOR INFORMATION TECHNOLOGY INFRASTRUCTURE FACILITIES

1. General

The University of New Mexico has identified the need to incorporate a structured approach to the integration of Information Technology Infrastructure facilities within the planning, and programming of new construction projects, and retrofitting of existing facilities on the Campus. The University has embraced the need to actively support the technology environment of today as well as decades into the future. Key to this need is the necessity to integrate the budgetary, engineering, and architectural implications of a standards-based Information Technology Infrastructure system of pathways, and spaces within, and between the buildings of the Campus.

Inter-building Communication Infrastructure is designed for a useful life of 20 to 50 years. Intrabuilding pathways and spaces have approximately the same useful life and are intended for reuse when cable media is replaced. Cable media and equipment for Inter and Intrabuilding distribution should be planned for a range of 5 to 15 years, which varies based on developments, and changes in technology.

The TIA, EIA Standards, and the BICSI design manuals are the basis for the UNM Design Guidelines, and Specifications.

All questions concerning the intent, updates, and information not included in the UNM Design Guidelines, and /or Specifications, and the information contained within this document shall be directed to the UNM Information Technology Services.

Note: Due to the logistical implications, and warranty requirements, UNM IT has limited the number of approved manufacturer's systems for cabling installations. Substitutions that do not interfere with logistical operations or affect warranty requirements will be evaluated if equal to the approved products.

Note: For further details of design, and specification requirements refer to the UNM Information Technology Design Guidelines at: <https://policy.unm.edu/university-policies/5000/5310.html>

2. Purpose, and Scope

The purpose of this document is to provide programmers, budgeters, planners, designers, and architects with the requirements, standards, and guidelines, for inclusion

in the construction programming of information technology infrastructure facilities. These guidelines apply to the physical aspects of new construction projects, as well as a retrofit, and upgrades of existing communication infrastructure facilities on the University of New Mexico (UNM) Campus.

Note: The provisions for use of this document are specified in UNM Policy 5310; Information Technology for Facilities: <https://policy.unm.edu/university-policies/5000/5310.html>. Architectural, and /or engineering firms selected for the planning, and design of University buildings shall provide qualified IT design expertise, including a Registered Communications Distribution Designer (RCDD), to University projects requiring IT infrastructure, and services. These resources must be actively involved in the project's IT design.

Note: All deviations, changes, or modifications to the requirements of these specifications, equipment, materials, methods, procedures, and requirements of these documents shall be subject to the approval of UNM IT Networks.

This document provides descriptions, and general specifications for the components that encompass the pathways, spaces, and cable media for both interbuilding, and intrabuilding information technology infrastructure systems. UNM has a published set of specifications for the Campus Data Communication Network that includes infrastructure, which these guidelines are intended to complement.

The application of the Guidelines varies from building to building, based on the building's purpose, and design. These are the specified minimum requirements for the infrastructure features described within this document; however, these may be subject to specific exceptions, and modifications upon approval or specification by UNM IT Networks. In the case where the requirements set forth within this document exceed those provided by UNM in their existing specifications, the more stringent requirement shall prevail.

When applying these Guidelines to retrofit projects in existing buildings, the designer should consider that some of the requirements, particularly for space, might not be practical or even possible to achieve. These exceptions and modifications also shall be submitted to UNM IT Networks for review, and approval.

Note: The architect, design team, and contractor are directly responsible to provide, plan, design, engineer, construct, and installing all IT facilities, and fixtures within these requirements providing installed systems that are Sustainable, Assessable, and Coordinated with other building systems to allow for Flexibility, and Optimal use for future operational, and maintenance activities.

This document includes guidelines for the planning, and construction of Information Technology infrastructure, and facilities. Note that they are arranged in order starting with intrabuilding infrastructure, and media components for placement within buildings

and moving outward to the inter-building physical communication infrastructure. These are features created between buildings that are necessary to coherently connect them:

Intrabuilding Spaces

Service Entrances

Equipment Rooms

Technology Rooms

Server Rooms

Intrabuilding Pathways

Conduits

Cable Tray

Pull Boxes

Intrabuilding Cable Media

Equipment Racks, and Cabinets

Optical Fiber Backbone Cable

Multi-pair Copper Backbone

Cable Coaxial Cable

Horizontal Copper UTP Cable or FTP

Inter Building Spaces (Transition Structures)

Communications Vaults/Maintenance Holes

Hand Holes

Inter Building Pathways

Ductbanks

Utility Tunnels

Inter Building Cable Media

Multi-pair Copper Backbone Cable

Wireless

Special Systems Emergency Phones Alarms

Multimedia & Classroom Technologies

Project Requirements

Documents, and Warranty

Project Design, and Communication Requirements

Scheduling Requirements

Testing, Labeling, Documentation, and Acceptance

Warranty Requirements

3. Life of These Guidelines

This set of Guidelines is a living document and is intended for review, and update by UNM periodically as warranted by changes in building construction techniques, and communications technology. UNM IT retains the right to modify these documents on an interim basis between updates or for project-specific requirements to meet the needs of UNM or ITS.

4. Submittal Requirements

The design professional should provide the following submittals for all UNM major capital projects. All requests for changes to the submittal package shall be approved by UNM IT.

Note: All Information Technology construction documents shall be in CSI Division 27 format.

Schematic Design Phase Submittals: The design professional should provide the following after the schematic design phase:

Existing site plan showing IT, ISP, Telephone, and other utility locations, and elevations

Line drawings of the building and local distribution including IT rooms, (location, size, cable tray routing.

Floor plans with IT outlet locations

Plans of special floors or areas such as classrooms Diagrammatic sections 1/16-inch scale

IT symbol list (Use symbol list, and acronyms from the BICSI Telecommunications Distribution Methods Manual).

IT equipment, and special equipment (for example classroom technology components) that influences the design

Telecommunications Report:

Service Line or Entrance Facility point of Entrance Description of systems, and capabilities

Technologies Report:

Detailing IT equipment for classroom multimedia, and other special applications

IT Code Analysis:

Provide a written statement describing methods proposed to comply with governing codes, and regulations, occupancy, life safety, fire protection, and fire resistance (examples: fire rating of cabling as related to NFPA 90 A, fire rating requirements for IT spaces, ADA requirements, etc.

IT Program Conformance Analysis:

Provide a written general statement describing how the proposed IT design meets the technical, and functional requirements of the IT program, and general program. Note, and describe any departures from the program or provide recommended changes, and reasons for departure. Include:

Voice Systems Data Systems

Classroom Technology Multimedia Systems

Distant Learning Technology Special Systems, and Technology IT Room/Name/Number Systems

Assign IT rooms, and spaces a name (Example: ITS Equipment Room (ER), and space number that will appear thereafter through construction, completion of the architect's work, and occupancy. Numbering and naming should be approved by the Office of Planning, and Space Management and the nomenclature should be consistent with the TIA Reference Standards listed in the following section.

IT Project Cost Estimate IT Construction Cost

IT Consultants Cost

IT Fixture, and Equipment Cost

IT Owners Other Direct/Indirect Cost

Note: The rate of technology change from programming through construction can be significant. The programmer, designer, project manager, and construction manager need to ensure that a project contingency for technology is in place to accommodate these changes. The recommended contingency is 25% for the Information Technology rate of change. This contingency should be separate, and a part of the assigned project contingency.

Schedule: Provide a project schedule that reflects the completion of IT scheduled activities, design activities, construction phase milestones, and related activities.

List of Exceptions: Provide a statement outing exceptions to the UNM IT Design Guidelines, and Design Guide Specifications.

Classrooms: Floors Plans, and interior elevations: Locate furniture and technology-related components. Include site lines, viewing, and noise obstructions. Evaluate technology viewing clearances. Define lighting zones, impacts, and switches.

Design Phase Submittals: The design professional is to provide the following after the design phase:

Details of IT distribution components for the building, and local distribution

Provide a specification that addresses all Division 27 requirements, approved manufacturers, and systems, testing requirements, and warranty requirements.

Note: Specifications shall only call out materials, and systems or “approved equals” specified in the UNM Guide Specifications, and /or the current version of UNM IT RFP Structural Cabling, Equipment Installation, and Maintenance Repair. The term or similar terms such as “or equal” shall not be specified or recognized as an approved equal. All “approved equals” shall have the approval of UNM IT Networks.

Provide a substantially complete Division 27 specification, and drawings for all IT systems. Address all applicable requirements of the UNM IT Networks Design Guidelines, Specifications, Standards, and CSI Division 27 activities, and items. The list below identifies common items that should be included in the design phase documents.

Other items not identified in this list that are project specific shall be included in the specifications and drawings.

Riser Diagrams

Voice, Data, and Wireless Access Point Locations with Outlet ID

Detailed diagram of IT Equipment, Telecommunications Rooms fit out, and footprint including cable tray, ground bar, backboard, equipment racks locations, etc. Ghost electrical, lighting, fire protection, HVAC, and other support systems. Verify all clearances are met.

Detailed diagram of equipment rack layout that includes components (i.e. UPS, electrical outlets, data switches, patch panels, fiber optic hardware, etc.

Site drawing that identifies all UNM IT, and other service providers (i.e. local exchange carrier, ISP, CATV, etc.) infrastructure. Include the locations of Code Blue Emergency Phones and supporting infrastructure. Include a connection to the nearest available connection points.

Notes applicable to the installation are numbered in the plan. Include conduit requirements for bend radius, transitions, and similar specifics for construction or installation requirements.

Provide Raceway Distribution Plan

Work with the UNM Wireless Team for wireless coverage, and design requirements.

Typical detail diagram of penetrations including firestop assemblies

Typical detail diagram related to cable tray design including, grounding, bonding, splicing, waterfalls, and other transitions.

Typical detail diagram of cable support systems

Typical detail diagram of pull box and conduit assemblies Typical detail diagram of raised floor sections and fit out.

Typical detail diagram of surface raceways and fit out including conduit entrance.

Typical detail diagram of floor boxes, and poke-thru devices including conduit entrance, and power assemblies. Include all apparatus needed for assembly.

Typical detail diagram of Code Blue Emergency Phones including unit, pad, IT, and Electrical components. Include the location of Emergency Phones on the Telecommunications Site Plan.

Typical detail diagram of elevator phone including make, and model. Typical detail diagram of outlet components

Detail of outlet box, and conduit assembly to wall, floor, ceiling, or access point.

Typical detail diagram of Wireless Access Point Outlets, and Hardware

Interface outlets, the interface of Alarms, and Building Systems details of all ADA IT equipment

Typical detail diagram of all other accessories, and support apparatus Typical detail diagram of all classroom equipment installations Typical detail diagram of special IT equipment installations

Typical detail diagram of all multimedia equipment installations

Classrooms:

Provide more detail of room layouts, technology equipment, obstructions, and viewing lines from student seating, and instructor positions.

Provide more details related to lighting, zoning, and switching. Define specific locations of changes in ceiling planes, light fixtures, technology projector lighting paths, and HVAC diffusers with their air throw impact on projector screens, air return locations, and noise. Define noise criteria (NC)

Provide a written Acoustical Report for classrooms.

Provide a written report of all Value Engineering decisions, and items. Provide, an updated Project Cost Estimate for IT deliverables.

Update the project schedule as related to IT activities.

Construction Phase Submittals: The design professional is to provide the following after the construction design phase:

Provide a complete final specification for the IT systems. Address all applicable requirements of the IT guide specifications, CSI Division 27 activities, and items

Provide notes, and cross-references for common work results in specifications. Place notes in related sections.

Provide a complete final set of plans for the IT systems in CAD and PDF. Address all applicable requirements of the IT guide specifications, and CSI Division 27 activities, and items.

Provide notes, and cross-reference notes, and for all common work on related plans.

Provide notes for all transitions, and instructions related to ceilings, confined spaces, walls, floors, and other spaces.

Provide notes for specific instructions to the contractor for IT-related work activities.

Ghost ceiling plans to IT drawings.

All IT rooms, and spaces are to be clear to the deck above.

Provide outlet schedule that includes each Outlet ID shown on the IT plans, final room numbers Room, outlet requirements (Ports), Performance Requirements (i.e. Category 6 or 6A 10 G), Activation requirements for voice, and data, Set type (i.e. single line, digital multi-line service set, FAX, wall phone, Code Blue Emergency Phone, elevator phone, alarm, etc. Verify outlet schedule to program requirements. Provide in electronic format to ITS, and on plans as this will be used to assemble the cut sheet.

Provide final details for classrooms.

Floor plans, elevations, and layout specifics

Technology equipment, and relationship to view lines, and obstructions Define details and changes to IT equipment

Finalize lighting, zoning, switching, noise (NC), clearances, and HVAC requirements

Include final security requirements for classrooms, and equipment.

Provide a final written report of all IT Value Engineering decisions items, and activities.

Provide, and updated a final Project Cost Estimate for IT deliverables. Provide a final project schedule as related to IT activities.

Bid, Award, and Construction Documents: The design professional is to provide the following during the construction phase.

IT shall be notified before the acceptance of all awards including the selected IT contractor, and the cabling system's selection and IT shall be included in the final approval process for these systems.

Only IT-approved contractors on the current version of RFP-2311-21 - UNM IT Structural Cabling, Equipment Installation, and Maintenance Repair, shall be considered for award.

Approval of all substitutions for parts, products, or systems is at the discretion of IT.

All work designed and installed that does not meet UNM IT guidelines or specifications may be rejected and shall be corrected, modified, or installed at the project design team, and contractors' expense.

IT reserves the right to approve all assumptions, and exceptions to IT project deliverables.

IT shall be provided copies of all RFI's or other information requests related to the IT project deliverables upon receipt by the project's design team.

Construction Substantial Completion Phase Submittals: The design professional shall provide the following to IT after the construction phase:

As-built floor plans with final outlet locations that include each outlet ID two weeks before the first move date.

Provide an as-built outlet schedule that includes each outlet ID shown on the IT plans, final room numbers Room, outlet requirements (Ports), Performance Requirements (i.e. Category 6 or 6A 10 G), Activation requirements for voice, and data, Set type (i.e. single line, digital multi-line service set, FAX, wall phone, Code Blue Emergency Phone, elevator phone, alarm, etc. Provide two weeks before the first move date.

Test results for submittal to IT included all ITS cabling including optical fiber, building distribution, and horizontal cabling two weeks before the first move date. Provide an electronic format direct from the tester. Hand-written test results are not acceptable.

A copy of the contractor's punch list of open IT items

Copy of cabling system warranty application two weeks before first move date

Training, and information on all IT, and equipment support systems, including fire protection, HVAC, alarm systems, etc.

Construction Completion Phase Submittals: The design professional is to provide the following final documents after the project.

Final as-built plans including modifications made during substantial completion.

Final as-built outlet schedule including labeling ID

Final test results after punch list completion, and IT verification.

Cabling system warranty certificate assigned to UNM Information Technology

Resolution report for all punch list items Final Value Engineering Report for IT items.

Manuals for all IT equipment, and support systems

5. Codes & Standards

The specifications included within these Guidelines, incorporate generally accepted communications infrastructure practices described in industry-recognized standards documents (, and addenda) published by recognized Standards Bodies, and

organizations. These include applicable standards published by ANSI, IEEE, the Telecommunications Industry Association/Electronics Industries Alliance (TIA/EIA), ISO/IEC, and Building Industry Consultant Services International (BICSI).

Note: It is the responsibility of the architect, design team, and approved IT contractor to provide, plan, design, engineer, construct and install IT systems that meet the requirements of the UNM IT Design Guidelines, and Specification Standards that are industry standard's compliant and meets the warranty, and installation requirements of the system's manufacturer.

Note: The architect, design team, and the approved IT contractor is directly responsible to provide, plan, design, engineer, construct, and installing all IT facilities, and fixtures in compliance with the building codes, and the laws applicable to the State of New Mexico, City, and the Authority Having Jurisdiction (AJH). This includes code modifications to existing conditions within the project boundaries, and adjacent areas where associated project work is required such as pathways, and IT equipment spaces.

Provide full compliance with the American Disabilities Act for all IT installations.

The most recent editions of the codes, laws, standards, and specifications listed below shall be referenced for project design, and construction requirements unless specifically addressed in the UNM Design Guideline, and /or Specifications.

ANSI/TIA/ EIA 568B, Commercial Building Telecommunications Cabling Standard

This prescribes the requirements for Intra building copper, and optical fiber cable performance, installation, and testing.

ANSI/TIA/EIA 569A, Telecommunication Standard for Pathways, and Spaces

This standard includes specifications for the design, and construction of pathways, and spaces within buildings required to support information technology equipment, and cable media.

ANSI/TIA/EIA 607, Commercial Building Grounding and Bonding Standard

This document includes the components of an effective grounding system for communication systems within public and commercial buildings.

ANSI/TIA/EIA 758 Customer-Owned Outside Plant Telecommunications Cabling Standard

This standard provides specifications for Inter Building communication facilities that include cable media, pathways, and spaces.

ANSI/TIA/EIA 862, Building Automation Systems Cabling Standard for Commercial Buildings

This standard describes the generic cable system for building automation systems (BAS) that are intended to support a multi-product, multi-vendor automation environment within public, and commercial buildings.

ISO/IEC 11801

International Standard ISO/IEC 11801 specifies general-purpose telecommunication cabling systems ([structured cabling](#)) that are suitable for a wide range of applications (analog, and ISDN telephony, various data communication standards, building control systems, factory automation).

Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual

This is a manual of proven design guidelines, and methods accepted by the telecommunications industry.

Building Industry Consulting Services International (BICSI) Specialty Manuals

Customer Owned Outside Plant Wireless

ANSI/NFPA 70, National Electrical Code, (NEC) Current Edition

In addition to standards related to electrical safety, the NEC has several sections which specifically address low-voltage cable installation.

NFPA 90 A: Installation of Air Conditioning, and Ventilating Systems This standard prescribes requirements for cabling fire ratings in ceiling spaces, and the distribution of cabling within.

American Disabilities Act of 1990

This law mandates construction, and installation requirements for handicap accessibility

Additional Standards:

All work not specifically related to the fore mentioned standards shall be performed following the applicable ANSI or International Standards associated with it.

Manufacturer Specifications, and Instructions:

In addition, all work shall be performed to the applicable manufacturer's specifications and instructions about that work.

6. Definitions, and General Requirements

These definitions are arranged to present the logical order of their relationships to each other in an overall infrastructure topology.

Pathways – Structures - or hardware that provides a permanent, and reusable route for housing, and the protection of cable media installed between two points. These facilities also provide a permanent enclosure or mechanism that facilitates the addition or replacement of cable over time.

Intrabuilding Pathways - include cable tray, and conduit, which may be used for horizontal or vertical routing of the cable. The intrabuilding communication cable system infrastructure includes the pathway, and support hardware that concentrates supports, and protects horizontal cable media between its origination point in the Equipment or Technology Room, and the workstation outlet location. Horizontal support hardware is further defined as continuous, (e.g. Conduit, Cable Tray), and non-continuous (e.g. J-Hooks).

Inter Building Pathways - including direct buried, and concrete-encased ducts as well as the existing utility tunnel system that is now in use for the routing of the majority of the University's legacy communication cable system. Aerial cable routes are another example of Inter Building Pathways; however, underground pathways should be constructed wherever possible, and aerial pathways shall only be used when buried or concrete-encased facilities are not an option.

Spaces — Permanent structures that provide a protected area for the termination of cable and placement of equipment, allow for the dispersion, and distribution of cable, and worker access to facilitate the placement of the cable. Intrabuilding spaces include Service Entrances, Equipment Rooms, Technology Rooms, Server Rooms, and Pull Boxes. Inter Building Spaces include Transition Structures such as Underground Communication Vaults (Maintenance Holes), Hand Holes, and Termination Spaces such as Pedestals.

See Diagram 1, a Typical Large Building with a Separate Service Entrance, Equipment Room, and Multiple Technology Rooms, and Diagram 2, Typical Building with Equipment Room/Service Entrance, and Multiple Technology Rooms; for an illustration of the relationship between Intrabuilding Space.

Service Entrance Rooms - These are rooms typically located in building basements or on the ground floor of a building where there is no basement and are the terminus of Inter Building conduits. Service Entrances are often the location where unrated Inter Building backbone cable is spliced to rated cable, and /or electrical protector units for distribution within the building. There is no need for significant environmental support in

these rooms other than what is provided in a standard office since they do not contain sensitive electronic communications equipment. Convenience power, normal ventilation, adequate lighting, and a secured entry door are usually sufficient for these facilities.

Equipment Rooms (ERs) – These facilities are also referred to as MDF (Main Distribution Frame) Rooms or BDF (Building Distribution Frame) Rooms, and they are special-purpose rooms that provide space and maintain a suitable operating environment for the termination of backbone, and campus cabling, and house centralized communications, and/or computer equipment such as Core Switches.

Servers, and PBX - The Equipment Room is considered the demarcation point within the building itself, the location where the Inter Building, and Intrabuilding communication distribution systems, interconnect companies, ISPs, CATV, and other outside service providers. Equipment Rooms differ from Technology Rooms in that Equipment Rooms are generally considered to serve a building or campus area, whereas Technology Rooms serve a floor area of a building.

Equipment Rooms may also include other building information systems such as classroom technology, community antenna television [CATV], multimedia, fire alarm, security, building management systems (BMS), and other building signaling systems. In some cases, an Equipment Room may also contain the service entrance facility for the campus backbone, access providers, or both, and serve as a Technology Room (TR). The Equipment Room is the recognized termination point for all backbone cabling in a building. The Equipment Room may require adjacent space, and electrical provisions allocated for batteries, UPS, rectifiers, fire suppression systems, HVAC, and other support systems.

Technology Rooms (TRs) --, Also known as Wire Centers, IDF Closets, Telecommunications Closets, or Tele/Data Rooms, differ from Equipment Rooms (ERs), and entrance facilities in that they are generally considered to be floor-serving (as opposed to building or campus-serving) spaces that provide a connection point between the backbone, and horizontal distribution pathways. Technology Rooms provide an environmentally suitable, and secure area for installing cables, patch panels, cross-connects racks- and wall-mounted hardware, and technology equipment. The Technology Room is the recognized connection point between the backbone and horizontal pathways. Technology Rooms may require space, and electrical provisions allocation for batteries, UPS, rectifiers, fire suppression systems, HVAC, and other support systems.

Server Rooms – The requirements for Server Rooms are similar to Equipment Rooms or Technology Rooms. The Server Room requires equipment racks, ladder racks, dedicated, and convenient power, and air conditioning. Air conditioning requirements could be higher, and the calculation is provided in the Equipment Room section of this document. An infrastructure connection is required for cabling to either the Equipment Room or Technology Rooms to provide connectivity to the University data network. All requests and requirements for new server rooms shall be submitted to IT, and the Office of the CIO for approval during programming, and before design.

Intrabuilding Backbone Cable – These cables are used to connect the Equipment Room to the respective Technology Rooms, primarily to carry signals to, and from the edge, and core IT electronics equipment. Multi-pair Copper Backbone Cable may also be used to concentrate alarm and building control system signals distributed throughout a building. Typically, Intrabuilding Backbone Cable consists of multi-pair copper and high strand count fiber optic cables.

Inter Building/Campus/Off Campus Infrastructure – Includes the conduits, manholes, easements, right of ways, antenna, and other systems that support inter-building IT transport systems. Also included are provisions necessary for the public, and private service providers to provide IT services to UNM off-site facilities, buildings, and campuses. IT will be the ultimate provider of these services; however, projects may have both fiscal, and material responsibilities for their provision. The programmer or designer needs to address and include with IT these requirements when planning for both on, and off-campus locations in the planning, and design of all UNM facilities.

Note: Easements, and /or written agreements are required for non-UNM entities such as the local telephone company, CATV providers, and other carriers for the placement of their facilities on UNM/UNMH properties. It is the responsibility of the project design team to make an application to and receive approval from the UNM Department of Real Estate, and UNM IT for these requirements before construction, and placement.

Inter Building Backbone Cable -- Inter Building Backbone Cable is used to connect buildings, concentrate, and distribute aggregated signals to, and from Zone Hub-Level Core Electronic Systems. Inter Building Backbone is typically multi-pair copper (hundreds to over one thousand pairs), and high-count optical fiber cable (up to hundreds of str, and s). Inter Building Backbone Cable is constructed to withstand the elements of cold, heat, and moisture as well as the harsh external installation environment. The cable is manufactured with heavier jackets, and sometimes even “armor” where rodent damage to cable is common. With few exceptions, it is not rated for installation within buildings and must be spliced to riser or plenum-rated cable for continuation within buildings. These splices normally are housed in the Service

Entrance, or smaller buildings, co-located within the Equipment Room. See Optical Fiber Section for performance requirements for optical fiber.

Optical Fiber Cabling – Inter and Intra-Building Backbone - Both Single Mode optical fibers shall be specified for intra-building systems. Single Mode fiber shall exceed ITU G.652.c/d., shall be low water peak, and suitable for CWDM applications. Multimode Fiber is used when specified by IT. Separate cables shall be installed for multimode, and single-mode applications, and each cable terminated in a dedicated FDU. All terminations shall be LC connectors with pigtails or fusible LC connectors, and fusion spliced the FDU. The designer and contractor shall verify both specified and submitted optical fiber cable, and components for exact matching as specified by the manufacturer for the system being installed. This matching includes both performance and physical optical fiber matching.

Horizontal Cable – This is a predominantly 4-pair, high-performance Unshielded Twisted Pair (UTP Cat 6 or 6A) or Screened /Foiled (Category 6A) cable, as specified by UNM IT, that is run from the Technology Room to the workstation. In limited applications, Optical Fiber, and Coaxial cable is also installed in the horizontal environment. Generally, one cable is required to support each user device, (e.g. PC, printer, telephone), and dependent upon the projected equipment density, several UTP cables are usually installed in each workstation faceplate.

Industry-standard practices dedicate horizontal cable to a particular floor. In approved cases, small numbers of horizontal cables may serve to feed floor box devices or poke thru's from more than one floor from a single Technology Room. Total cable length limitations of 90 meters or 295 feet dictate the reach of Horizontal Cable from the Technology Room, and often, floor plate areas require the provision of more than one Technology Room per floor to conform to cable distance limitations.

Twisted pair cable has different performance ratings or Categories. Category 6, and Category 6A are the current typical cabling installations installed at UNM. The level of cabling performance shall be determined by evaluating the end-user needs, and IT requirements.

Category 6, 23 AWG should be installed for all Power-Over-Ethernet (POE) applications to more effectively dissipate heat generated from the power applications.

Outlet, and Cable Labeling - These are essential to the successful installation, testing, and quality control of cabling systems. The designer shall provide labeling identification for outlets on plans, and provide a labeling schedule for each outlet using

the labeling scheme provided by IT. The outlet plan and schedule are to be kept updated at each phase. The contractor is to maintain the outlet plan, and schedule in the project's as-built drawings and as-built schedule during construction. The outlet as-built plans and outlet schedule shall be made available upon request to IT during construction for inspection, quality control, or other purposes. A copy of the changes to the outlet schedule and plans shall be provided to IT two weeks before occupancy. A final copy of the plans and schedule is to be submitted directly to IT as part of the final document submittal.

The NEC specifies installation ratings in plenum and non-plenum environments. However, the plenum-rated cable should be used exclusively in new and retrofit installations. Exceptions to the use of plenum-rated cabling must be approved by IT, and the AHJ (Authority Having Jurisdiction) for code requirements. This decision is dependent upon requirements met in NFPA 90A and conditions.

Optical fiber and multimedia cabling may be required for special applications in horizontal cabling. The needs for these special applications need to be identified during programming. A centralized optical fiber distribution topology may be acceptable for limited distribution of horizontal optical cabling to the desktop and is subject to the approval of IT.

CATV/CCTV Media Cable – CATV service is managed by UNM Purchasing. In many locations on campus, coaxial cable is used for television signal distribution. In general, where this is required for legacy CATV (Community Antenna Television) distribution, a system of RG-6, and RG-11 cables should be installed. RG-6 will typically be sufficient for station or “drop” cable, whereas RG-11 is better suited for backbone cable use. Coaxial cable distribution systems require individual engineering for each building location which includes the placement of active, and passive components (amplifiers, splitters, and taps) at specific points in the system to ensure proper signal levels. As with the UTP cable, the plenum-rated coaxial cable should be installed. The designer shall verify CATV requirements, and include CATV, and CCTV systems in their needs assessment.

Wireless Data - Wireless access points (WAPs or APs) shall be planned for, and installed per the requirements of the end-users, and the requirements set forth by IT Wireless. Wireless shall be deployed in all public areas such as classrooms, conference rooms, study areas, stadiums, open areas adjacent to buildings, etc.

Typically, a wireless access point survey will be conducted by IT Networking. For final placement so cabling for the access points needs to be planned for an extension of up to 25 feet. Typical power deployment for wireless at UNM uses Power-Over-Ethernet

Technology (POE) eliminates the need for a power outlet at the access point. The requirements for wireless service can vary depending on the planned use of the system, and the exact system requirements. These needs should be determined during programming, and early design with assistance from IT because of budgetary, and service considerations. For specific wireless deployment, guidelines refer to the UNM Wireless Guideline Specification 2715 53 and contact IT Networks for specific requirements and assessment.

Multimedia, Visualization Labs, and High Technology Classrooms - New Classrooms, meeting rooms, auditoriums, and other areas that have requirements for high-speed data, video, teleconferencing, and other technology applications must be planned for, and installed according to the needs of the end-users, and the University's Information Technology Department. All related requirements should be planned, programmed, designed, and approved by the Office of the CIO/IT. Systems shall be designed and installed to the manufacturer's specifications, and applicable ANSI/ISO standards. Provide an equipment and system warranty as well an equipment schedule, and owner's manuals to IT two weeks before occupancy. Coordinate, and verify cabling, and /or wireless equipment transport requirements.

Special Conditions – The Design Team shall identify special requirements for work done in operational areas adjacent to or within projects. Special instructions shall be given about dust, and water mitigation, security, occupant safety, utility location, traffic control, and similar needs or conditions. Special considerations and precautions shall be given to areas that provide patient care, research, artifacts, and similar areas.

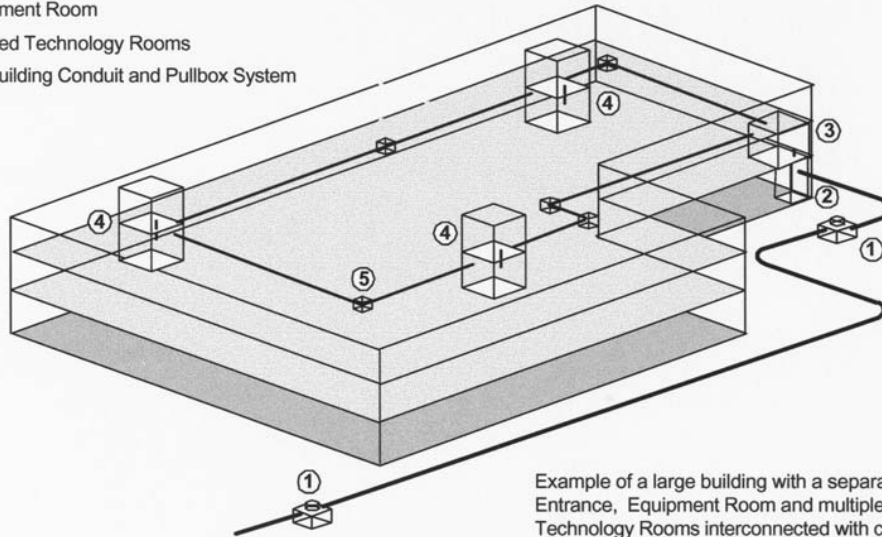
7. Design Criteria – Spaces

The information provided in this document contains common work requirements with other trades, and disciplines. The design team is responsible for that common work results are included in the design and are distributed to all disciplines to ensure continuity in the design, and construction of IT project requirements.

(Continued on Next Page)

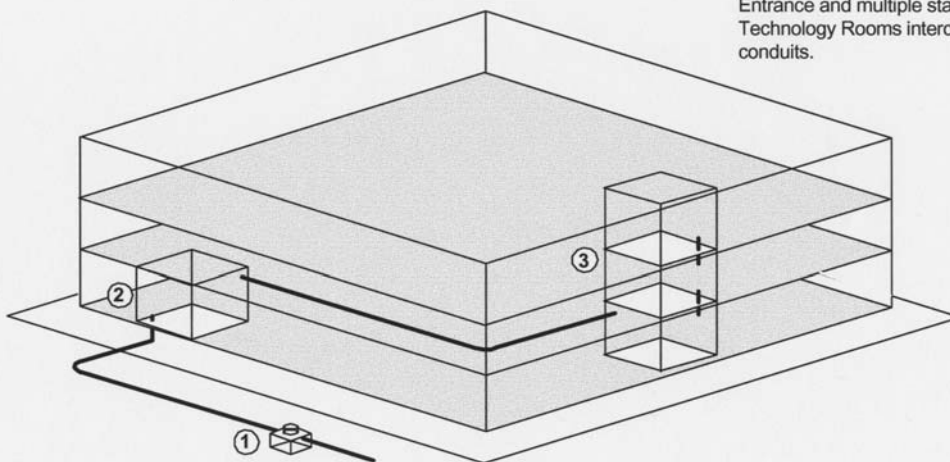
Typical Building Infrastructure with a Service Entrance

- ① Interbuilding Manholes
- ② Service Entrance
- ③ Equipment Room
- ④ Stacked Technology Rooms
- ⑤ Intrabuilding Conduit and Pullbox System



Typical Building with a Combined Service and Equipment Room

- ① Interbuilding Manhole
- ② Equipment Room with Service Entrance Facilities
- ③ Stacked Technology Rooms

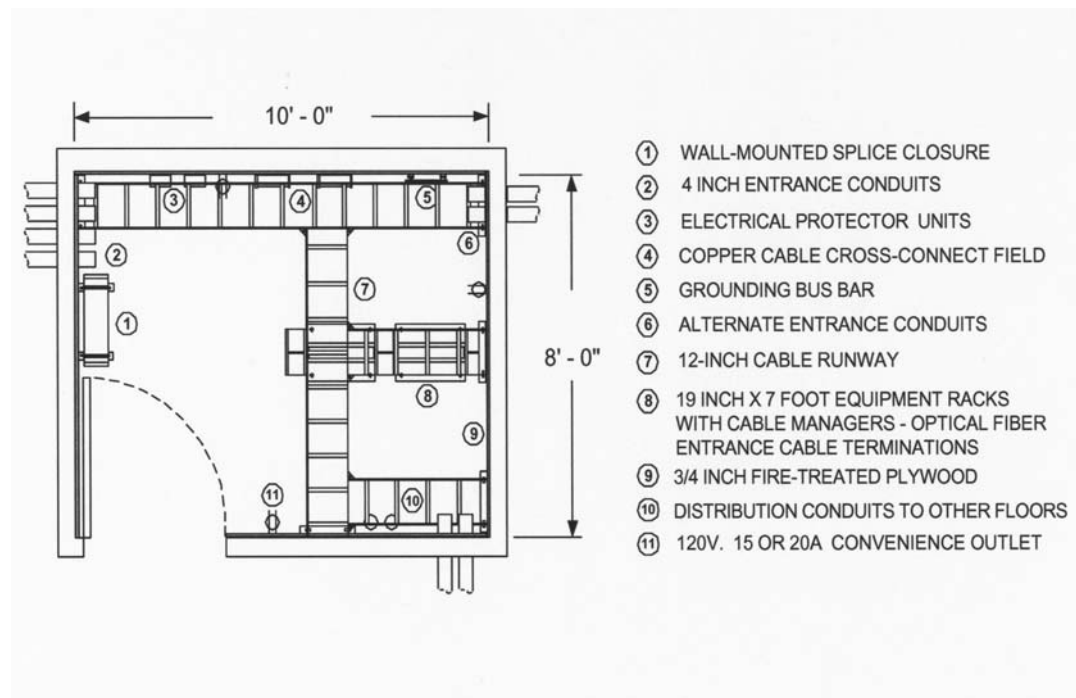


8. Design Criteria for Service Entrances

Size, and Location of Service Entrance - A separate Service Entrance may be required in large buildings where a separate Equipment Room is to be built. In buildings of 10,000 sq. ft. or larger, a room size of 100 sq. ft. is the minimum size with a minimum dimension of 10 feet. The Service Entrance shall be dedicated solely to Information Technology, and related facilities. Equipment that does not support the Service Entrance (e. g., pipes, duct work, distribution of building power) shall not be located in or pass through the Service Entrance. Do not locate Service Entrances in any place that may be subject to water infiltration, steam infiltration, humidity from nearby water or steam, heat (e. g., direct sunlight), or any other corrosive atmospheric or adverse environmental conditions. Avoid locations that are below water level unless preventive measures against water infiltration are employed.

Locate the Service Entrance far enough away from sources of EMI to reduce interference with the telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, Magnetic Resonance Imaging (MRI), X-ray equipment, radio transmitters, radar transmitters, and induction heating devices. Provide conduits for both primary, and redundant entry points into the buildings.

Typical Service Entrance



Ceiling Clearance - The minimum ceiling clearance shall be 9.5 ft above the finished floor with ceiling protrusions (e. g., sprinkler heads) placed to assure a minimum clear height of 9 ft. clear of obstructions, to provide space overhead for Ladder Racks or cable trays, and conduits. To permit maximum flexibility, and accessibility of cabling pathways, ceilings are not acceptable for in-Service Entrances.

Doors and Access Control Service Entrances - Doors should be equipped with electronic access-controlled locks, and be at least 3 ft. wide, and 7 ft. tall. Doors should be equipped with sweeps; however, doorsills are not recommended because they impede the movement of equipment.

Note: Doors should be provided that open outward unless prohibited by code. This provides additional usable space and reduces constraints on the service entrance room layout, and space requirements.

Flood Prevention - Locate the Service Entrance Rooms above any threat of flooding. Avoid locations that are below or adjacent to areas of a potential water hazard (e. g., restrooms, and kitchens). Ensure walls are sealed to prevent water seepage. Provide a floor drain to prevent flooding from the accidental seepage of water from entrance cables, and ducts. It is recommended that a water detection alarm system be installed in the service entrance room.

Cable Trays, and Raceways - Provide ladder-type cable trays, splice supports, and other support devices to support entrance cables. Also, include 4-inch rigid conduits or heavy-duty ladder-type trays to extend cabling to the building equipment room.

Note: Cables exiting the service entrance room shall be transitioned from an outdoor-rated cable to the NEC-specified fire-rated cable type, and fire-sealed to meet code requirements.

Wall Requirements - Service Entrance walls should extend from the finished floor to the structural ceiling (e. g., the slab), be painted white, and be fire-rated for a minimum of one hour. Service Entrance walls should not have windows installed, nor is it desirable to locate Service Entrances on perimeter/curtain walls where windows comprise the entire surface of the wall.

Backboards - Provide AC-grade plywood, 8 ft. high with a minimum thickness of 0.75 in. around the perimeter of the room. Plywood shall be fire-rated and treated on all sides with at least two coats of white latex, or preferably, white, fire-resistant paint. The bottom of the plywood shall be mounted 18 in. AFF (Above Finished Floor).

Lighting - Provide adequate, and uniform lighting that provides a minimum equivalent of 50 foot-c, and less when measured 3 ft. above the finished floor level. Locate light

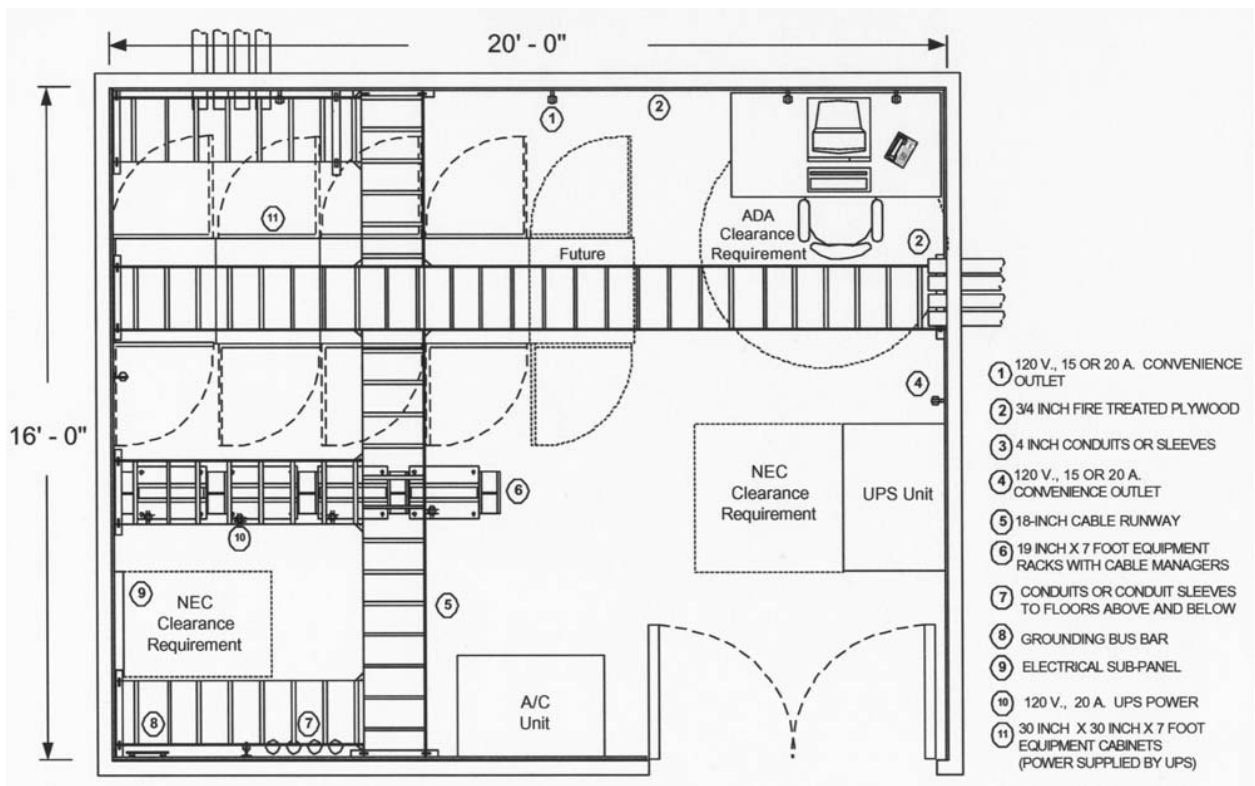
fixtures a minimum of 9 ft. above the finished floor. Locate light switches near the entrance to the Technology Room.

Environmental Control - The Service Entrance should be provided with ventilation, heat, and cooling which is similar to a standard office space to prevent extremes in temperature, and humidity. Unless active electronic components are present, separate, 7 x 24-hour environmental control is not required.

Power and Grounding - Provide 120 V., 15A or 20A, 60 Hz, non-switched, convenience power receptacles (NEMA 5-15R, 5-20R) on perimeter walls. Outlets should be recessed in walls, surface-mounted outlets, and conduits are not acceptable. A ground bus, connected directly to the building ground shall also be provided, using a conductor sized as required to provide a minimum of 2 Ohms of resistance. Provide labeling that states: "DO NOT DISCONNECT".

Fire Control and Detection - The Service Entrance should be equipped with a standard pressurized fire sprinkler system as required for a general office, and common spaces. Smoke detectors connected to a central fire alarm panel within the building shall also be provided

9. Design Criteria for Equipment Rooms



Size and Location of Equipment Room - The Equipment Room may vary from 150 sq. ft. to 1000 sq. ft or larger, with a minimum dimension of 15 ft. in one direction. The size of the Equipment Room must be determined by the footprint of the equipment to be installed to assure proper sizing and include space for future equipment installation. The final size of the Equipment Room shall be approved by IT.

If the Equipment Room supports the outside cabling connections, it shall be located so that it can support two physically separate points of entry. The space shall be planned to accommodate the outside plant cabling, and other systems located in the equipment room when no Service Entrance room is provided. The Equipment Room shall be accessible for the delivery of large equipment throughout its useful life.

Collocation of other approved low voltage systems in the technology room may require additional space allocation in the room. The Equipment Room may also serve as a distribution point for horizontal cabling. If so, the equipment shall be located to accommodate horizontal cabling distance requirements of 295 feet to the voice/data outlet. The room should also be aligned for a vertical riser to the Telecommunications Rooms on each floor.

Unacceptable Locations - The Equipment Room shall be dedicated solely to telecommunications, campus backbone cabling, centralized computer equipment, and other related infrastructure. Do not locate Equipment Rooms in any place that may be subject to water infiltration, steam infiltration, humidity from nearby water or steam, heat (e. g., direct sunlight), or any other corrosive atmospheric or adverse environmental conditions. Avoid locations that are below water level unless preventive measures against water infiltration are employed. Locate the Equipment Room far enough away from sources of EMI to reduce interference with the telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, Magnetic Resonance Imaging (MRI), X-ray equipment, radio transmitters, radar transmitters, and induction heating devices. As Equipment Rooms are frequently occupied by working technicians and sensitive electronic equipment, the room location should not be adjacent to sources of constant, excessive, low, or high-frequency noise, such as air-handling equipment, pumps, generators, and the like.

Note: Systems that do not support the Equipment Room (e. g., pipes, duct work, distribution of building power) shall not be located in or pass through the Equipment Room. This includes plumbing, electrical, HVAC, gas, and other utilities.

Architectural Requirements

Clearances - The following clearances shall be maintained for equipment racks and cabinets in the Equipment Room. A minimum of 3 ft. of clear working space from equipment and cross-connect fields. Including an additional minimum of 6 in. depth off the wall for wall-mounted equipment. Aisle clearances shall be a minimum of 36 in. wide. Provide additional wall clearances for equipment that extends more than 6 inches from the wall.

Cable Pathways within the Equipment Room

Overhead Cable Trays - Cable tray systems shall be provided for routing equipment, and backbone cables between cross-connects, equipment, and backbone pathways. The tray shall be coordinated with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trays will not obstruct or impede their operation. Ladder racks and trays shall be specified in equipment rooms, and for all cable entrance points into rooms. The Cable Tray layout shall be approved by IT before construction, and a detailed drawing of the equipment room is to be provided. Ensure the cable tray systems are specified and supported to meet both the weight and the number of installed cables including an additional 40% of spaces for future growth. The sagging of cable trays is not acceptable.

Access Floor Systems - Access floors may be provided to route cables in large Equipment Rooms. Access floor systems (often called “raised floors”) are often recommended by equipment manufacturers and are frequently used for telecommunications cabling when the Equipment Room serves multiple applications for both computers, and PBX equipment). Raised floor applications require cable trays, and/or raceways for cabling distribution. Design, and install to code requirements, manufacturer specifications, and project requirements.

Ceiling Clearances - The minimum ceiling clearance shall be 9.5 ft. above the finished floor with ceiling protrusions (e. g., sprinkler heads) placed to assure a minimum of 9 ft. clear of obstructions, to provide space over the equipment frames for cables, and suspended cable trays. To permit maximum flexibility, and accessibility of cabling pathways, drop ceilings are not acceptable in Equipment Rooms. The ceiling space shall be open, and walls extended from floor to deck.

Doors and Entryways - Design entryways to accommodate the transport of heavy equipment in and out of the space. If freight elevators are not available design to accommodate rigging for equipment movement. Ensure the primary access is not impeded by stairs or other impediments to the movement of heavy equipment.

Equipment Rooms shall have doors that are at least 3.5 ft. wide, and 7 ft. tall and equipped with a door sweep. Since large equipment is often located in the Equipment

Room, a double door 6 ft. wide by 7.5 ft. tall is recommended. Doorsills are not recommended because they impede the movement of equipment. Outside door access is preferred with an entrance to the inner building or provides direct access from a public area or hallway.

Ensure that doors are installed, and lockable before cable termination, and equipment installation.

Note: Doors that open outward (unless prohibited by code) provide additional usable space and reduce constraints on the Equipment Room layout. Additional space shall be provided to provide for the loss of usable space when doors open inward of the equipment room.

Security and Access Control - Equipment Rooms will typically house high-value and mission-critical electronic equipment. Electronically controlled access systems (proximity readers, card swipe, etc.) shall be provided to ensure restricted access. Planners should consider the addition of security surveillance systems to record ingress, and egress occurrences for Equipment Rooms that are not frequently occupied by technicians. Provide final key requirements to the UNM Police, and Lock Shop.

Dust and Static Electricity - Bare concrete floors are a considerable source of dust, and conventional vinyl floor tile promotes the generation of static electricity. Anti-static floor tiles should be provided in each Equipment Room. Embed 2 in. copper tape between the anti-static tile, and the conductive adhesive 1.5 feet from the wall. Leave 12 in. of copper tape exposed above the anti-static tile for grounding to the copper signal ground busbar in each Equipment Room.

Note: Ensure that the Equipment Room is free, and sealed from dust before cable termination, and equipment installation. Provide doors, locks, and seal penetrations before the termination of cabling, installation of IT hardware, and equipment.

Flood Prevention - Locate Equipment Rooms above any threat of flooding. Avoid locations that are below or adjacent to areas of a potential water hazard (e. g., restrooms, and kitchens). Do not install fan coil units or water piping in equipment rooms overhead. Place water detection alarm devices in the room.

Wall Requirements - Equipment Room walls should extend from the finished floor to the structural ceiling (e. g., the slab), be covered with two coats of white latex or fire-retardant white paint, and be fire rated for a minimum of one hour. Equipment Room walls should not have windows installed, nor is it desirable to locate Equipment Rooms on perimeter/curtain walls where windows comprise the entire surface of the wall.

Backboard - Provide AC-grade plywood, 8 ft. high with a minimum thickness of 0.75 in. around the perimeter of the room. Plywood shall be fire-retardant and treated on all sides with at least two coats of fire-resistant paint. The bottom of the plywood shall be mounted 18 in AFF (above the finished floor). Ensure the fire-retardant stamp is visible in one location.

Structural Requirements - The floor rating under distributed loading must be 4.8 kPa – 12kPa(100-250 lbs/sq.ft.), and the rating for concentrated loading must be greater than 8.8 kN (2000 lb/sq.ft) in areas that will support telecommunications equipment such as batteries, and UPS equipment. If access flooring is used in the Equipment Room, it must be rated accordingly. Provide a minimum of 18” of clearance underneath raised floor applications and verify exact raised floor height requirements with IT before specification. Verify floor loading requirements to the requirements of the planned equipment installation.

Mechanical System (HVAC) Requirements

Environmental Control - Provide Equipment Room with either dedicated HVAC equipment or access to the main HVAC delivery system. Thermostatic controls should be located within the room itself to prevent setting changes by unauthorized personnel. IT equipment requires the HVAC system to function 24 hours per day, 365 days per year. If a building's HVAC system cannot ensure continuous operation (including weekends, and holidays), provide a stand-alone HVAC unit with independent controls for the Equipment Room. If an emergency power source is available in the building, connect the HVAC system that serves the Equipment Room to it.

Plan the design of HVAC systems for easy future upgrades and replacement. The heat dissipation requirements for IT equipment are increasing with the need for more power to produce higher bandwidth transmission.

The HVAC system that serves the Equipment Room should be tuned to maintain a positive air pressure differential for surrounding areas with a minimum of one air change per hour in the Equipment Room. Provide equipment to control humidity, and air quality if needed.

Provide HVAC that will maintain continuous and dedicated environmental control (24 hours per day, 365 days per year). The system shall include a manual thermostat within the room for override control as required. Maintain positive pressure with a minimum of one air change per hour in the Technology Room.

Temperature: mean of 63 degrees with an operating range of 41 to 86 degrees

Relative Humidity: 15 to 65%

Estimated Heat Loads: 2500 to 7,500 BTU per equipment cabinet or rack. Verify exact requirements.

Estimated Heat Loads for Server Rooms should be calculated using the following:
Estimate 5-7 Kilowatts per rack. The conversion is 3,412 BTUs Per 1KW.

Note: The mounting of HVAC units or water piping above equipment or equipment racks shall not be permitted. Do not locate HVAC units requiring chilled water or drainage in the equipment room. Install drains for condensation lines.

Install heaters when necessary to achieve proper humidity levels.

The need for a humidifier shall be evaluated when interfacing an HVAC unit into spaces with swamp coolers or other high-humidity areas.

Electrical System Requirements

Lighting - Provide adequate and uniform lighting that provides a minimum equivalent of 50-foot candles when measured at the finished floor level, and properly distributed throughout the room. Locate light fixtures a minimum of 9 ft. above the finished floor. Locate light switches near the entrance to the Equipment Room.

Emergency lighting systems that operate on trickle-charge storage batteries are required as a safety precaution in the event of an inadvertent power outage or emergency power shutdown.

Coordinate the lighting layout with the equipment layout, especially overhead cable trays, to ensure the light is not obstructed. Power for the lighting shall not come from the same circuits as power for the telecommunications equipment.

Power - Verify exact equipment power requirements with IT. Coordinate exact power requirements for equipment, and footprint with ITS before design.

Note: All power outages shall be coordinated, and approved by IT. Once operational, notice shall be given at least seven days in advance of the outage to IT.

Provide individual branch circuits serving a single load from the feeder panel directly to a branch circuit receptacle or equipment power terminal (for hardwired equipment).

Provide branch circuits for equipment power that are protected, and wired for 110V, 30A (NEMA L5-30R), and 208V, 20A (NEMA L6-20R) as shown on the drawings.

Provide above each equipment rack dedicated to electronic equipment a tray mounted dedicated to 110 V 20A 4-plex, 110V 20A twist lock, and 208V 20A outlets secured to cable tray, and mounted above the equipment racks in addition to wall outlets.

At a minimum, provide wall mounted dedicated, non-switched 20A, 120 Volt (V) alternating current (AC) with locking electrical outlets (NEMA L5-20R), and straight blade NEMA 5-20R receptacles for equipment power, each on separate branch circuits. Dependent on equipment requirements, wall mounted 208VAC power may also be required.

If emergency power is provided for the building, provide emergency service to the equipment room for dedicated power. Connect lighting, and HVAC to the generator. Generator emergency power is necessary to provide uninterrupted voice service for VOIP service and certain data networking requirements for an extended service beyond UPS capacity. Verify the requirement for a power generator with IT during programming, and before design.

Any outlets in the Equipment Room that are protected by UPS or generator power shall be terminated on red receptacles for ease of identification identify dedicated power outlets by circuit number labeling All outlets must be on non-switched circuits.

Design, and provide power, space, and rack(s) for a rectifier, and or batteries when needed. Verify requirements with IT.

UNM ITS will provide local UPS to power essential IT equipment.

Maintain the clearances specified in the NEC between power, and IT equipment.

If the Equipment Room houses RF-generating equipment, power should originate from an isolation transformer.

Do not install transformers or other high EMI emitting equipment in any technology or equipment room.

Do not install transformers in any technology or equipment room.

If the Equipment Room houses RF-generating equipment power should originate from an isolation transformer.

Provide surge protection for equipment power circuitry.

Emergency Power-Off Switches (EPO) - The Equipment Room shall have an Emergency Power Off Switch (EPO) located in the corridor adjacent to the entrance of the Equipment Room. EPO switches control power to all equipment within the particular room and allows for a complete power shutdown in the event of a fire or other extreme

emergency. The EPO switch also needs to control power to the rectifier, batteries (if present), and the HVAC system. The EPO switch shall also have signage, and a hinged, clear plastic cover installed over it to prevent accidental power shutdown. Signage shall note Emergency Power Shut Off.

Convenience Power - Provide separate duplex 120 V AC convenience outlets (NEMA 5-15R) for tools, test sets, etc., located at least 15 in. above the finished floor, placed at approximately 6 ft. intervals around perimeter walls, and identified, and marked as such. Label outlets to identify them for convenience.

Dedicated Power Feeders - Provide Equipment Rooms with a power supply circuit that serves only the Equipment Room and terminates in its electrical panel.

The feeders that supply the power for telecommunications equipment in Equipment Rooms and Technology Rooms should be dedicated only to supplying that equipment.

More than one dedicated feeder may be required for large installations with a wide variety of telecommunications equipment. Power required for other equipment in the room (e. g., fluorescent lighting, motors, and air conditioning equipment) shall be supplied by a separate feeder, conduit, and distribution panel.

Backup Power - Because of the “mission-critical” nature of the Equipment Room, it is strongly recommended that backup power be provided, allowing a controlled shutdown of the equipment in the event of a power failure. If emergency power is provided for the building, provide emergency service to the equipment room for dedicated power. Lighting and HVAC should be connected to the generator. A single module UPS with parallel (maintenance) bypass, 100% isolation from raw utility power, and 30-minute (exp, and able to -minute) battery capacity at full load shall be provided. Any outlets in the Equipment Room that are protected by UPS or generator power shall be terminated on red receptacles for ease of identification.

Bonding and Grounding - Provide a copper signal ground busbar in each Equipment Room. The ground conductor shall be copper cable sized as required to provide less than 2 Ohms of resistance. The conductor shall be cad-welded directly to the Ufer Ground, Main Building Entrance Ground, or building steel. Provide labeling that states: “DO NOT DISCONNECT”. Ground bars shall minimally comply with the TIA 607 standard. Bonding of the cable tray and conduits must be continuous from the TGB in each Telecommunications room to TMGB located in the equipment room. Continue bonds to each equipment rack. Bond each equipment rack individually to TMGB or TMG.

Fire Suppression System Requirements

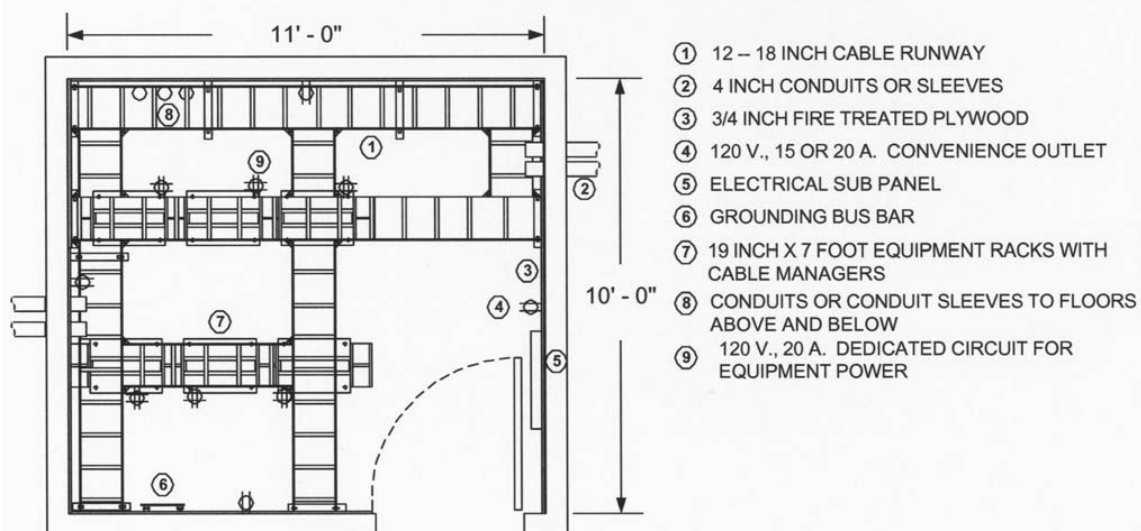
General - Coordinate the layout of fire protection systems with the equipment layout to avoid obstructing sprinklers, access to the alarm, or other protective measures.

Pre-action Sprinkler Systems - Provide a fire alarm system with heat, and smoke detectors and a multi-zone, pre-action, dry pipe fire suppression system. A manual fire suppression “hold-off” shall be installed adjacent to the main entrance to the data center. Locate a phone and data connection in the Equipment Room to contact emergency response personnel. Provide sprinkler heads in wire cages to prevent accidental operation.

Gas Fire Suppression Systems - Dependent upon the density and criticality of electronic equipment housed in the Equipment Room, planners should consider the installation of a gas fire suppression system. An example of where this may be appropriate is Core Network Hub Rooms. Gas fire suppression systems such as FM 200 systems employing agents such as Heptafluoropropane require the construction of an air-tight envelope, provision of space for tanks, and manifold equipment as well as special discharge annunciator systems. For this reason, planners must weigh the acquisition costs of these systems versus the risk of extended service outages that could be caused by a catastrophic fire in the most critical Equipment Rooms.

Portable Fire Extinguishers - Mount portable fire extinguishers (with the appropriate ratings) in the Equipment Room as close to the entrance.

10. Criteria for Technology Rooms



Size and Location of Technology Rooms

Floor Space Served - There must be at least one Technology Room per floor or up to 10,000 sq ft. Multiple rooms are required if the cable length between the Technology Room, and the telecommunications outlet, including slack, exceed 295 ft.

Size Requirements - Technology Rooms shall be minimally 100 to 120 Sq. Ft. in size, depending on the systems they will contain. The rooms shall be roughly square, with a minimum clear dimension of 10 ft. in one direction. The size of the Technology Room must be determined by the footprints of equipment to be installed to assure proper sizing. Collocation of other approved low voltage systems in the technology room will require additional space allocation in the room. Ensure space for special data systems such as LANs, CATV, security alarms, access controls, building controls, sound masking, patient monitoring, and healthcare and educational systems.

Clearances - The following clearances shall be maintained for equipment, and cross-connect fields in the Technology Room:

A minimum of 36 in. of clear working spaces for aisles, in front of and behind equipment and patch panels, doorways, electrical panels, and other equipment shall be maintained. Calculate to include clearances from wall mounted equipment.

A minimum of 6 in. clearance depth off the wall for wall-mounted equipment.

Verify equipment footprints: design equipment, and fixtures to ensure working clearances with the future growth of minimally one rack. Provide additional wall clearances for equipment that extends more than 6 inches from the wall.

Architectural Requirements

Ceiling Clearance - The minimum ceiling clearance shall be 9.5 ft. above the finished floor. To permit maximum flexibility and accessibility of cabling pathways, suspended ceilings are not allowed in Technology Rooms. The ceiling shall be open from floor to deck.

Doors - Technology Rooms shall have doors with electronically controlled access that are at least 36 inches wide, and 7 ft. tall. Doors shall be equipped with sweeps; however, doorsills are not recommended because they impede the movement of equipment. Provide doors that open outward unless prohibited by Code, Ensure the primary access is not impeded by stairs or other impediments to the movement of heavy equipment. Provide direct access from a public area or hallway. Ensure 36 -inch clearances from all equipment. Ensure that doors (temporary or permanent) to Technology Rooms are installed before cable hardware installation and termination.

Dust and Static Electricity - Bare concrete floors are a considerable source of dust and conventional vinyl floor tile promotes the generation of static electricity. Anti-static floor tiles should be provided in each Equipment Room. Embed 2 in. copper tape between the anti-static tile, and the conductive adhesive 1.5 feet from the wall. Leave 12 in. of copper tape exposed above the anti-static tile for grounding to the copper signal ground busbar in each Technology Room.

Before the installation of technology hardware, and cable termination, ensure that room is clean and free of dust and dirt.

Flood Prevention - If possible, locate Technology Rooms above any threat of flooding. Avoid locations that are below or adjacent to areas of a potential water hazard (e. g., restrooms, and kitchens).

Floor Loading - In general, provide a minimum floor loading of 2.4 kPa – 4.8 kPa(50 – 100 lb/sq.ft.). Ultimately, the Architect shall determine structural requirements.

Other Uses - Technology Rooms must be dedicated to Information Technology functions including multimedia, CATV, CCTV, classroom technologies, and related support facilities, such as alarms, and other low-voltage communications systems. Equipment not related to the support of the Technology Rooms such as piping, duct work, and distribution of building power shall not be located in, or pass through, the Technology Room. Technology Rooms must not be used as passageways for unauthorized persons to other facilities within the building. Technology Rooms shall not have roof access for maintenance (such as hatches) that could pose security or environmental (i.e., rain leakage) threats.

Wall Requirements - Technology Room walls shall extend from the finished floor to the structural ceiling (e.g., the slab), be covered with two coats of white latex or fire-retardant white paint, and be one (1) hour fire-rated or as required by the applicable codes, and regulations. Technology Room walls should not have windows installed, nor is it desirable to locate Technology Rooms on perimeter/curtain walls where windows comprise the entire surface of the wall.

Backboard - Provide AC- grade or better plywood, 8 ft. high with a minimum thickness of 0.75 in. around the perimeter of the room. Plywood shall be either fire-rated or treated on all sides with at least two coats of fire-resistant paint. The bottom of the plywood shall be mounted 18 in. AFF (Above Finished Floor). Keep visible the fire-rated labeling on plywood.

Mechanical System (HVAC) Requirements

Provide HVAC that will maintain continuous and dedicated environmental control (24 hours per day, 365 days per year). If the building's HVAC system cannot ensure

continuous operation (including weekends, and holidays), provide a stand-alone HVAC unit with independent controls for the Technology Room. Thermostatic controls should be located within the room itself to prevent setting changes by unauthorized personnel. Maintain positive pressure with a minimum of one air change per hour in the Technology Room. Design to accommodate future HVAC upgrades and replacements.

Provide:

Temperature: Mean of 63 degrees with an operating range of 41 to 86 degrees

Relative Humidity: 15 to 65%

Estimated Heat Loads: 2500 to 7,500 BTU per equipment cabinet or rack.

The mounting of HVAC units or water piping above equipment racks shall not be permitted. Install drains for condensation lines. Install heaters when necessary to achieve proper humidity levels.

Electrical System Requirements

Lighting - Provide a minimum equivalent of 500 Lux (50 foot-c, and less) measured at floor level, evenly distributed. Locate light fixtures a minimum of 2.6 m (8.5 ft) above the finished floor. Emergency lighting systems that operate on trickle-charge storage batteries are required as a safety precaution in the event of an inadvertent power outage.

Coordinate lighting with equipment racks, trays, HVAC equipment, and other obstructions to ensure the required light levels. Power for lighting shall not be on circuits providing power for IT equipment or convenience outlets.

Power - Technology Rooms shall be equipped to provide adequate electrical power. Verify all equipment power requirements with IT.

At a minimum, provide three (3) wall mounted dedicated, non-switched 20A, 120 Volt (V) alternating current (AC) with locking electrical outlets (NEMA L5-20R), and straight blade NEMA 5-20R receptacles for equipment power on racks, each on separate branch circuits.

Provide tray-mounted dedicated 110 V 20A 4 plex, 110V 20A twist lock, and 208V 20A outlets secured to cable tray and mounted above the equipment racks in addition to wall outlets. Dependent on equipment requirements, wall mounted 208VAC power may also be required.

Do not install transformers in any technology room. If the Technology Room houses RF-generating equipment power should originate from an isolation transformer.

The room should include a dedicated power panel that supports both voltages to allow for the future addition of circuits and allow for isolated equipment shutdowns.

Provide circuit number labeling on dedicated outlets. Dedicated power should feed from the dedicated panel in the Equipment Room.

If emergency power is provided for the building, provide emergency service to the Technology room for dedicated power. Connect lighting, and HVAC to the generator. UNM IT will provide UPSs to power essential IT equipment

Any outlets in the Technology Room that are protected by UPS or generator power shall be terminated on red receptacles for ease of identification.

Provide separate duplex 120 V AC convenience outlets (NEMA 5-15R or 5-20R) for tools, test sets, etc., located at least 18 in. above the finished floor, placed at approximately 6 ft. intervals around perimeter walls, and identified, and marked as such.

All outlets must be on non-switched circuits. Provide surge protection for equipment circuitry.

Bonding and Grounding - Provide a copper signal ground busbar in each Technology Room. The ground lead shall be a copper cable sized appropriately to provide a minimum of 2 Ohms of resistance, cad-welded to the Ufer Ground or building steel. Provide labeling that states: "DO NOT DISCONNECT".

Provide: Ground bars shall minimally comply with the TIA 607 standard.

Bonding of the cable tray, and conduits must be continuous from the TGB in each Technology Room to TMGB located in the equipment room. Continue bonds to each equipment rack.

Bond each equipment rack individually to TMGB or TMG.

Fire Suppression System Requirements - Provide a wet-pipe system with sprinkler heads in wire cages to prevent accidental operation. Smoke detectors are required.

11. Communication Cable Trays

Purpose - Cable Tray is intended for above-ceiling installation for the creation of main pathways for the management of high volumes of cable through corridors, access, and egress to Equipment Rooms, and Technology Rooms.

General Installation Considerations

Coordination with Other Trades - Cable Tray installation must be coordinated continuously with the other trades, (Structural, Electrical, Mechanical, Ceiling installers, etc.,) during construction to ensure that it will be accessible once construction is completed. In general, the tray should be placed about 8 inches above the suspended ceiling to ensure access once the ceiling is in place. One (1) foot clearance shall be maintained on two sides of the cable tray.

Routing - Where possible, Cable Trays should be routed over common-use areas such as corridors, and not be routed over restrooms, or electrical rooms. Avoiding routes over classrooms, exam rooms, offices, and other private areas is important where repeated access to the tray would disrupt normal teaching or work activities. Use manufacturer specified turns, and waterfalls for elevation transitions. The cable tray shall be installed continuously. Use 4" inch conduits through a solid ceiling or inaccessible areas. Bonding of the cable tray, and conduits must be continuous. The capacity of the conduits shall equal the capacity of the cable tray. Maintain clearances from fluorescent lights, ballast, and other EMI sources as specified by the manufacturer of the cabling system, and the industry standards specified in this document.

Heavy Duty or Medium Cable - Tray shall be installed in areas where a high density of communication cable is to be installed. IT designers should be consulted during the early stages of design to determine the projected density of cable to be supported. Aluminum is preferable to steel due to weight, and corrosion considerations. A ladder rack-type cable tray is preferable as it allows access, and egress of cable from above or below the tray. Ladder-type cable trays shall be installed in equipment rooms, technology rooms, the corridors adjacent to those rooms, and areas supporting more than 200 cables. Solid bottom configurations may be required in transition areas, (e.g. across hard ceilings), in areas where the tray is accessible to the public, or in areas where the density of air handling equipment or structural members above the ceiling prohibit access to the tray. Flanges should be configured inward to assist in the containment of cable within the tray.

Light Duty Cable Tray - Welded wire or "Basket"-type Cable Tray is acceptable for installation in areas where the density of cable, typically 200 cables or less, does not warrant the installation of a Heavy or Medium Duty Cable Tray. Basket type tray is particularly well suited for installation below raised access floors. Install wire or welded-type cable tray areas where a two feet clearance is accessible from one side, and one foot from the top side. The arch of clearance shall be continuous.

Dimensions - In general, Cable Tray should be a minimum of 18" in. wide, with a depth of 4 in. Narrower cable tray may be acceptable for locations with low volumes of cable; however, a narrower Cable Tray shall not be substituted for the 18 in. standard without prior approval. Ensure rail height will accommodate future growth.

Support Requirements - Where possible and practical, wall-mounted angle brackets shall be used to support the cable tray. For locations away from a supporting wall, trapeze-style support is to be used along the span of the Cable Tray. The trapeze is constructed of channel stock (i.e., Unistrut), and 5/8" in. threaded rod. The trapeze support elevation should allow a minimum of 8" in. between the top edge of the cable tray, and the slab above. Appropriate threaded rod anchors are to be selected and approved by the Project Structural Engineer.

Install trapeze supports to the manufacturers' specifications, and at cable tray intersections, and terminations. Sagging of cable trays due to heavy cable loads is not acceptable.

Place labels on each side rail 20 feet apart: "Not for Support 'Do Not Stand or Walk'".

Seismic bracing for the Cable Tray as required by the Code shall be installed along Cable Tray routes. Coordination of lateral, and oblique bracing locations must be affected by the other disciplines whose equipment, and systems share the area above the suspended ceiling.

Cable Tray Bonding, and Grounding Requirements - Cable Tray shall be bonded to the Telecommunications Grounding Bus Bar in the Technology Room(s) on the same floor. All non-contiguous segments of the Cable Tray shall be bonded together using appropriately sized copper wire ensuring less than 2 Ohms of resistance, with crimp-on lugs. The lugs shall be bolted to each segment of the Cable Tray to ensure electrical continuity throughout the length of the Cable Tray system. Cable tray bonding shall minimally comply with the TIA 607 standard and meet the manufacturer's installation specification using manufacturer approved methods. Bonding of the cable tray, and conduits must be continuous from the TGB in each Telecommunications room to TMGB located in the equipment room.

Continue bonds to each equipment rack.

Cable Tray Fire and Smoke Stopping Requirements - Cable Trays that penetrate fire-rated walls shall be equipped with wall penetration sleeves at each location, and have approved fire stopping materials, and systems installed after the placement of the cable has been completed. Fire and smoke-stopping applications for cable trays must be re-enterable. The use of foam type products is not approved. Firestopping bricks and pillows are recommended for most applications. All systems are to be UL approved for

the application intended. Provide, and complete the manufacturer's fire-stopping label at all penetrations.

Communication Cable Ladder Rack - Ladder racks, shall be installed within Technology, and Equipment Rooms to route cable to or from sleeves, risers, ducts, cable trays to termination fields within equipment racks or mounted on walls. It does not have the trough characteristics of a cable tray and therefore, it provides continuous support with ease of access. This is highly desirable in Technology Rooms where moves, adds, and changes to cable routing are relatively frequent.

Install ladder racks around the perimeter of equipment rooms, and technology rooms. Provide cross runs of ladder racks perpendicular to perimeter runways while overhead, and parallel to equipment racks.

Materials and Applications - Ladder Rack is available in various widths and therefore may be used for a range of cable types, and volumes. Ladder Racks may be mounted vertically on walls and be used to support riser cable from floor to ceiling as it passes between floors.

Ladder Rack systems are typically contained within the confines of a single room or closet, and it is not normally installed through walls, floors, or ceilings in the same manner as a conduit, and cable tray. The well-designed Ladder Racks system uses a combination of the walls, the top of equipment racks, and threaded rods for bracing, and support.

The attachment of Ladder Racks to these components provides the integrity of a mutually supporting system. Provide manufacturer specified transitions, turns, waterfalls, and other parts to maintain bend radius requirements for the structured cabling system. Despite this level of structural integrity, Local Building Codes may require additional seismic bracing for code compliance.

Communication Ladder Racks Bonding and Grounding - In Technology and Equipment Rooms, the ladder rack system shall be bonded to the Telecommunications Ground Bus with an appropriately sized copper wire to ensure not more than 2 Ohms of resistance. In areas where Ladder Racks are installed outside of Technology and Equipment Rooms, including riser closets, and other locations, bonding, and grounding of Communication Ladder Racks is also required. Bond ladder racks to the cable tray distribution system.

12. Communications Conduit Systems

Purpose - Conduit is intended as a permanent, and continuous Intrabuilding pathway for communication cable. Conduits are used in locations where access to the cable tray is unavailable, where portions of the pathway span are inaccessible (i.e. embedded in walls) and used as a pathway for small quantities of cable where the cable tray is impractical. Conduit is relatively easy to bend and it is used extensively to provide structured pathways where significant changes in cable direction are necessary.

Conduit is used to protect the cable from damage and to minimize EMI interference. In addition, certain conduit materials may be used to house non-rated cables between endpoints to ensure NEC Code compliance.

Conduit General - All conduits shall be supported to meet code requirements. Ream all conduits ends. Install bushings at all ends and terminate in boxes. Conduits shall not extend beyond terminators and shall not extend into boxes. Does not use pull boxes or LB's for conduit turns. Maintain conduit diameter when h, and bending.

Conduit Quantity, and Diameter - The quantity and diameter of conduits vary with their application. In general, large-diameter conduits, such as 4-inch conduits, are typically used for major trunk routes, and they are installed in multiples to provide spare capacity. Install 4-inch conduits in all Intra and inter-building pathways including building entrances.

Conduit Bend Limitations - In general, conduits shall not have more than 180 degrees of bends or turns in a segment without the installation of a pull box. The placement of pull boxes must be considered as another contender for above-ceiling space when planning conduit routes. Typically supply large pull boxes with hinged covers that are accessible from the bottom of the box. Provide sufficient access to the cover to perform cable-pulling operations.

Conduit Fill Ratios - Communication Conduits have fill limitations based on the number, and size of cables installed within them. Planning the number, and diameter of conduits required for specific routes should be based on the anticipated cable load, and guidance for fill ratio calculations provided in ANSI/ TIA/EIA/569, and the NEC.

Provide for a 40% growth of the cable system for future installations.

Conduits to Individual Communication Outlets, Floor Boxes, and SMR - Conduits serving individual workstation outlets are smaller in diameter, and typically are specified to be 1.00 inches in diameter for up to six cables for Category 6, four cables for Category 6 10G FUTP, or 3 cables for Category 6 A 10G. Conduit to floor boxes should be 1.50 inches in diameter. In new construction, conduits should be run continuously

from the outlet box to the cable tray installing pull boxes where necessary to meet bend radius requirements. They are to be connected to double-gang, deep device boxes (2 1/8" "box with a 1" box extension, and mud ring), equipped with a single-gang drywall ring at the outlet location.

Conduits to Surface Mounted Raceways (SMR) shall be sized to equal the capacity of the SMR channel or cabling capacity. The raceway size of the SMR must be designed to meet the size, and number of cables to be installed, and include space for the installation of communication outlets. Individual workstation conduits are to be dedicated to only one outlet box, floor box, or SMR each, and shall not be "daisy-chained" together. Install SMR to meet the bend radius requirements of category 6, and above cables

Note: The designer is to verify outlet box specifications, and ensure adequate space is provided to meet all warranty requirements, bend radius, and termination requirements.

Conduits to Building Roof - A minimum of one 2-inch rigid galvanized steel conduit should be installed which penetrates the roof membrane and routed to the Technology Room on the uppermost floor of the building. This conduit will provide a pathway to the roof for the connection of antennas to the building backbone. The penetration of the roof must be weather sealed as specified by UNM Facilities. The exposed end of the conduit shall be equipped with a weather head to prevent the entrance of moisture, insects, birds, etc. Should the penetration point not be collocated with the antenna placement location, and it is not practical to route, the conduit within the building shall be placed along the roof from the penetration in the roof of the Technology Room to where the antenna is to be set.

Note: Horizontal conduit shall be affixed to free-standing redwood blocks (2" X 4" X 12") with galvanized conduit straps or other approved rooftop supports. The redwood blocks are to be placed along the route from penetration to the antenna site no more than 8 feet apart. Should the antenna require power for steering motors, separate power conduits must also be provided. Coordinate, and ensure the conduit installation maintains the roof warranty.

Conduit Materials

Rigid Galvanized Steel - (RGS, or Rigid Metallic Conduit [RMC] per NEC) is used in areas exposed to the outside elements both above and below ground or in hazardous conditions, etc. It is an optional material specified by the NEC for the containment of non-rated cables that pose a smoke inhalation hazard in the case of fire. RGS Conduit is heavier than either Intermediate Metallic Conduit (IMC) or Thin wall Electrical Metallic Tubing (EMT) and thus requires more robust support structures to hold it in place. RGS also requires the use of threaded couplers and fittings that add to installation costs due

to the increased labor necessary to assemble several sections. The thickness of the walls of RGS Conduit makes the use of conduit bending machines an absolute necessity for field installation.

Intermediate Metallic Conduit - (IMC) IMC Conduit is used in areas exposed to the outside elements, and although it is Galvanized like RGS Conduit, its walls are of thinner gauge steel, and IMC is not often used in direct-buried applications. IMC Conduit is acceptable for non-rated cable installation. IMC Conduit may be used, however, to carry riser-rated cable, and inner duct in vertical, and horizontal cable applications. The thickness of the walls of IMC Conduit makes the use of Conduit bending machines strongly recommended.

Thin Wall Electrical Metallic Tubing (EMT) - EMT is used primarily for both high-, and low-voltage electrical installations within the confines of an environmentally controlled building. EMT is relatively light, and in smaller diameters, easy to form using only h, and tools. EMT Conduit connectors and fittings are available in two configurations, either the more commonly seen “Set-Screw” Type or the virtual airtight “Compression” Type fittings. In general, set-screw connectors, and fittings comply with NEC Code for low-voltage applications and are suitable for most installations. EMT Conduit is not acceptable for non-rated cable installations or building entrances. EMT Conduit may be used, however, to carry riser-rated cable, and inner duct in vertical, and horizontal cable applications. Short sections of EMT Conduit are commonly used as sleeves for wall penetrations, and floor cores for riser applications.

Flexible Conduit (Flex) - The use of a Flexible Conduit is not the preferred alternative for communication cable installation and shall not be used when EMT Conduit is practical for use. Installation of Flex Conduit is an acceptable option in congested ceilings, and walls, for connections into modular furniture, or similar applications when approved. When using Flex Conduit, increase the diameter of the Flex by one trade size over what the requirement would be using smooth-wall conduit.

Plastic Conduit/Polyvinyl Chloride (PVC)/Liquitight Conduit - Plastic, and PVC Conduit are to be used for underground duct construction between buildings, and vaults. Liquid tight Conduit is commonly used as a flexible pathway for higher voltage electrical conductors in wet environments. The use of Plastic, PVC, or Liquitight Conduit within buildings is not recommended due to NEC Code compliance issues for fire rating.

Innerduct - Innerduct is sometimes referred to as sub-duct, and is used primarily as a means to subdivide large diameter metallic or plastic Conduits into distinct pathways for fiber optic cable, however, copper cable is sometimes placed within Innerduct to prevent

tangling with other cables already present. Innerduct is available in plenum, riser-rated, and non-rated materials, for interior, and exterior applications, in a range of diameters, as well as a variety of colors for ease of identification. The most common configuration is corrugated Innerduct which is very flexible and provides a low friction pulling environment. Innerduct is produced in solid, and ribbed styles as well. Besides installation within the conduit, Innerduct can be placed by itself within cable trays, suspended from ceilings using cable hangers, and run vertically through sleeves as pathways for riser cables.

Conduit Support Requirements - Conduits require substantial support mechanisms such as channel stock/threaded rod trapeze supports. Individual Conduits may be supported using threaded rods with clamps. Conduits can also be attached to the underside of cable trays and affixed to walls where practical.

Supports are particularly critical at points on the pathway route where significant changes in direction (i.e. 90-degree bends) occur. This support is necessary due to the lateral forces incurred by the conduit when the cable is pulled through the bend itself. In some areas, seismic bracing of the conduit is required by local building codes. Accommodations for lateral, and oblique bracing struts must be coordinated with the other disciplines that vie for critical ceiling space.

Bonding and Grounding of Conduits - Bonding of Conduits to the Telecommunications Grounding System is required. At the termination of Conduit runs within Technology Rooms, attachment of a ground wire between the Telecommunications Ground Bus to grounding rings installed on Conduit box connectors should be accomplished to ensure electrical continuity of the conduit system. Bonding and grounding must be performed where metallic conduit is installed or embedded in concrete.

Firestopping of Conduits - Partially filled, and empty conduits that pass through fire-rated walls or floors shall be fire stopped per the NEC and Local Fire Codes. Metallic re-enterable listed devices are standard. Flexible non-hardening, fire stopping putty or pillows are also commonly used for smaller penetrations as these materials can be readily removed (and replaced) for additional cable installation when necessary.

Labeling of Conduit - All newly placed conduits designed to carry distribution cables, both fiber optic, and copper, shall be labeled as "Communications" at least every 25 feet. The labeling shall be permanent such as manufactured labels, stenciling or other IT agreed upon methods.

Miscellaneous Conduit Requirements - To protect the cable from damage during installation or static conditions following installation, Conduits should be cut square, with the cut ends reamed, and deburred. Plastic bushings shall be installed over each end of every Conduit. To facilitate cable installation, measured pull tape shall be placed in each Conduit from end to end, and secured. Conduit plugs are not necessary for empty or spare conduits in indoor environments, however, any empty conduit or duct which traverses the outdoors should have a conduit plug installed to prevent the introduction of noxious gases or water into the building.

Pull boxes -Intra Building Communication Cable System Pull Boxes - Pull Boxes are used in conjunction with conduit installations to provide access to cables at appropriate locations for distribution to tributary locations and to facilitate cable installation along the route after the length, and the number of bends in a conduit run make cable pulling difficult.

Materials - For indoor use, NEMA Type 1 pull boxes are adequate for most applications. For areas exposed to heavy moisture, chemicals, or weather elements, NEMA Type 3 or 4 Pull Boxes are usually required. The configuration of pull boxes varies, as some are equipped with hinged covers, and others with removable covers which are screwed or bolted on. The configuration selected should account for the accessibility of the pull box once all construction is completed, and other fixtures or finishes may interfere with the removal of the cover.

Placement - In general, a pull box is required every 100' feet of conduit run, and /or after 180 degrees of directional change has been affected. For example, a pull box should be placed along the route after two 90-degree bends, 25' feet apart are encountered. Consideration should be made for the direction of cable pulls, or, if this is ambiguous, pull boxes should be placed on both ends of such bends. The use of pull boxes for directional change itself shall be avoided since the pulling, and frictional forces absorbed by the inside radius of conduit sweeps cannot be mitigated. Pull boxes should be placed after bends in the conduit such that the resulting pulls are straight through the pull box, and the directional change is accommodated by the sweep of the conduit.

The size of pull boxes makes placement above suspended ceilings a challenge since in most commercial buildings, the area above the T-bar grid is typically congested with mechanical, and electrical equipment. This equipment occupies the area above ceilings in addition to structural components that comprise the basic building itself.

Ensure conduit terminations, and terminations are mounted flush to the surface of the pull box to ensure optimal usage. Ensure all box covers are secured tightly.

Pull Box Support Requirements - Pull Boxes are structures permanently affixed to the building structure. They can be attached directly to the ceiling slab or suspended by 4-point threaded rod supports anchored to the ceiling.

Pull Box Bonding and Grounding Requirements - As pull boxes become an integral part of the conduit system, the conduit connectors that attach the conduits to the box create electrical continuity with the conduits themselves. Individual bonding of pull boxes is not normally required.

Firestopping of Pull Boxes - As pull boxes are designed to be resealed with the appropriate cover after they have been accessed, the fire stopping of conduits within Pull Boxes is not required.

Labeling of Pull Boxes - All newly placed pull boxes designed to carry distribution cables, both fiber optic, and copper, shall be labeled as "Communications". The labeling shall be permanent such as manufactured label stenciling, or other IT agreed upon methods.

Horizontal Cable Support Hardware (Non-Continuous) - Non-Continuous Horizontal Cable Support Hardware is used in locations where the communication cable is not supported by continuous systems such as cable trays or conduit. Since support is not continuous, cable weight is concentrated at the intervals of the support hardware. Therefore, Non-Continuous Cable Supports shall be placed not more than 4 feet apart in linear runs.

J-Saddle Hooks - These components are metal stampings configured in a "J" form, which provide a broad cradle or saddle support for bundles of cable. The larger surface area of the saddle prevents kinking or crimping of high-performance UTP cable. J-Saddle Hooks are available in a variety of sizes, and they can accommodate a range of cable bundle sizes and weights. These hangers may be supported by a threaded rod, beam clamps, etc., and can be "ganged" together to provide some support waypoints along a cable route. As this type of hanger preserves critical UTP cable geometry, they are the preferred method for non-continuous cable support. These are approved for use in small projects, and renovations when approved. All j-Saddle hooks shall be rated by the manufacturer for the Category of cables (i.e. Category 6) being installed.

Bridle Rings - The use of bridle rings is not approved for supporting communications cabling.

13. Intra & Inter Building Cabling Systems

Intra & Inter Building Cabling Approved Manufacturers - Due to the logistical implications, and warranty requirements, UNM IT has limited the number of approved manufacturer's systems for cabling installations. Substitutions that do not interfere with logistical operations or affect warranty requirements will be evaluated if equal to the approved products.

Specifications shall only call out materials, and systems or "approved equals" specified in the UNM Guide Specifications, and /or the current version of UNM IT RFP Structural Cabling, Equipment Installation, and Maintenance Repair. The term or similar terms such as "or equal" shall not be specified or recognized as an approved equal. All "approved equals" shall have the approval of UNM IT Networks.

Intrabuilding Backbone (Riser) – The Single Mode OM3 Optical Fiber Intrabuilding Backbone shall support standards-based network protocols up to and including 10 Gigabit Ethernet.

Intrabuilding Backbone (Link): The Link Single Mode OM3 Optical Fiber connections between Technology Rooms on a floor shall support standards-based network protocols up to and including 10 Gigabit Ethernet.

Horizontal Cable: The horizontal cabling shall be minimally Category 6 UTP plenum rated with a performance at a 5 DB margin in NEXT, PSNEXT, ELFEXT, PSELFEXT, ACR, and PSACR tested to 550 MHz Category 6A or 6A UTP/FUTP as specified by UNM IT, and as determined through programming or by end-user requirements.

Single Mode OM3 optical fiber is typically specified for 10G applications to the desktop.

Category 6 UTP 23 AWG shall be installed for all wireless applications.

All cables shall be certified to comply with advertised performance and warranted against defects by the manufacturer according to industry standards.

All cables shall be plenum rated unless otherwise specified.

14. Equipment Racks, and Cabinets

General - Intrabuilding Cable patch panels used for both Intrabuilding cable, and Horizontal Cable termination, wire managers, and electronic equipment, will be mounted

in standard 19" inch x 7-foot aluminum equipment racks. Chatsworth is the approved manufacturer.

Cable Management - Essential to the proper installation of cable, and equipment is vertical, and horizontal cable management hardware which must be considered in the

space planning layout of every Equipment and Technology Room. Typical vertical cable managers add approximately 6 inches of width to each of the outboard sides of a single equipment rack. Ensure vertical, and horizontal management systems will accommodate patch cords for a fully loaded patch panel and allow for an additional 20 percent growth. The designer and architect shall take the additional space requirements for vertical, and horizontal managers into consideration to determine the equipment footprint, the specified clearances, and room space requirements. In situations where rows of multiple racks are "ganged" together, one vertical cable manager is placed between two adjoining racks. (i.e., an array of two racks would require a minimum of three vertical cable managers). Chatsworth is the approved manufacturer.

Equipment Racks - The equipment racks are to be mounted in Equipment Rooms, and Technology Rooms in the quantity necessary to support all necessary cables, hardware, and equipment. Four post racks are typically specified. The layout or footprint of equipment racks and equipment must be detailed on project plans and approved by IT. A minimum allowance of 25% percent vacant rack unit space or one (1) vacant rack minimum (which either is larger) is required for future growth in the Equipment Room, and Technology Rooms of each facility. One rack unit (RU) is 1- 3/4" inches in height, and a standard 7' foot equipment rack has a mounting capacity of approximately 44 RUs. Termination, and cable management equipment are manufactured in standard multiples of RU's in height.

Equipment racks are typically supported and braced by overhead Ladder Racks (Ladder Rack) which serve the dual purpose of providing support, and a means for routing cable to the termination hardware installed within the racks themselves.

Provide both vertical, and horizontal transitions. Use only manufacturer approved accessories and attachments. Chatsworth is the approved manufacturer.

Equipment Cabinets - Equipment cabinets are used typically in Equipment and Server Rooms where large, and heavy electronic equipment is mounted. However, depending on program or technology requirements, space, and clearance requirements for cabinets should be taken into consideration when planning Technology rooms. Equipment Cabinets have the same mounting configuration as equipment racks, the mounting rails are typically 19 inches wide, 7 feet tall, and have a 44-RU capacity. Since they have a depth dimension as well, Equipment Cabinets allow four-point support, and suspension of hardware. For example, large zone hubs can be 10-12 RU's in height, and 20 inches in depth. They may weigh over 100 lbs.

Manufacturers of such hardware usually specify mounting rails that require attachment to the front, and rear of a cabinet for adequate support. Cabinets can be customized with, cooling, fans, locking doors, and other appliances that make them a versatile element of the communications infrastructure. Additional space shall be planned to

allow the installed cabinets to meet the space, and clearance requirements previously specified in this document. Requirements for these products are project specific and should be determined during programming or as early in the design phase as possible.

Provide vertical, and horizontal cable, and patch cord management to accommodate a fully loaded unit as specified for equipment racks in determining patch cord management requirements.

15. Intra Building Cable Termination Hardware

Intra Building Copper Backbone Cable Termination Hardware - Multi-pair Copper Backbone cable is to be terminated on 110-style termination blocks, with 5- pair connectors. 110 blocks will either be attached to the plywood backboard or mounted on brackets within the equipment racks as determined by UNM. The layout or footprint of termination hardware and equipment must be detailed on project plans and approved by Information Technology/Telecommunications.

Data Patch Panels – Install system compliant patch panels that are four pair pinned TIA/EIA B per manufacturer's specifications and instructions.

Telco Patch Panels - Install Telco pinned, connectorized, 48 port patch panels with pins 3,4,5&6 activated, and install 25 pair connectorized cables. Terminate the 25 pair cables to the 110 connector blocks and activate 2 pairs per patch panel port or jack. Test each port, pair, and pin for continuity, grounds, shorts, opens, crosses, and splits. The approved product for this application is Ortronics PN: 809004909 48 port patch panel.

Intra Building Optical Fiber Backbone Cable Termination Hardware - Optical fiber cable shall be terminated within a Fiber Distribution Unit (FDU) with appropriate connectors according to UNM specifications. The FDU is to be mounted within the Equipment Racks according to UNM guidelines. Dedicate each optical fiber cable to an FDU that incorporates splice trays. Fusion spliced pigtails using LC connectors or direct terminate fusion spliced LC connectors.

The layout or footprint of FDUs and optical fiber equipment must be detailed on project plans and approved by Information Technology/Telecommunications.

Centralized Optical Fiber Distribution, and Optical Fiber to the Desktop - When a limited number of optical fiber connections are required to the desktop with locations

scattered on various floors, the installation of a centralized optical fiber distribution system is permitted with approval from IT. The use of this system will optimize the use, and cost of optical fiber ports, and equipment.

The design and installation of the system shall meet all the requirements of the current version of TIA/EIA 568-B, and the NEC.

The designer is to ensure that deep outlet boxes are specified during the design to accommodate optical fiber bend radius and termination requirements.

The designer will specify OM3 optical fiber for the desktop. Mechanical optical fiber terminations are preferred at the work area outlet. Verify with IT the exact connector requirements for the planned installation.

16. Intra-Building Optical Fiber Testing, Labeling, and Acceptance Requirements

Optical Fiber Testing, Labeling, and Acceptance Requirements - Intra-building optical fibers shall be tested using a tester, and power meter that is specified to test links at short distances. Test, and label the optical fiber to the manufacturer's system requirements, TIA/EIA 568-B standard requirements, and UNM specifications.

Verify labeling is consistent with the numerical alignment of fibers. Power meter test results (attenuation), and OTDR traces shall be submitted to IT two weeks before occupancy. Bi-directional testing is required for all links.

Optical fiber coupler/panel insert colors: Single Mode – Blue

Laser Optimized Multimode, 50 Um– Aqua Multimode - Tan

All FDU's and optical fiber connectors shall be labeled using an electronically printed label. An adhesive shall be secured to the FDU door. All FDU's shall be labeled sequentially on equipment racks.

All contractors for optical fiber cabling systems shall be selected from the list of UNM IT-approved contractors. Project approval by UNM IT is subject to the contractor's workload at UNM, past performance, and technical capabilities. The selected contractor shall employ an RCDD who is the contractor's site project manager, a primary point of contact, and the contractor representative at project meetings.

Acceptable Testers: Fluke DTX 1800 for Intra building testing procedures. Other testers are acceptable with prior approval by IT.

17. Horizontal Cabling Media

Horizontal Cable Media - There remains a large installed base of Category 5, and 5e cables on the UNM campus. However, as new buildings are constructed, and renovations of older buildings occur, UNM intends to transition to the deployment of Category 6 UTP, and 6A 10G F or 6A UTP cable for high speed applications. The end user and UNM's IT data requirements must be verified during programming in early design to determine the exact category of performance for cabling requirements. Category 6 UTP is specified for all POE, and Wireless applications.

Horizontal (station) Category 6 UTP or Category 6 10G F/UTP cabling systems will run from the Technology Room to outlets located throughout the facility. The maximum cable length is 90 Meters (295 feet). Each outlet will be provided with multiple, standards-based cables, faceplates, and connectors. Workstation termination hardware shall be manufactured by providers approved by UNM. The typical number of cables for each outlet is two cables which can be of mixed category cabling media. An outlet schedule shall be prepared during programming to determine the exact requirements for each outlet. This schedule will determine the exact horizontal cabling requirements for both design, and budget. It also allows each outlet to support multiple information systems without requiring re-cabling. Cables shall be provided and installed as "home runs" from the Technology Room to each outlet it serves.

Horizontal Cable Media Termination Hardware - Horizontal UTP Cable for either voice or data applications shall be terminated on 48-port, RJ-45 style patch panels. Terminating connectors shall be modular, and patch panels shall be interchangeable to support multiple categories of performance of applications. Optical fibers and coaxial links to the horizontal shall be terminated in separate dedicated patch panels.

Optical Fiber Horizontal Links - These are typically LC-type connectors using fusion spliced or mechanical connectors with connector type as specified by IT at the outlet. Verify exact connector types with IT.

Note: The use of Consolidation Points, and MUTOAs are not approved by UNM IT for use in horizontal cabling systems unless an exception is approved by UNM IT.

The category and number of cables per outlet shall be specified in programming and approved by IT before design.

Note: Verify with the owner the exact number, category of cabling, and ports per outlet with the owner before designing.

Future Growth - Planners shall provide enough spare ports to support 25 percent growth of the standard outlet configurations in the facility being served. (e.g., for a facility with 100, 4-cable outlet terminations in a particular Technology Room, the planner must provide space for greater than 25 additional outlets or 100 additional ports for growth.

Optical Fiber to the Desktop - Certain program requirements for high b, and width may require optical fiber to the desktop. Typically, a four-fiber single mode, OM3 tight buffered cable terminated at the FDU (patch panel) connectorized with LC connectors shall be installed.

Intra Building Coaxial Cable Termination Hardware – RG6 coaxial cable is the UNM standard. Install as designed or directed by UNM IT.

18. Horizontal Cable Media - Testing, Labeling, and Acceptance

Horizontal Cabling Testing - Test results for cabling shall be submitted to UNM IT two weeks before occupancy. Testing shall be performed following the requirements of TIA/EIA 568-B, and /or other applicable standards and body testing requirements, and the manufacturer's specifications for the installed system as approved by UNM IT.

The testing of systems shall meet the requirements of the applicable standards, and manufacturer.

Minimum Testing Requirements - The passing of the link parameters is required as the primary measurement of acceptance. The manufacturer shall provide test requirements for the link, and channel performance for twisted pair cabling systems to pre-qualify for the proposed system. Marginal or star pass measurements either pass or fail will not be accepted by IT.

Optical fiber links shall be tested using a power meter measuring for link loss at a budget as specified by the manufacturer, and TIA/EIA 568-B. One directional test is required for horizontal links.

Test results shall be submitted in electronic format directly from the approved tester as specified by IT. The results shall be submitted in Excel and LinkWare format.

Note: Handwritten test results will not be accepted.

Acceptable Testers: The currently approved tester is the Fluke DTX using LinkWare for Intra building testing. Other testers are accepted as approved by IT.

Note: No cabling system shall be specified nor will be accepted by IT that does not meet the aforementioned cabling testing requirements.

Optical Fiber Polarity - All optical fibers in the optical fiber shall be terminated in numerical order without compensation for polarity. IT will make the required polarity adjustments at the patch cord.

Labeling and Documentation - All labeling, and as-built outlet schedules shall be completed before testing. All patch panels and outlets are to be labeled using an electronically printed label. An adhesive label or otherwise secured attachment method shall be secured to the patch panels. Patch panels, ports, and cables are to be labeled sequentially on equipment racks. Ports and cables are to be labeled sequentially on patch panels by outlet number except for changes made after base termination. Telecommunications plans shall show the placement of outlets, and outlet identification designations on plans no later than design documents.

Approved Contractors - All contractors for copper horizontal cable systems shall be selected from the list of contractors approved on the current version of IT Structured Cabling, Equipment, Installation, and Maintenance Repair

19. Inter Building Pathways

Duct Banks - Inter Building Communication Duct Banks are communication infrastructure pathways that carry communication cables between buildings in a campus environment. The duct itself is typically constructed of contiguous segments of schedule 40 or 80 PVC conduit. In the absence of a multi-building campus, duct banks complete the underground connection between the building, and specified IT vaults or buildings where a combination of copper, fiber optic, and in some cases, coaxial cable is distributed from the carrier to the user building. Duct banks can be constructed in several configurations, each with a differing level of permanence, and durability. Duct banks should be concrete encased unless otherwise specified or approved by IT.

Transition Structures - These are spaces classified as vaults, manholes, hand holes, and pedestals where a cable is distributed, and routed to other locations such as buildings. These structures allow technicians access to cables and splices to perform maintenance or modify distribution configurations. The size of the transition structure selected for installation is determined by the number of ducts, and potential cable count the structure must contain with spares for maintenance, and repairs.

Transition structures should be placed at accessible locations for critical inter-building backbone cables, and splices, and therefore shall be secured by tamper resistant locking mechanisms. This measure will minimize the potential for serious disruption to

campus communications in the event of malicious damage or destruction of these cables.

The following provides general requirements for all inter-building communication duct banks, and transition spaces as components of the overall communication cable system infrastructure. Duct banks used for low-voltage communication facilities are not permitted by the Code to be collocated with electrical transmission cables.

Inter Building Communication Duct Banks - Inter Building Communication Duct Banks are designed to provide a permanent, and durable pathway system that is available for the delivery of entrance cable from carrier service providers, or as part of a campus Inter Building backbone system connecting several buildings.

Building Entrance Conduit Requirements – Entrance conduits requirements for buildings will vary depending upon the size, use, and ITS service requirements.

Large buildings, zone hubs, PBXs, entrances for LECs, and CLECs may require from 6 to 10 or more conduits. The minimum conduit entrance facility is four (4) 4" conduits, encased in a concrete mixture, sloped out, and down to the entrance manhole. The minimum size conduit diameter is 4" for all conduits relating to building entrances. Seal building entrances with watertight conduit plugs. Requirements are project specific, and the designer shall contact IT for specific requirements.

Duct Bank Conduit Requirements – The typical primary duct bank size for backbone systems shall be four (4) – 4" conduits encased in a concrete mixture. Install a minimum of a #6 AWG ground wire terminated to a ground rod in each pass-through structure, and a measured pull line of 400 lbs. continuous through the system. Terminate the ground wire at the building grounds at all termination points. Install watertight plugs, a rod, and mandrel to clean the system after its construction. The minimum size conduit diameter is 4" for all applications in inter-building applications. 5" conduits should be installed for large count copper and air-blown fiber multiducts.

Routing of Duct Banks - Inter Building Communication Duct Banks carry vital backbone cable media which serve a host of facilities on Campus. The severing of the inter-building backbone can potentially cause a loss of communications to the buildings downstream of the damage.

Note: It is critical that duct banks be routed around buildings, and that in no case does the pathway for the inter-building backbone pass through a building on its route through campus.

The architect is to submit to the UNM Planning, Design, and Construction (PDC), and Facilities Management all proposed routes to ensure the placement of cables, duct banks, and manholes do not conflict with future projects. Campus rights of ways, and

easements for non-UNM carriers, and service providers shall be applied for, and approved by the Department of Real Estate, and UNM IT during design, and before construction.

Duct Bank Configuration, and Quantity of Ducts - Once it is in place, modification to the communication duct bank is often impractical. It is critical, therefore, to plan for adequate expansion, and growth of the communication system at the time the duct bank is constructed, rather than after the fact. This is especially true of concrete encased duct banks. No less than four ducts should ever be installed at the time of construction, including for building entrances of over 10,000 sq ft. The exact number of ducts required shall be approved by IT. This rule applies, even if only a small number of cable pairs or str, and s of fiber that partially fill just a single duct are projected to be required over time. Duct banks are configured in arrays, typically with several rows stacked together. 1 x 4, 3 x 3, or 3 x 4 are examples of duct arrays, which also correspond to the arrangement of duct openings in pre-cast concrete vaults, and manholes where transitions occur.

Duct Bank Construction Materials and Methods - As the majority of inter-building communication duct banks are installed in utility-populated areas; the ducts must share underground pathways with existing underground infrastructure components such as water lines, gas lines, sanitary systems, and so on. As these utilities frequently need to be dug up for maintenance, and repairs, the communications infrastructure must be provided the highest level of durability to prevent inadvertent damage by backhoes and other heavy equipment. Only 3000 p.s.i. compaction concrete-encased duct banks are considered acceptable for installation in these environments. The duct material itself should be Trade Size 4 (4-inch diameter), PVC Schedule 40 EB or equal for concrete encasement, and suitable for contact with concrete. Schedule 80 EB or Rigid Steel conduits shall be installed in areas where non-encased duct banks have been approved. Install a measured pull line rated a minimum of 800 lbs. tensile strength into each duct secured on each end. Install re-enterable duct plugs in vacant ducts.

Duct Placement - Duct routing should be planned with consideration for the distance between Transition Structures, and the difficulty of cable pulls, particularly when high-count multi-pair copper cables are necessary. The minimum radius for curves is 15 feet. Trenches should be dug with the following depth and width considerations for concrete pour:

Concrete-Encased Duct Bank Dimension Guidelines

Ground Cover	Minimum of 36 inches
Top Level of Concrete	Minimum 2 Inches above the top duct

Concrete on the Outer Sides of the Duct bank	Minimum 4 inches
Concrete Between Ducts	1 inch (above, below, and to each side)
Bottom Level of Concrete	Minimum 1.5 inches

Duct bank Marking, and Locating - A metallic warning tape, detectable with magnetic location equipment, shall be buried directly over the path of the Ductbank approximately 18 inches above the ducts.

Duct Bank Termination at Building, and Vaults - Communication Ducts should be terminated with bell-end connectors, flush with the inner surface of the wall.

Duct Bank - Grounding Bonding, and Tracer Wire- A solid copper insulated # 6 copper wire shall be installed and terminated in an empty duct for duct bank locating purposes. Provide continuous grounding wire connectivity for the entire length of the duct bank.

20. Inter Building Spaces: Vaults, Handholes, etc. (Transition Structures)

Purpose - Inter-building spaces are essentially Transition Structures that allow access to cable installed within underground duct banks (vaults, manholes, hand holes, etc.). These structures are required by Codes to be exclusively for low-voltage communication cables, and equipment. They may not be collocated with electrical transmission lines or facilities. Transition structures provide a protected location for the storage of splice cases and slack loops of cable. The transition structures also facilitate the distribution of cable to multiple locations by providing a junction point for ducts radiating in several directions.

Pedestals - These are above-ground enclosures that are used for the termination or splicing of campus backbone cables. As pedestals are vulnerable to vandalism, and other damage such as from vehicle impact, their use on the UNM Campus is not permitted without approval from UNM IT.

Selection of Transition Structure Type - The type of structure chosen for installation is dependent on the number of ducts in the span. These can range from vaults measuring 20 feet long, and 12 feet deep, to small, shallow, hand holes only several feet square. In most cases, preformed concrete structures are available in several sizes, and capacities from large vaults down to h, and holes. Rarely is it necessary to form and pour a custom structure on-site. Structures also have weight-bearing cover/lid capacities that range from light pedestrian traffic to deliberate heavy vehicular traffic. The appropriate rating should be selected based on the anticipated exposure of the

structure to these differing traffic types. The minimum accepted rating for transition structures is typically 20-H, and the use of Quartzite Pre-cast Polymer Concrete boxes is not permitted without IT approval. The impact resistance rating of the structure shall also be evaluated before specification. Verify exact size, impact rating, and load requirements with IT. Contact UNM / IT for approval before specifying this type of structure.

Placement of Transition Structures - Structures should be placed after 180 degrees of directional change has been affected in the duct bank route. In straight or relatively straight runs, there should be no more than 400 feet between structures.

Structures should not be used as the apex of 90-degree changes in duct direction. Sweeps and structures should be planned such that the sweep occurs outside of the structure, allowing straight cable pulls through the structure itself.

Transition Structure Accessories and Equipment -Transition structures require the following equipment: or hardware to be installed:

- A sump hole, and /or gravel drainage in the case of small hand holes.

- Corrosion-resistant pulling eyes

- Cable racking, and attachments

- Ladder

- Round 36" iron lid.

- Inner keyed security lid as specified by UNM IT.

- Grounding cables installed per applicable codes or practices

- Watertight duct plugs

- Labeling to include distances to transition structures, and buildings.

- Measured pull lines to buildings, and structures.

21. Inter Building Backbone Cable Media

General - This section describes the cable materials and configuration of inter-building backbone cable media. This type of cable is specifically designed for use in areas exposed to the elements, and that will be subjected to harsh installation conditions. Every type of cable listed shall be warranted by the manufacturer against defects in material or performance. The contractor shall verify upon receipt of the cable,

regardless of type (copper or optical fiber shall be free from defects or damage, and meets the specified, and code requirements for the installation. The liability for the replacement of installed defective, damaged, non-specified, or non-code-compliant cable is at the expense of the contractor.

Note: The contractor shall verify, and ensure that the cables specified, and installed meet the intended use specified by UNM IT, and are code compliant before procurement. Submit product specifications to UNM IT for approval.

Optical Fiber Backbone Cable Requirements - UNM has determined that dependent upon the purpose, and /or the tenant assets within a specific building, cables of standard sizes shall be installed between their endpoints. It will be the responsibility of UNM to specify the strand count and routing of cables in each instance.

Optical Fiber Backbone Splicing – All optical fiber splices in the backbone shall be fusion spliced. The splice case and splicing apparatus shall be approved by IT.

Optical Fiber Backbone Termination – Termination of optical fiber backbone cabling shall be fusion spliced with LC pigtailed connectors in a splice tray incorporated into the fiber distribution panel. Optical fibers shall be terminated in numerical sequence without compensation for polarity.

Optical fiber coupler/panel inserts colors: Single Mode – Blue

Laser Optimized Multi-Mode 50 Um– Aqua Multi-Mode - Tan

Testing Backbone Optical Fiber Cable, Labeling, and Acceptance - Inter-building optical fiber cable- shall be tested using both a tester capable of providing both power loss, and an OTDR trace. When building, and testing installed circuits the installer shall provide a circuit loss budget (attenuation), and OTDR trace for the channel (end to end). Bi-directional testing is required for all links, and circuit channels. Acceptable testing perimeters shall meet the link loss budget for combined components.

All FDUs and optical fiber connectors are to be labeled using an electronically printed label and shall be visibly secured to the FDU door. All FDUs are to be labeled sequentially on equipment racks.

Approved Contractors - All contractors who provide services for optical fiber cable systems shall be selected from the list of contractors approved on the current version of UNM IT RFP Structural Cabling, Equipment Installation, and Maintenance Repair.

Approved Manufacturers - Approved manufacturers for optical fiber systems are listed in the UNM Specifications, and /or the current version of UNM IT RFP Structural Cabling, Equipment Installation, and Maintenance Repair. Materials and systems or

“approved equals” are specified in the UNM Guide Specifications. The term or similar terms such as “or equal” shall not be specified unless they have the written approval of UNM IT Networks.

Acceptable Testers - The approved manufacturer is Fluke, and their testers use LinkWare for Intra building optical fiber and copper testing. Other testers require approval by IT.

22. Multi-pair Copper Inter Building Backbone Cable

Multi-pair Copper Inter Building Backbone Cable is diminishing its utility in campus backbone scenarios since optical fiber has overshadowed copper cable’s bandwidth-carrying capacity and physical size. Nonetheless, multi-pair copper backbone cable will remain an important element in the Campus backbone for years to come.

Typical multi-pair Outside Plant (OSP) Copper Backbone Cable - Is constructed with a heavy polyethylene jacket over a metallic shield. The cable pairs inside the jacket may be coated with a water displacement gel in the event the water integrity of the jacket is lost or for specific design requirements.

Multi-pair copper backbone cable is unrated, and according to NEC, must be terminated within 50 feet of building entry, or if these distances are exceeded, the cable must be installed in a rigid conduit for its entire length. All filled OSP cables shall be transitioned by splicing them to non-filled rated cable or pre-terminated protector-rated cable assemblies.

Multi-pair copper cable is conductive, and capable of delivering damaging, and potentially lethal electrical surges to equipment, and personnel caused by lightning strikes or by exposure to high voltage electrical current. For this reason, multi-pair copper cable is spliced to, the manufacturer's electrical protector units with cable tails at the service entrance. This equipment protects personnel, and equipment within the building from electrical shocks caused by factors outside the building.

The type and manufacture of electrical protector units will be determined by UNM IT; however, splices or protector unit panels should be mounted on backboards within the Service Entrance/Equipment Room. The square footage necessary for this equipment varies with the pair count of the multi-pair copper cable entering the building and should be calculated within the planned size for the space as part of the footprint.

Copper Splicing - Splices for all inter-building backbone cable types are to be spliced within building service entrances or manholes. The contractor is to provide a well ventilated, clean working environment for all placement splicing, and termination operations. All work areas shall be left clean, all cables are properly supported, the landscape restored, safe, and water sealed during, and after work. Approved splice modules are 3M 4000 or 710 series. All splices are to be colored-coded, dressed, wrapped per applicable use, and bonded. All OSP splices shall be filled with a re-enterable waterproofing encapsulated and sealed in a splice case approved by IT. Splice diagrams shall be submitted to IT upon completion.

23. Inter Building Multi Pair Copper Cable Testing

Test Requirements - Provide IT wire map tests, and results for opens, shorts, crosses, grounds, and splits. Provide measurements for all failures, and repair deficiencies. Provide test results for all pairs whether pass or fail directly from the test equipment or in Excel format if approved. Include the project name, technician names, and date tested. Provide test results two weeks before substantial completion of the project

Note: All defective pairs shall be corrected and retested before the submittal of test results.

Note: IT recommends that all testing is completed before the closing of splice cases, to allow for immediate repair of defective pairs. The contractor is responsible to protect all work until accepted.

24. Warranties, Quality Control, and Commissioning for Horizontal, Intra, and Inter Building Cabling Media

UNM IT acts as the UNM project team member, and owner's representative charged with the final acceptance of the performance, and quality control for the Information Technology infrastructure, and systems included within this document. IT will perform quality control observations, inspections, testing, and verification, and owns the right to engage, and assign third-party testing, inspection, and commissioning agents to inspect, observe, verify, test, and document deliverables as a condition of acceptance on behalf of UNM through all phases of a project's design, and construction.

Warranty - The Contractor shall provide a one-year warranty on all parts, products, and labor for all project deliverables. The Contractor shall apply for, and receive a manufacturer's warranty of not less than 20 years for labor, and material before the start of work for the cabling system. IT shall be copied on the contractor's notification to manufacturers for warranties.

Inspections - The Contractor shall request from the cabling system manufacturer a warranty inspection at infrastructure rough-in, and the completion of terminations. IT representation shall be included in the warranty inspections.

Warranty Assignment - The manufacturer's warranty certificates shall be assigned to UNM IT.

Note: For further details, and specific requirements of design and specification requirements refer to the UNM IT Guide Specifications, and contact IT for all questions or areas not addressed in this Document.

25. Special Work Requirements for UNMH

Patient Privacy & HIPPA - Care must be taken to ensure patient privacy rights are protected as per the requirements of HIPPA, and other state, and federal laws.

Firestopping - The contractor shall ensure that all cabling fire stop is completed and documented. The contractor is responsible to report all missing firestop applications before the start of work to IT. In failing to do so the contractor is subject to the discretion of IT to restore the missing firestop at their expense.

Ceiling Tiles - Shall be replaced at the end of each day in all clinical areas.

Patient Monitoring Equipment - Patient monitoring cables shall be installed on a separate patch panel near the top of the equipment rack with red outlet jacks at the work area outlet.

Safety - The contractor is required to maintain safe conditions that protect patients, and staff when working in operational areas. Provide HEPA cart, proper barricades, and signage, ensure the area is clear of trip hazards, and ensure staff, and patient safety at all times.

Protect operational areas against dust, water, and other pollutants in inpatient, and clinical areas.

26. Acknowledgments:

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