National Oceanic & Atmospheric Administration

Office of the Chief Information Officer

Facility IT Standards Guide

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FACILITY IT STANDARDS GUIDE

TABLE OF CONTENTS

1.0 PREFACE

The purpose of the NOAA Facility IT Standards Guide (FITCSG) is to communicate the requirements of the National Oceanic and Atmospheric Administration for the design, installation and operations of information technology systems at both NOAA-owned and leased facilities. The FITCSG is written for those in NOAA responsible for the design of new or remodeled facilities where IT infrastructure currently exists and is operational or where it will be installed or upgraded. It is also intended as a design guide for contractors or NOAA personnel installing IT infrastructure at NOAA facilities when a formal design is not developed.

A. The NOAA FITCSG has been developed from information contained in current industry methods, materials and standards. The FITCSG reflects the Federal Government, Department of Commerce, NOAA, and industry standards in effect as of this publication.

B. NOAA personnel should be familiar with these requirements with respect to their application to both large-scale IT installation projects and smaller scale renovations. These requirements also apply to the in-house operations and maintenance of existing telecommunications and other IT systems; including “moves/adds/changes” projects.

C. It is the responsibility of the IT design lead to coordinate with the other project designers (architectural, electrical, HVAC, etc.) to determine that other systems are both compatible with and complementary to the communications cabling system. NOAA agrees with BICSI®’s design philosophy which emphasizes that it is critical to coordinate among the various construction disciplines during the design phase of a project, rather than making adjustments in the field during construction.

D. This document uses many terms and abbreviations that are common in the telecommunications industry. While a Glossary (Section 8.0) includes the most frequently used terms in this document, please refer to the BICSI® *Telecommunications Distribution Methods Manual* (TDMM)[1] and also the Glossary section at the end of the BICSI® *Customer-Owned Outside Plant Design Manual* (CO-OPDM) for further information.

1.1 LOW VOLTAGE SYSTEMS

Wherever practical, telecommunications pathway and cabling systems designed for NOAA facilities are expected to support and integrate low voltage systems that convey information within and between buildings. IT infrastructure shall be designed in accordance with the requirements in this document to support the Ethernet communications channels on low-voltage devices. Throughout this document, references to “low voltage systems” shall apply as discussed below:

A. The common outside plant (OSP) telecommunications pathway infrastructure is intended for shared use (to the extent possible) by the following low-voltage systems; in addition to voice and data systems:
   - Building Automation Systems
   - Fire Alarm Systems

[1] The BICSI® TDMM is widely considered to be the industry reference text for the design of standards-compliant communications distribution systems (see http://www.bicsi.org/Content/Index.aspx?File=tdmpubs.htm). BICSI®, 8610 Hidden River Pkwy, Tampa, FL 33637-1000 USA; 1-800-242-7405; http://www.bicsi.org

- Closed Circuit Television Systems (Analog)
- Security Systems
- Video Systems (Digital)
- Access Control Systems
- Energy Management Systems
- Other Alarm Systems
- Environmental Control Systems
- Intrusion Detection Systems

B. The common inside plant (ISP) telecommunications pathway is intended for shared use (to the extent possible [note]) and the common ISP telecommunications media is intended for separate use by the following low-voltage systems, in addition to voice and data systems:

- Building Automation Systems
- Fire Alarm Systems
- Video Systems (Digital)
- Security Systems
- Energy Management Systems
- Access Control Systems
- Environmental Control Systems
- Other Alarm Systems
- Intrusion Detection Systems

Note: These systems typically require separate paths

Inside plant telecommunications infrastructure that is intended to support Ethernet communications (or other similar protocols for security and fire alarm systems) shall be designed in accordance with the inside plant telecommunications infrastructure requirements in this document.

Where low-voltage systems require different media (other than fiber optic cabling and 24 AWG UTP), the systems shall be designed to comply with the pathway and space requirements of this document wherever practicable.

1.2 DOCUMENT INTENT

NOAA has standardized on the ANSI/TIA/EIA Commercial Building Telecommunications Standards series and has adopted the BICSI® *Telecommunications Distribution Methods Manual* (TDMM), the BICSI® *Customer-Owned Outside Plant Design Manual* (CO-OPDM) and the BICSI® *Information Transport Systems Installation Manual* (ITSIM) as the basis for communications distribution design in NOAA facilities. The NOAA FITCSG is a guide to the application of the ANSI/TIA/EIA Standards, the BICSI® TDMM, the BICSI® CO-OPDM and the BICSI® ITSIM for the unique circumstances present in NOAA facilities and projects.

This NOAA FITCSG is not intended to replace or detract from the GSA P-100 Facility Standards, the BICSI® TDMM, BICSI® ITSIM or CO-OPDM manuals. This document is to be used in conjunction with the BICSI® manuals to reinforce selected content as well as highlight any restrictions and/or limitations on BICSI® requirements to meet the specific requirements of NOAA facilities.

This document addresses distribution system design for all telecommunications, low voltage and signal systems for use within a building and between buildings on a contiguous site as related to:

- Telecommunications Spaces – Entrance facilities, equipment rooms and telecommunications rooms
- Intra-building Backbone Distribution – Pathway and raceway requirements, communications media requirements
- Horizontal Distribution – Pathway and raceway requirements, communications and low voltage media requirements, requirements for special work areas
- Outside Plant Backbone Distribution – maintenance holes, handholes, ductbanks, ducts (conduits), communications and low voltage media requirements

A. Unless otherwise stated, the requirements defined in this document apply to new construction, renovation and remodeling projects and, as appropriate, to leased facilities.

B. Many NOAA facilities house highly sensitive critical IT infrastructure components. It is essential that every precaution be used to safeguard this information capability. NOAA facilities can contain areas of different security levels:

- There may be spaces where the public has ready access.
- There may be spaces within a security perimeter where general employees and contractors have access and visitors are given access with an escort.
- There are other spaces where only authorized persons are allowed to enter. This may include IT restricted spaces.

C. Access to IT equipment could provide an opportunity to sabotage critical mission functions, life safety or security monitoring systems and could provide an opportunity to obtain unauthorized access to confidential information. The level of risk should be assessed for each area and appropriate protective measures employed in designing the telecommunications infrastructure.

- IT equipment should not be located in or directly adjacent to space readily accessible to the public. If it is, it should be adequately protected.
- IT equipment in spaces within a security perimeter with general employee access can be treated as normal business operations areas. These same considerations can be given to telecommunications in bio-containment areas or areas where access is restricted for other than IT safety/security reasons; however, telecommunications assets that require access for IT maintenance should not be located where access is restricted for other than IT safety/security reasons.

D. Restricted IT spaces should be secured against access by other than authorized individuals and incorporate procedures and design standards set forth in NOAA OCIO IT Security Guidelines. Restricted IT spaces may include computing facilities, web farms, telecommunications/magnetic media rooms and space that contain firewalls, intrusion detection systems or network nodes.

E. Facilities that have areas that meet the description for Restricted IT spaces shall incorporate the following recommended Standards:

- Parking facilities shall be controlled.
- CCTV surveillance cameras with time-lapse digital video recording (DVR) shall be provided.
- Provide lighting with emergency power backup for Restricted IT spaces.
- Provide armed security guards and intrusion detection systems with central

monitoring capability.

- Use high security locks on all entrances and exits. Keep entrances to a minimum as required by local fire code. Keys should not be on the master key system.
- Other recommended standards can be found in Section 4.7.5.
- Relief from Security Compliance Standards on a project-by-project basis may be requested via the Alternative Design Request along with the approval of the NOAA OCIO.

F. This document provides directions for making standards-compliant design decisions that will, in due course be reflected in Construction Documents. The Construction Documents for a project will be comprised of drawings and a system specification that properly incorporates IT infrastructure within a project. The FITCSG shall be used in conjunction with the GSA P-100 Facilities Standards Specification (P-100). Drawings shall conform to the requirements contained in this document for content and completeness, and the specifications shall be based upon the P-100.

G. Adherence to and compliance with the codes, standards and industry practices listed below along with the NOAA requirements contained in this document is mandatory.

- Local and/or State Rules and Regulations for Installing Electrical Wires and Equipment
- Federal, Local and/or State Safety Standards for General Safety and Health
- National Electrical Safety Code, American National Standard C2
- National Electrical Code®, (NEC®), National Fire Protection Association®, (NFPA®) 70
- ANSI/TIA/EIA Commercial Building Telecommunications Standards series
- Fiber Optic Test Standards, ANSI/TIA/EIA 455 (Series)
- Optical Fiber Systems Test Procedures, ANSI/TIA/EIA 526 (Series)
- Local Area Network Ethernet Standard, IEEE® 802.3 (Series)

H. All references to the following manuals within the NOAA FITCSG shall specifically address only the editions specified below. Newer editions shall not be used for reference until authorization is provided by NOAA in writing at the time of design or through a revised edition of the FITCSG:

- BICSI® *Telecommunications Distribution Methods Manual* (TDMM) (11TH Edition)
- BICSI® *Customer-Owned Outside Plant Design Manual* (CO-OPDM) (3rd Edition)
- BICSI® *Information Transport Systems Installation Manual* (ITSIM) (4th Edition)
- BICSI® *Wireless Design Reference Manual* (WDRM) (2nd Edition)

I. Requests to deviate from the NOAA requirements may be submitted on a case-by-case basis, in accordance with the instructions in the Alternative Design Request (ADR) section of this document. No deviation from the requirements of the National Electrical Code® will be allowed. For further information regarding codes and standards, please refer to the BICSI® TDMM as well as the BICSI® CO-OPDM bibliography.

J. The requirements contained in this document are in addition to those listed in the NOAA Facilities Design Standards (P&P 242.1-NOAA). Where the requirements differ, the issue shall be brought to the attention of the NOAA Engineering Project Manager.

Otherwise, the more stringent requirement shall apply.

1.3 DOCUMENT STRUCTURE

The NOAA FITCSG is organized in 9 sections:

- Preface
- NOAA Policies
- Project Procedures
- Design Criteria
- Construction Document Content
- Appendices
- List of Figures
- Glossary

A. The Preface (this section) describes this document, its intent and its relationship to industry standards and practices. It also describes how to use this document.

B. The NOAA Policies section describes internal NOAA IT policies requirements, standard practices and processes associated with designing, installing and operating telecommunications and other IT infrastructure.

C. The Project Procedures section describes the required qualifications for telecommunications designers as well as the procedures that designers must follow when working on IT infrastructure projects at NOAA facilities. It includes activities that are required throughout the project as well as phase-specific requirements.

D. The Design Criteria section serves two purposes. The first is to describe the general requirements for NOAA IT infrastructure along with the typical features required for different categories of building spaces and construction types. The second purpose is to place limitations on the materials and methods described in the BICSI® TDMM and CO-OPDM to reflect some unique characteristics of certain NOAA facilities. Some of the materials and practices discussed in the TDMM and CO-OPDM are expressly prohibited in NOAA facilities. *Generally speaking, if the BICSI® TDMM and CO-OPDM do not describe a particular material or method for use with telecommunications distribution infrastructure, it will not be allowed for NOAA facilities. In addition, the NOAA FITCSG places restrictions on the use of some materials and methods that the BICSI® design guidelines support.*

E. The Construction Document Content section defines the minimum level of detail that NOAA requires in the telecommunications portion of the Construction Documents for a project. In this section, the required types of details along with the content in the details are both described. This section also briefly describes how to use the P-100 for producing the specification for a particular project. More detailed instructions for producing a project specification based on the P-100 are included with the P-100.

F. The Appendices section provides standard forms and diagrams along with example forms and diagrams that are required for NOAA IT designs.

G. The List of Figures section contains a reference listing of figures used in this document.

H. The Glossary section defines the most frequently used terms and acronyms.

I. The Index section provides a page number cross-reference to common terms and subjects.

1.4 HOW TO USE THIS DOCUMENT

The following diagram depicts the relationships between the ANSI/TIA/EIA Standards, the BICSI® Design Guidelines, NOAA documents (Policies, FITCSG, P-100) and the project-specific Construction Documents:

NOAA IT Infrastructure Design Process

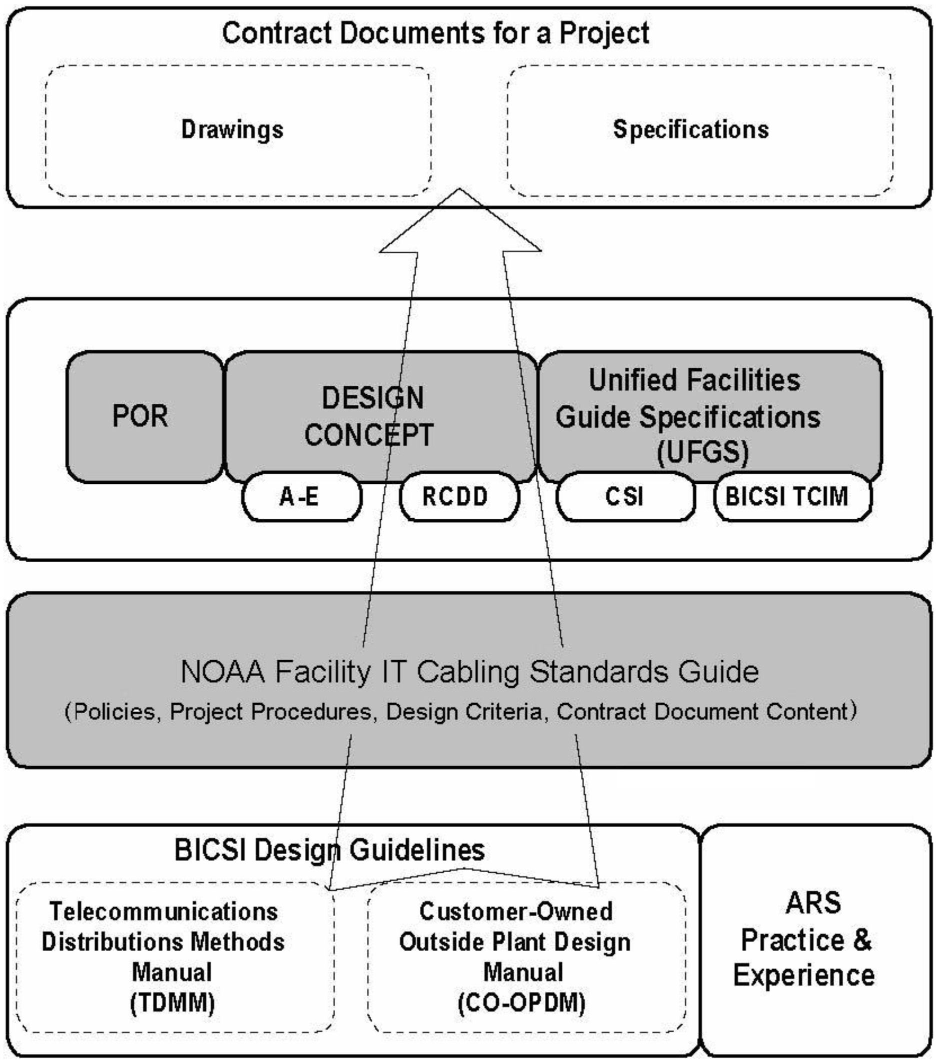


FIGURE 1: OVERVIEW: NOAA IT INFRASTRUCTURE DESIGN PROCESS

Telecommunications distribution infrastructure at NOAA facilities shall be designed based on the BICSI® design guidelines (the TDMM, the CO-OPDM and the ITSIM) and compliant with the ANSI/TIA/EIA Standards as applied by and illustrated in the NOAA FITCSG. Designers shall also follow the guidance in the FITCSG to create the Construction drawings for a particular project.

1.4.1 NOAA Personnel

A. The NOAA IT Policy section of this document applies specifically to NOAA personnel. In addition to the NOAA IT Policy section, NOAA personnel should be aware of the instructions, requirements and guidelines for Designers contained in the other sections of this document.

B. NOAA personnel should be familiar with these requirements with respect to their application to both large-scale telecommunications distribution projects and smaller scale renovations. These requirements also apply to the in-house operations and maintenance of existing telecommunications distribution systems; including “moves/adds/changes” projects.

1.4.2 IT Infrastructure Designers

IT infrastructure designers and Architect-Engineers (A-Es) shall be responsible to apply the guidelines, instructions and requirements in this document as part of the process of designing telecommunications distribution infrastructure at NOAA facilities.

1.4.3 Contractors and Cabling Installers

Contractors and cabling installers involved in projects without a formal engineering and design process shall adhere to the requirements of this document and also requirements for telecommunications distribution system materials and installation methods contained in the BICSI® design manuals.

2.0 IT INFRASTRUCTURE DESIGN AND INSTALLATION POLICIES

A. NOAA personnel designing or installing IT infrastructure in NOAA facilities, regardless of size or cost of the project, shall adhere to the requirements set forth in this document.

B. NOAA requires the use of BICSI® Registered Communications Distribution Designers (RCDD®s) to design the telecommunications distribution infrastructure for all new construction, major renovation, remodeling, and major telecommunications upgrades that will be performed by NOAA personnel or contractor work crews. The RCDD® designation is recognized worldwide as a design professional that has met specific professional design experience requirements and has successfully completed an extensive examination on the subject of telecommunications distribution design. RCDD®s are employed by architectural and engineering firms, and by telecommunications-infrastructure installation contractors. NOAA prefers installation work be completed by BICSI®-certified installers.

C. NOAA personnel shall be aware of the impact of policies or regulations on telecommunications specifications and acquisitions. Among these are the NOAA OCIO Policies and NOAA IT Security Office requirements that require specific planning and waivers for telecommunications. Failure to incorporate and follow these policies can result in significant delays for a project. The NOAA OCIO can provide guidance to NOAA personnel on these issues. Departmental OCIO policies may be found at: http://www.cio.noaa.gov/Policy_Programs/ppa.html .

D. Input from NOAA Headquarters and Area IT and site operations staff must be incorporated in developing the initial and on-going construction schedules. This input is especially important when an early or phased acceptance of buildings is required, but is also vital for the initial startup of a new facility. Timing on the construction of the main telecommunications room and building, and the backbone cable plant connecting it to key buildings, is a vital consideration in bringing key buildings online at required dates. Commercial infrastructure with longest lead times should be the highest priority.

E. Management of NOAA's Wide Area Networks (WAN) is the responsibility of the Office of the Chief Information Officer (OCIO) IT staff at NOAA Headquarters. It includes standards for network design, security, operations, performance monitoring, optimization, troubleshooting, and disaster recovery. The IT staff in field and area offices are responsible for day-to-day operations of the telecommunications infrastructure to include the Local Area Networks at each site. Under no circumstances will local policies override Administration policies without written waiver approvals.

F. At most sites, NOAA Regional and local staff have the responsibility to acquire, install, and operate telecommunications equipment such as PBX's, Key System Units, Public Address (PA) systems and other voice and videoconferencing systems. The program must support the budget requirement for this equipment in new and remodeled buildings.

G. Local or Area staff order and manage billing for local telecommunications services. However, these acquisitions should be coordinated with the NOAA OCIO to assure all Departmental or Agency requirements are met before acquisition and that FTS2001/MCI services or other Departmental and GSA contracts are correctly associated with local services.

H. Unique rules and policies at the Federal, Department, and Agency levels govern all IT and telecommunications acquisitions. NOAA staff acquiring traditional telecommunications, laboratory information systems, Internet 2®, or other IT goods and services is accountable for ensuring that the acquisitions meet both NOAA technology standards and the mandatory aspects of telecommunications and IT planning and acquisition processes.

2.1 NOAA Personnel

2.1.1 Team Structure

When the NOAA Facilities Division manages large projects, NOAA staff shall work closely (as team members) with the architects, engineers and designers throughout the entire project life cycle, beginning with the scoping, site selection and budgeting stage prior to the preliminary design phase. Smaller projects also require teamwork, but include fewer professional staff outside the Agency. The team shall consist of the following NOAA OCIO staff positions, at a minimum:

- NOAA OCIO IT Specialist (hereafter called the "NOAA IT Infrastructure Specialist") at Headquarters who has professional, expert knowledge in telecommunications and IT infrastructure standards and policies.
- NOAA Area IT Specialist and Local IT Specialist or local person involved in telecommunications infrastructure (or their designee).
- NOAA Telecommunications Specialist for meeting certain NOAA telecommunications infrastructure planning and acquisition requirements. (To be determined on a case-by-case basis.)

2.1.1.1 NOAA IT Infrastructure Specialist

This person's responsibilities are to:

- Ensure that relevant Departmental and NOAA Area, management, and specialized technical staff are informed and involved on all telecommunications infrastructure activities (design, construction, support, and maintenance)
- Keep the NOAA OCIO management informed of telecommunication infrastructure activities as they apply to the NOAA OCIO office.
- Work with the NOAA Telecommunications Specialist as needed to meet Departmental requirements for telecommunications planning and acquisition.
- Review requirements, specifications, plans, and documents (including drawings) to assure Departmental and NOAA standards are being met.
- Actively participate in meetings with the NOAA Facilities Division Engineering Project Manager or other project leaders.
- Review and approve or disapprove Alternative Design Requests.
- Consult with the NOAA OCIO on IT infrastructure technology requirements planning.

2.1.1.2 Local IT Specialist or Local Person Involved In Telecommunications Infrastructure

The local IT Specialist or person involved in telecommunications is responsible:

- For reviewing and commenting on all telecommunications and information technology infrastructure issues and support services relating to NOAA facilities, including any special laboratory, audiovisual, or security considerations.
- For representing the Area in meetings with NOAA Headquarters IT, telecommunications, and facilities staff and management
- For reviewing and coordinating all telecommunication infrastructure activities within their Area as appropriate.
- For reviewing, commenting on and tracking the approval process for originated Alternative Design Requests.

2.1.1.3 NOAA Office of the Chief Information Officer (OCIO)

The NOAA OCIO has a role that includes Enterprise Architecture Governance and is therefore mandated by NOAA policy to be the sole approving authority for certain activities:

- For reviewing and commenting on NOAA Infrastructure designs, policies and procedures.
- For ensuring that they meet Departmental telecommunications infrastructure planning and acquisition requirements.

2.1.2 NOAA PERSONNEL AND CONTRACTOR WORK CREWS

A. NOAA personnel who install telecommunications infrastructure at NOAA facilities (with or without supervised contractor work crews) must be familiar with the requirements of this document. They must also be familiar with and apply the most current and applicable series standards: ANSI/TIA/EIA-568-B “Commercial Building Telecommunications Cabling Standard,” and ANSI/TIA/EIA-569-A “Commercial Building Standard for Telecommunications Pathways and Spaces.” For those sites that are doing work in residences, the applicable ANSI/TIA/EIA series standard is 570-A “Residential Telecommunications Cabling Standard.”

B. Use of an RCDD® is required for all telecommunications infrastructure design work performed by NOAA personnel or a contractor work crew. Use of an NOAA RCDD® is acceptable. The NOAA Area IT Specialist and NOAA OCIO IT Infrastructure Specialist may agree to waive the requirement to use an RCDD® for the design documentation, engineered specifications, and to periodically observe the installation work while in progress, providing written observation reports following each visit on a case-by-case basis. The waiver request must be submitted in writing to the NOAA OCIO IT Infrastructure Specialist. This waiver will not be granted for outside plant telecommunications pathway or telecommunications maintenance hole / handhole work.

2.2 INITIATING ACTIVITIES AFFECTING TELECOMMUNICATIONS

All telecommunications infrastructure and substructure activity, regardless of the size or scope of the project, or quantity of cable involved, must be closely coordinated with the NOAA OCIO office to assure that Departmental and Agency standards will be met. The use of “ad hoc” means of providing telecommunications in NOAA facilities is not permitted. This includes: splicing cabling to reach new rooms or outside locations, running cable without a structured cabling plan, and using cable that does not meet standards set by NOAA (e.g., using CAT 3 cable in lieu of CAT 6 cable).

This requirement applies to all types of building structures (including residential) whether new construction, renovation of existing structures, upgrading telecommunications infrastructure to support new technology, upgrading telecommunications infrastructure to meet new standards, infrastructure to support other agencies or tenants at NOAA facilities, and all moves, adds, and changes (MACs) at NOAA facilities; including MAC work performed by NOAA personnel. All Departmental and NOAA requirements must be met, regardless of the size of the project. This includes the use of Internet 2® or other scientific or research-based systems.

There is no requirement to upgrade existing telecommunications infrastructure at any NOAA facility simply to meet evolving industry standards or the requirements of this document.

2.2.1 INFRASTRUCTURE TO SUPPORT TENANTS AT NOAA FACILITIES

In rare cases, some private businesses have contracts with NOAA, and contractor telecommunications are provided on NOAA property under contract with a commercial carrier. As the owner of the property, it is normally incumbent on the NOAA to provide the telecommunications infrastructure to support other agencies or tenants at NOAA facilities. The terms and conditions for reimbursement of any expenses incurred by NOAA to provide telecommunications support to other agencies will be negotiated and documented in the contract or an interagency support agreement with the tenant. NOAA IT security policy forbids co-mingling NOAA data network lines with those of any other entity.

2.2.2 INFRASTRUCTURE AT UNIVERSITY LOCATIONS

Many NOAA offices are located on University campuses. These situations present several challenges to NOAA staff that need new or updated telecommunications infrastructure, equipment or services. Locations are strongly advised to consult with the NOAA OCIO to develop the most cost-effective and secure approach to communications services in these locations.

Many NOAA-University agreements do not have service level agreements (SLA's) relating to telecommunications with the host University. Also, existing SLA's may not be written in detail sufficient to meet current NOAA requirements. These agreements should be revisited during the project. The NOAA OCIO can provide support to NOAA facility project staff in this regard.

2.2.3 DAMAGE TO EXISTING TELECOMMUNICATIONS INFRASTRUCTURE

Construction, maintenance, severe weather, or catastrophic events can result in damage to the telecommunications infrastructure, including cabling. In some cases, this damage can affect a large service area.

A. In the event of damage to the telecommunications infrastructure, regardless of the cause or party responsible, the local NOAA staff shall immediately contact the Area IT Staff and they shall consult with the NOAA OCIO to help determine the repair or replacement strategy for the damage. Due to deregulation, telecommunications companies' responsibilities may be limited. On some NOAA sites, for example, NOAA must pay for any outside plant repairs. On other sites, the property owner would repair the damage. On still others, the local telephone company would make the repairs. The NOAA OCIO can assist in reconciling these issues.

B. Catastrophic emergencies are handled at the Agency level through the Area offices. The management of losses and any subsequent rebuilding or relocation decisions will be the responsibility of high-level NOAA officials.

C. NOAA OCIO will coordinate staff to:

1. Work with the Area or local NOAA staff to identify potential methods of emergency or interim repairs.
2. Identify the steps necessary to assess whether the damaged infrastructure can be repaired or whether it must be replaced.
3. Help determine the most cost-effective approach to the repair.
4. Determine whether NOAA clearances or waivers are required.

D. All damaged infrastructure shall be restored to meet the requirements of the current FITCSG within the scope of the original design/installation parameters. This shall include, but not be limited to all repair or replacement work performed by a certified contractor of NOAA's choosing, all testing and re-certification of the infrastructure for full compliance with the current NOAA IT Infrastructure Standards and any applicable manufacturer's warranty.

E. All damaged Federal government property must be disposed of according to Federal regulations. Contact the NOAA Office of the Chief Administration Officer Logistics (OCAO) for further instruction.

2.3 Acquisition and Installation Policy

In keeping with the principles of Enterprise Architectural Governance and Lifecycle Security Design, the National Oceanic and Atmospheric Administration has established specific policy controls over the procurement of all IT-related equipment and services, to include telecommunications, regardless of the application type or source of funds. As a result, readers are encouraged to obtain current policy from the NOAA OCIO.

By law, the NOAA Administrator has primary responsibility for the management and use of information systems, telecommunications, and information technology equipment, software, and services. The Federal government, Department of Commerce, and NOAA have acquisition regulations and policies that apply only to information technology and telecommunications. NOAA staff who are not familiar with these procedures may consult with the NOAA Program Planning and Analysis Office in the NOAA OCIO.

2.3.1 NOAA Certified Manufacturer Structured Cabling System (SCS) Products And Approved Alternatives

Existing NOAA facilities have an installed base utilizing several manufacturers' cabling system products. Standardization at a facility on a single manufacturer's structured cabling system is a goal that ensures NOAA technical personnel are familiar with the installed infrastructure components and that they are prepared to efficiently handle moves, adds, and changes to the infrastructure. Standardization also ensures that there will be performance compatibility with the installed base when additions and/or changes are made to the infrastructure, and that spare parts and components can be efficiently managed.

A. A “Certified Manufacturer” is a manufacturer which:

- Has SCS products and components that are warranted to be compliant with all applicable industry standards, including TIA/EIA, IEEE, NEC, and BICSI.
- Provides and maintains a manufacturer approval/certification process that insures the qualifications of the telecommunications cabling/wiring personnel used to design, install and maintain their systems.

B. Where additions or modifications are made to existing facilities (including new buildings on an existing campus) and the facility has standardized on a manufacturer’s structured cabling system, the addition or modification shall consider using products from the existing manufacturer.

C. Where additions or modifications are made to existing facilities that have not currently implemented a standard structured cabling system, a Certified Manufacturer’s product line shall be evaluated for use with the eventual goal of standardizing on these products.

D. The telecommunications infrastructure design for new facilities shall be based upon a Certified Manufacturer’s structured cabling system (SCS) product line.

Standardization on a Certified Manufacturer’s SCS product line does not imply that there is a sole source for acquisition or installation of these products. All Certified Manufacturers’ SCS products can be acquired through multiple supply sources, and installation can be acquired through multiple Manufacturer-Certified cable installation contractors using competitive solicitations and existing contracts.

2.4 LARGE TELECOMMUNICATIONS PROJECTS

Large telecommunications infrastructure projects are usually associated with New Facility construction or Major Renovations at an existing facility.

2.4.1 DESIGN PHILOSOPHY

A. An engineered structured cabling design for telecommunications is required for all new construction, major renovation or remodeling, including technical specifications and drawings to be used as the basis for competitive bidding for the construction contract. An engineered telecommunications design will also be developed for projects where NOAA personnel or contractor work crews will be used for construction.

B. Telecommunications infrastructure shall be designed and installed in accordance with applicable codes and industry standards. Due to the unique physical characteristics and security requirements of many NOAA facilities, some technical design solutions are better suited than others. This document identifies which design solutions are appropriate for and approved for common types of buildings and areas at NOAA facilities.

C. The telecommunications infrastructure design process shall be included in the preliminary design phase for each project within this classification. This will provide the NOAA IT Infrastructure Specialist the opportunity to provide input to the design for telecommunications requirements throughout the design process. The A/E firm shall work closely, through the chain of privity, with the designated project RCDD®, the NOAA IT

Infrastructure Specialist, and the NOAA Engineering Project Manager from the start of each project. The NOAA Contracting Officer and the Facilities Division Engineering Project Manager will be the principal points of contact for the A-E firms.

D. The NOAA site project representatives shall explore existing Federal contracts for potential vendors to provide the required telecommunications products and services.

2.5 SMALL TELECOMMUNICATIONS PROJECTS

Small telecommunications infrastructure installation projects may be standalone projects to prepare for the installation of new technology, or a separate project concurrent with a locally managed facility project.

A. The size and scope of a small project, and the expertise available in-house, are factors to consider when determining whether to outsource the development of a telecommunications distribution design.

B. For small projects or installation of additional cabling, a Manufacturer's Certified installation contractor can be hired for a limited scope installation. The only alternative to using a Manufacturer's Certified installation contractor (for copper cabling installation only) is to use NOAA personnel who are certified by the manufacturer as "self-maintainers."

C. NOAA personnel shall not install fiber optic cable under any circumstances without specific written permission from the NOAA IT Infrastructure Specialist.

D. The NOAA Statement of Work offered to the Manufacturer's VAR must be approved by the NOAA IT Infrastructure Specialist before acquisition.

E. The Manufacturer's VAR must state in their contract document, that they will meet the requirements of the NOAA FITCSG. The project shall not commence until the Manufacturer's VAR has agreed to comply with its requirements.

2.6 REVIEWING TELECOMMUNICATIONS DESIGNS

The review process for Telecommunications Designs will vary in detail and complexity depending upon the type and scope of the project involved.

The Telecommunications Design Review Process for NOAA Facilities Division-managed projects shall be incorporated into the FD project's overall design review schedule.

NOAA Area-managed and Local IT-managed projects shall incorporate the design review process for "Small Projects" as outlined and discussed in this document.

2.6.1 <u>ALTERNATIVE DESIGN REQUESTS (ADR)</u>

A. Requests to deviate from industry standards or NOAA design solutions will be considered on a case-by-case basis. Any request to deviate from the requirements of the National Electrical Code® will not be accepted.

B. Requests to apply alternative design solutions shall be submitted to the NOAA IT Infrastructure Specialist for consideration. The ADR will follow the review process as shown in the flow chart in the Alternative Design Request (ADR) section of this document. Approval will only be granted in writing, and the NOAA IT Infrastructure Specialist must authorize it. The NOAA Engineering Project Manager or appropriate Area official must also authorize any design changes resulting from an ADR if it is associated with a Facilities Division-managed project.

C. The request shall be in writing and sent to the NOAA IT OCIO. It shall include all the requested information outlined in Section 3.4.2.B of this document.

2.6.2 TELECOMMUNICATIONS DESIGN REVIEW PROCESS

The following information applies to large projects managed by the NOAA Facilities Division. Parts of this process may also be applied in smaller projects, as indicated by the word "small" in parentheses after the process step.

A. The Telecommunications Design Review Process will, at a minimum, be completed by NOAA at the following points in the design process:

- Program Of Requirements
- Concept
- Site Selection
    - Telecommunications Paths and routing alternatives
- Schematic Design (small)
- Design Development (All submittals)
- Review Set (95% CD)
- Construction Documents (100% CD) (small)

B. The following people will participate in the Telecommunications Design Review Process:

- NOAA IT Infrastructure Specialist (small)
- NOAA Engineering Project Manager
- NOAA-selected RCDD® Review Consultant (optional)
- Architect/Engineer (Prime Consultant)
- Designer (A-E selected RCDD®)
- NOAA Area IT Specialist and/or Local IT Specialist (as required)
- NOAA Telecommunications Specialist (as required)

C. For more information relating to Telecommunication Design Reviews and associated timeframes, see Section 3.2 in this document.

2.7 TELECOMMUNICATIONS OPERATION AND MAINTENANCE

2.7.1 NOAA TELECOMMUNICATIONS INFRASTRUCTURE RESPONSIBILITIES

A. Under most circumstances, NOAA is responsible for providing a cable pathway from the property line to the Telecommunications Entry Point (TEP) (also known as the "Demarc"). At NOAA-leased facilities, the responsibility falls to the building owner who may require leasehold improvement costs. Close coordination with the different service providers is required to design the entrance cable pathway. Some service providers are not willing to share conduit or utility poles with another service provider, therefore it is important to install one or more spare conduits in the pathway. NOAA organizations such as the Facilities Office or the NOAA OCIO may need to become involved.

B. The service providers' technicians will need access to the inside and outside of the facility. NOAA is responsible for coordinating this access and providing escorts as required. Some work may require close coordination with several contractors.

C. In NOAA-owned facilities, NOAA is responsible for the installation, maintenance, and troubleshooting of all telecommunications equipment and infrastructure from the service provider's demarc point throughout the facility. In NOAA-leased facilities, the local staff will provide information to the responsible organization.

2.7.2 SERVICE PROVIDER RESPONSIBILITIES

In almost all cases, the local service provider is responsible for providing and installing the entrance cable up to the demarcation point as well as the termination hardware at the demarcation point. In some cases, NOAA contracts with the service provider to extend to the demarcation point from the demarc to another location at the facility. In such cases, the service provider is also responsible for maintenance and troubleshooting of the extended portion of the cabling and termination hardware. The service provider may also be contracted (for an additional charge) to provide troubleshooting and maintenance services for NOAA-owned equipment. All service provider contacts specific to a given location shall be directed to the responsible Area/Local IT Specialist.

2.7.3 MANUFACTURERS' "SELF-MAINTAINERS"

A. Training is mandatory for NOAA personnel who install, move, or make changes to high performance telecommunications cabling because warranties may otherwise be voided. NOAA personnel who are installing Certified Manufacturer telecommunications cabling systems must first obtain certification as a "self-maintainer" through the manufacturer's training and certification program. NOAA personnel are required to have the same level of knowledge and skill as required for the manufacturer's certified installation technicians in the private sector. This restriction does not apply to patch cables.

B. NOAA personnel who are not certified by the manufacturer as a "self-maintainer" shall not perform moves, adds, or changes at a facility that has Manufacturer-Certified cabling installed. Cabling installations performed by NOAA personnel must be tested in accordance with the manufacturers' requirements, and may be inspected as discussed in this document.

C. NOAA personnel who have obtained certification as a manufacturer "self-maintainer," but fail to follow required practices during move/add/change (MACs) activities shall surrender their "self-maintainer" certification to the NOAA Area IT Specialist. The NOAA Area IT Specialist will notify the NOAA person in writing they are no longer allowed to make MACs to high performance telecommunications cabling at NOAA facilities. The notification shall be copied to their immediate supervisor, the NOAA IT Infrastructure Specialist, and the NOAA Chief Information Officer.

2.7.4 MOVES, ADDS, AND CHANGES

A. Moves, adds, and changes (MACs) to the telecommunications infrastructure shall be performed in accordance with the requirements of this document. This includes (but is not limited to) all copper cables for the local area network, telephones, workstation area outlets, patch panels, patch cords, etc. All MACs must be coordinated with the Area IT Specialist and an exact record kept. The records must meet industry structured cabling system approaches to recordkeeping and must be updated in a timely manner.

B. NOAA personnel shall not install fiber optic cable under any circumstances without specific written permission from the NOAA IT Infrastructure Specialist. Professional installation of fiber optic cabling by a Manufacturer SCS certified installer (or NOAA personnel with a current, documented Manufacturer SCS installer certification) is permitted in order to maintain the integrity of the Manufacturer's Warranty.

2.7.5 ELECTRICAL POWER IN TELECOMMUNICATIONS ROOMS

A. Each telecommunications room (MDF or IDF) will be equipped with power outlets that are dedicated for use by telecommunications equipment. They should be distinctly marked (e.g., orange-colored) and labeled for "Telecommunications Equipment Use Only".

B. These outlets shall not be used for general-purpose or utility devices such as electric drills, vacuum cleaners, coffeepots, etc.

C. Each IDF shall also be equipped with standard power outlets (white, gray, or beige-colored) that are available for use with non-telecommunications equipment.

D. Electrical power for the telephone system and other key equipment shall be supplemented with a generator, an uninterruptible power supply (UPS) with a four-hour minimum backup time, or a combination of these two items.

2.7.6 TELECOMMUNICATIONS ADMINISTRATION

A. The property custodian shall ensure that equipment inventory is properly maintained in the Sunflower System, and person(s) responsible for telecommunications work shall ensure that current wiring, software and maintenance records are maintained for each facility within his/her purview in compliance with NOAA policy.

B. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications closets, and other telecommunications spaces. NOAA shall follow ANSI/TIA/EIA-606-A: *"Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."* The purpose of this industry standard is to provide a uniform administration scheme that is independent of applications, which may change several times throughout the life of a building.

C. For more information about telecommunications records, see Section 5.25, Cable Records in this document.

D. Records shall be maintained electronically. Paper records are discouraged, but are optional. Record drawings ("as-built" drawings) are a vital component of the telecommunications administration system. Drawings must be kept current as adds, moves, and changes take place.

E. Telecommunications records show unique “identifiers” for each component of the telecommunications infrastructure. For more information about identifiers, see Section 4.13.1, Identification Strategy in this document.

3.0 PROJECT PROCEDURES

A. The Project Procedures section contains requirements for architects, engineers and telecommunications distribution designers regarding NOAA procedures for projects that include telecommunications distribution systems.

B. It is intended that the requirements in this section be included in conconsidered contractually binding for professional design firms providing telecommunications distribution design services.

C. The design team of a large construction project is composed of an Architect who is the lead professional on the project, Engineers who are licensed professionals recognized by the State and who focus on a particular design specialty (structural, mechanical, electrical, etc.) and Consultants who are design specialists recognized by the industry but not required to be a Professional Engineer in most states (elevator, kitchen, telecommunications, etc). Telecommunications professionals often have professional certification designations (e.g., RCDD®).

3.1 DESIGNER QUALIFICATIONS

A. For the purposes of this document, the term "Designer" shall mean a Registered Communications Distribution Designer (RCDD®) who is currently in good standing with BICSI®. This means that the telecommunications design shall be produced by the RCDD®. On projects where the RCDD® is not the prime consultant, the RCDD® shall keep the prime consultant (Architect-Engineer (A-E)) informed of all direct communications with NOAA.

B. The RCDD® shall affix his/her RCDD® logo stamp (showing the registration number and expiration date) and signature to the final Construction Documents (drawings and specifications) pertaining to the telecommunications distribution design.

3.2 DESIGN PROCESS – NEW FACILITY OR MAJOR RENOVATION

The project documents are generally developed by an A-E. The design team may include an Electrical Engineer and usually an RCDD® Telecommunications Designer (on staff or a Consultant) with the design coordinated through the A-E's Project Manager. Progress submittals are to be made at the prescribed stages of the development of the design to check progress and confirm that the design meets the Government's requirements and the User's needs. In addition to the design A-E, a separate Design Review A-E is often engaged by the Government to review each of the progress submissions of the Design A-E for completeness, conformance with the scope of the project, codes, standards of practice and coordination between disciplines. At each submission, the A-E will have received design input from the RCDD® Telecommunications Designer (Consultant) and the Engineering Project Manager will send the documents to the NOAA IT Specialist for comments. All comments are to be made in writing utilizing the Review Comment Report Form in Section 6.1 of this document.

The steps in the design process for a New Facility or Major Renovation usually include the following and shall incorporate the telecommunication design process:

A. PREDESIGN PHASE -Development of preliminary information and project requirements.

This phase usually produces the following informational report:

Investigative Report – Identifies requirements through facility conditions studies, evaluation of facilities to meet research program needs, and consideration of site selection and funding requirements. The investigative report will examine the condition of any existing telecommunications infrastructure to be changed, updated, brought to the site or connected to. Consultation with utility service providers is required to properly identify and evaluate the requirements.

Program of Requirements – A detailed statement of needs identifying the overall infrastructure and room-by-room requirements within a facility. The POR will identify the use of each room and the number and type of information jacks or other devices required; as well as special location requirements. In addition to users and research leaders, the Local or Area IT Specialist should be consulted to confirm these needs.

B. DESIGN PHASE – Development of Design and Associated Documents

During this phase, the following designs and associated reports are usually produced and submitted:

15% submittal – Shows the scope and major design schemes and assumptions. It includes a narrative description, calculations, estimates and cost analysis. Proposed systems are described, codes referenced are listed, a detailed cost estimate is prepared and documents that were the basis of design are appended. Telecommunications work shall be included.

35% submittal – Includes a design analysis and drawings including a site plan, building plans and elevations, major details and outline specifications. There may be alternate schemes. It includes a narrative description, cost estimate and will show that the A-E has a complete grasp of the intended work and can develop the design documents for bid. Utilities, including telecommunications, should be appropriately developed and detailed on the proper drawings and required specification sections should appear in the outline. Value Engineering is done at the 35% submittal level.

50% submittal – Includes a full set of drawings and specifications. Drawings should include all sheets appropriately completed and coordinated between disciplines. Equipment schedules, equipment locations and appropriate details should be shown. A design analysis will be developed to the 50% level. Telecommunications work shall be appropriately incorporated into codes and standards, cost estimates, descriptions of systems and drawings. A draft of the full text of telecommunications specification sections should be included.

95% submittal – The drawings, specifications and cost estimate should be complete. Any corrections should be minor. All telecommunications work should be shown completely and correctly on the drawings and the specifications should be fully developed and thorough.

100% submittal – This is a complete set of documents ready for bid and shall be accompanied by a schedule and manufacturer’s catalog cuts of all major equipment that was the basis of the design. Any corrections or adjustments shall be incorporated before final turnover of the design documents.

C. As noted in Section 3.5.3 -"Procedures Related To Project Phases", the project documents will pass through the telecommunications design review process at the end of each design phase; plus any follow-up reviews when necessary.

D. A separate Design Review A-E will review each submission of the Design Phase. The Design A-E shall be responsible to determine that the review process is conducted in accordance with NOAA's requirements, and shall participate in the review process to determine that the review comments are satisfactorily addressed.

3.3 TELECOMMUNICATIONS DESIGN REVIEW PROCESS – NEW FACILITY OR MAJOR RENOVATION

Telecommunications Designs are usually completed in phases and they are described in Section 3.5.3 of this document. The phases can be characterized as follows:

- Schematic Design and Field Work
- Design Development
- Construction Documents

A. The following design review steps shall be used by the Telecommunications Design Reviewers and they correspond to the numbered activities shown on the Telecommunications Design Review Process diagrams below:

Each time a review is required, the A/E shall provide submitted copies of the complete project documents set (drawings and specifications for all disciplines involved in the project) to the following people:

- NOAA Engineering Project Manager (EPM)
- NOAA IT Infrastructure Specialist
- RCDD® Review Consultant[2] (two sets)

If there is no RCDD® Review Consultant assigned to the project:

- The A/E and Designer shall coordinate with NOAA IT Infrastructure Specialist and FD EPM to initiate the review process.
- The NOAA IT Infrastructure Specialist will create the NOAA IT Review Report without RCDD® Review Comments
- The NOAA IT Review Report will then be sent to the NOAA Engineering Project Manager for review

Following the meeting, the NOAA Engineering Project Manager will submit the RCDD® Review Report to the Designer. The Designer will then be given five days to review the comments and respond to them in writing. Negative responses to any comment shall include a discussion of the reasons for non-compliance.

Finally, a meeting or teleconference will be held with the NOAA Engineering Project Manager, the NOAA IT Infrastructure Specialist, the RCDD® Review Consultant (if involved) and the Designer to discuss the review comments and the Designer's responses. Following the meeting, the Designer shall revise the design in accordance with NOAA's resolution for each comment.

B. The A-E Design Review Consultant shall be responsible to determine that the review process is conducted in accordance with NOAA's requirements, and shall participate in the review process to determine that the review comments are satisfactorily addressed.

C. For NOAA Facilities Division-managed projects, the review intervals and schedule shall be per the Task Order

3.3.1 RCDD® REVIEW CONSULTANT

For projects where NOAA contracts with an RCDD® Review Consultant, the prime consultant (Designer or A/E) shall provide two sets of the drawings and specifications (from all relevant disciplines involved in the project) for the RCDD® Review Consultant. The RCDD® Review Consultant will not perform any design services. The RCDD® Review Consultant could be asked to do the following:

3.3.1.1 Typical Document Review Scope

- Review the telecommunications distribution system design:
  - For compliance with NOAA and Industry standards
  - To identify apparent conflicts (routing, electromagnetic interference, etc.) with other discipline's designs
  - For apparent coordination with telephone service providers or other utilities
  - For general document clarity
  - For validity of any cost estimates

- Review the completed needs analysis report.

- Review the cutover plans.

The RCDD® Review Consultant shall review the documents according to NOAA's standards and produce a written report that addresses all deficiencies.

3.3.1.2 Other Services (upon specific NOAA request)

A. On some projects, NOAA may also use an RCDD® Review Consultant to provide services during the construction phase. These services may include submittal review and "big-picture" construction observation services. In these situations however, the Designer or Design A-E always remains responsible for submittal review, construction observation, punch-list management, and other contracted-for services.

B. In these situations, the RCDD® Review Consultant shall provide written comments to NOAA and to the Designer or Design A-E. In turn, NOAA will decide how to act on the written comments, and then direct the Design A-E, Designer or Contractor accordingly. The RCDD® Review Consultant shall not, under any circumstances, give direction to the A-E, Designer or Contractor out of the Chain of Privity (chain of responsibility).

3.4 ARCHITECT / ENGINEER TEAMS

It is imperative that the telecommunications design be incorporated during the preliminary architectural design phase. To accomplish this, the NOAA IT Specialist shall coordinate with the Design A-E, the designated project RCDD® and the NOAA Engineering Project Manager beginning with the Pre-Design phase of the project and throughout the Design Phase.

3.4.1 CROSS DISCIPLINE COORDINATION

NOAA also agrees with BICSI® that successful telecommunications projects require design coordination between the disciplines involved in the project. The Designer shall coordinate the telecommunications requirements and design features with the designs produced by the other designers on the project. At a minimum, the following aspects of the design shall be coordinated:

3.4.1.1 Outside plant telecommunications infrastructure:

- Ductbank routing around obstacles (trees, tunnels, buildings, existing ductbanks, etc.)
- Coordinate the locations of maintenance holes and hand holes to determine that they are not located in areas of water concentration, site requirements, drainage, traffic, joint usage, utility requirements, etc.
- Proximity of ductbanks to sources of EMI
- Proximity of ductbanks to steam piping
- Routing of entrance conduits through buildings
- Backbone cabling requirements of other disciplines (fire alarm, HVAC, security, CATV, etc.

3.4.1.2 Horizontal and Intra-building backbone telecommunications infrastructure:

HVAC cooling requirements for telecommunications rooms (TR)

HVAC ductwork routing (avoiding IDF ceiling spaces)

Plumbing routing avoiding IDF spaces Lighting requirements for IDFs

Power requirements for IDFs

Electrical Grounding

Power requirements for work areas (receptacle locations near telecommunications outlet locations)

Proximity of cabling to sources of EMI

Routing of telecommunications conduits through and location of telecommunications pullboxes in congested areas (HVAC ductwork, plumbing, electrical, etc.)

Floor treatments in IDFs

More information regarding the above requirements is available in the Design Criteria section in this document.

3.5 GENERAL PROCEDURES

3.5.1 CAD FILES

The Designer shall coordinate with the A/E to determine that the electronic CAD files used for backgrounds for the telecommunications design are consistent with the CAD file backgrounds used by the other disciplines on the project.

3.5.2 ALTERNATIVE DESIGN REQUEST (ADR)

A. This document identifies specific design solutions that are intended to meet the technical requirements of NOAA telecommunications and information technology systems, as well as the unique security or safety requirements necessary at many NOAA facilities. Design issues that are not consistent with the requirements in this document shall require prior approval through the NOAA ADR process. Requests to deviate from industry standards or NOAA design solutions will be considered on a case-by-case basis. Any request to deviate from applicable code requirements or to deviate from the requirements of a Certified-Manufacturer's warranty will not be accepted.

B. Requests to apply ADR solutions shall be submitted in writing by the Designer via the Engineering Project Manager and/or the Location/Area NOAA IT Specialist to OCIO for consideration. The substitution request shall include a complete description of the proposed alternative design identifying:

   1. The type of facility;
   2. The conditions at the facility;
   3. The approved design solution as described in this document or as described in the standards referenced in this document;
   4. The proposed alternative design;
   5. A list of the guidelines and standards referenced in this document with which the alternative design will not be in compliance, and the effect of non-compliance, both short and long term;
   6. The reason for wishing to use the alternative design;
   7. The estimate cost impact of this request (+/-);
   8. The contractor or personnel performing the construction;
   9. A statement identifying the impact to the physical security of the NOAA facility.

C. Finally, the Designer shall provide written comments indicating that the proposed alternative design will meet the applicable NOAA system performance requirements, and identify any performance limitations, drawbacks and benefits from using the alternative design.

D. The Designer shall ensure that the ADR process is properly followed. For projects where the Designer is not the prime consultant, the prime consultant shall also ensure that the ADR process is properly conducted, and shall participate in the process (review, acknowledge and address issues) to determine that NOAA's requirements are met.

E. A sample Alternative Design Request form is provided in Appendix 6.7.

3.5.3 PROCEDURES RELATED TO PROJECT PHASES

Telecommunications projects are typically conducted in phases. Designers of telecommunications distribution systems for NOAA facilities have the following phase-related responsibilities:

3.5.3.1 Schematic Design and Fieldwork

A. Telecommunications projects on existing NOAA campuses will require preliminary fieldwork to document the existing cabling and infrastructure systems into which the new cabling and infrastructure will integrate. At facilities hosted by a college or university, coordination with campus telecommunications professionals may be required.

B. The Designer shall visit the project site during the schematic design phase to perform the preliminary outside plant fieldwork. The Designer shall create the following types of documentation based on information gathered while onsite:

- Take digital photographs of existing telecommunications pathways, spaces and cabling that affect or are affected by the new project work.
- Create butterfly diagrams of each existing maintenance hole and handhole that is associated with the new project, identifying each cable and conduit in each maintenance hole and handhole. A sample butterfly diagram is shown in Appendix 6.2.
- Create a backbone schematic diagram showing the existing outside plant cabling in the area associated with the new project and the existing cross connection strategy. A sample backbone schematic diagram is shown in the Appendix 6.3.
- Investigate local utility companies' service capacities to location and potential construction timelines for estimating schedules.

C. The Designer shall visit the project site during the schematic design phase to perform preliminary field investigation of the horizontal and intra-building backbone telecommunications infrastructure. The Designer shall create the following types of documentation based on information gathered while onsite:

- Take digital photographs of existing telecommunications rooms and work areas that affect or are affected by the new project work.
- Create a riser diagram showing the existing intra-building backbone cabling associated with the new project and the existing cross connection strategy.
- Investigate and document the routing of existing horizontal pathways and cabling that is affected by the project.
- Create elevation diagrams of each telecommunications rack and each wall within each IDF affected by or affecting the new project work.

D. The Designer shall also conduct a needs analysis (involving NOAA personnel) to identify and describe the minimum required features and functionality in the new telecommunications infrastructure to bring the location into compliance with the basic BICSI® standards for telecommunication distribution systems.

E. The information gathered during the fieldwork, combined with the results of the needs analysis shall be the starting point for schematic design of the proposed new work.

F. Schematic Design documents shall show the following information:

- Building and local distribution

- Telecommunications Room sizes and locations
- Major distribution pathways
- Backboard locations

G. Upon completion of the Schematic Design documents, the standard Design Review Process shall be conducted prior to progressing to the Design Development phase.

3.5.3.2 Design Development

A. The Designer shall modify the design documents to address the review comments received during the Schematic Design Phase.

B. During the Design Development phase, the Designer shall obtain the assistance of a certified Structured Cabling System (SCS) manufacturer's product representative to review the project specifications to determine that the correct part numbers have been included for each SCS product in the specification. The Designer shall also verify that the part numbers for non-SCS products are accurate.

C. In addition to the content shown on the Schematic Design documents, the Design Development documents shall show the following information:

- Schematic diagrams
- Outlet locations

D. Upon completion of the Design Development documents, the standard Design Review Process shall be conducted prior to progressing to the Construction Document phase.

3.5.3.3 Construction Documents

A. The RCDD® Designer shall modify the design documents to reflect the accepted review comments received during the Design Development Phase. The Construction Documents are also expected to contain the items discussed in the *Construction Document Content* section of this document.

B. In addition to the content shown on the Schematic Design and Design Development documents, the Construction Documents shall show the following information:

- Raceway routing plans
- Telecommunications room wall elevation details
- Rack elevation details
- Maintenance Hole/Handhole details
- Ductbank details

C. Upon completion of the Construction Documents, the standard Design Review Process shall be conducted. The Designer shall then modify the documents to reflect the accepted review comments associated with the Construction Documents prior to the Bidding Phase.

D. Upon completion of the Final Construction Documents, the standard Design Review Process shall be conducted as described above. Any review comments generated at this point shall go into an Addendum to the Final Construction Documents.

3.5.3.4 Bidding

On projects where a pre-bid walkthrough is held, the Contracting Officer shall attend the walkthrough and shall provide the bidders with a written list of materials and practice requirements that the bidders might find peculiar and that might affect the bids if such requirements are overlooked. Noteworthy items would typically be requirements that are more restrictive than practices considered acceptable for other commercial projects. The Designer shall consider the following items for inclusion on such a list, as well as any other items applicable to the project:

- The existence of “rat walls”
- The requirement for no more than two 90 degree bends in any conduit run.
- The fact that telecommunications standards are more stringent than electrical installation requirements

3.5.3.5 Construction Observation

A. The Designer shall review the Contractor’s submittals that are required by the Construction Documents. When the Contractor’s submittals include materials or methods that deviate from NOAA standards, the Designer shall either:

  - Reject the specific materials and methods that do not comply, when the Designer believes
  - that they constitute undesirable solutions.
  - Pursue the ADR process to seek approval for each specific material and method that the Designer believes would constitute a better solution.

B. The Designer (RCDD®) shall visit the construction site frequently to observe the construction quality and status. The Designer shall confer with the NOAA Engineering Project Manager prior to proposing services for the project to determine an appropriate site-visit frequency for the project. On average, one site visit per week will typically be required for building-wide projects and one to three visits per two week period will be typically required for campus-wide projects. The frequency will likely change during the construction as the telecommunications-related activity increases and decreases.

C. During the site visits, the Designer shall take digital photographs of existing and new telecommunications pathways, spaces and cabling, both intra-building and outside plant and that are related to the project. In particular, the Designer shall photograph infrastructure that will later be concealed during the course of construction.

D. Accurate record drawings are considered critical for the efficient operation of NOAA facilities. During these site visits, the Designer shall observe and report on the Contractor’s progress toward staying current with the record drawings notations.

E. After each site visit, the Designer shall submit a written report describing the observed construction progress. Observations shall be documented in the report with annotated digital photographs and a written description of any problems, a description of the requirements in the Construction Documents and the resolution to the issues. For each item requiring corrective attention, the report shall describe the following:

<table>
<tr><td>Job Name:</td><td colspan="3"></td></tr>
<tr><td>Date:</td><td colspan="2">Designer's Name:
Company:</td><td>Phone:
E-Mail:</td></tr>
<tr><td>Description of the issue:</td><td colspan="3"></td></tr>
<tr><td>Location of the issue:</td><td colspan="3"></td></tr>
<tr><td>Applicable Requirements in the Construction Documents:</td><td colspan="3"></td></tr>
<tr><td>Applicable NOAA standards, Industry standards and codes:</td><td colspan="3"></td></tr>
<tr><td colspan="4">Corrective options available to NOAA:</td></tr>
<tr><td>A</td><td colspan="3"></td></tr>
<tr><td>B</td><td colspan="3"></td></tr>
<tr><td>C</td><td colspan="3"></td></tr>
<tr><td colspan="4">Designer's Recommendation:</td></tr>
</table>

FIGURE 5: CONSTRUCTION PROGRESS DESIGN DEVIATION REPORT

F. The Designer shall submit the construction observation reports via email to the NOAA EPM and the NOAA IT Infrastructure Specialist as soon as possible following each site visit. The reports shall also be reviewed at the next construction meeting. A timely report submission will aid the Designer and NOAA in identifying potential problems early in the construction process.

G. The Designer shall review the cable test reports produced by the Contractor for each cable installed during the project. The Designer shall verify that the following conditions are addressed in the cable test reports:

For Fiber-optic Cabling	For UTP Cabling
The cable test report shall be automatically produced by the test equipment.	The cable test report shall be automatically produced by the test equipment.
The report shall indicate that the cable passed the test.	The report shall indicate that the cable passed the test.
The Designer shall verify that the cable test report indicates a headroom dB value that is equal to or better than the value calculated in the link -loss budget.	The Designer shall verify that the cable test report indicates the correct Nominal Velocity of Propagation (NVP) indicated on the cut sheet from the cable manufacturer.

3.5.3.6 Post-Construction

A. The Designer shall review the Operation and Maintenance information provided by the Contractor for the telecommunications distribution system. The Designer shall verify that information is included for each component in the telecommunications distribution system. Upon approval of the content in the Operation and Maintenance information, the Designer shall submit the information to local NOAA IT Staff with written documentation indicating that the Designer has reviewed the information and that it appears to meet the requirements in the Construction Documents.

B. The Designer shall provide record drawings and record documentation to NOAA (based on documents that have been “red-lined” by the Contractor).

4.0 DESIGN CRITERIA

4.1 General Information

A. The NOAA FITCSG is not intended to be a comprehensive design resource guide for telecommunications design at NOAA facilities. The Designer shall look primarily to the BICSI® TDMM and CO-OPDM for design guidance. The resulting Construction Documents shall also be consistent with the installation practices described in the BICSI® *Information Transport Systems Installation Manual* (ITSIM).

B. Where ANSI/TIA/EIA Standards or BICSI® manuals offer multiple choices with a preferred method identified, and where the NOAA FITCSG does not select one method over another or define specific requirements precluding use of the preferred method, the ANSI/TIA/EIA or BICSI®-preferred method should be selected.

C. Where ANSI/TIA/EIA Standards or BICSI® manuals identify warnings regarding potential adverse effects from certain design or installation methods, the design or installation method used should typically be the method with the least potential for adverse effects.

D. Telecommunications distribution systems shall be designed for construction using materials from a Certified Manufacturer's Structured Cabling Solution (SCS) product line. The design documents shall require that the workmanship fully comply with the current Certified Manufacturer's SCS installation guidelines and performance specifications.

E. Any request to deviate from the requirements of the National Electrical Code® or from the Manufacturer's SCS warranty will not be accepted. The Designer shall seek approval for designs that are not consistent with NOAA FITCSG requirements through the NOAA Alternative Design Request (ADR) process. Requests to deviate from industry standards or NOAA design solutions will be considered on a case-by-case basis by the NOAA IT Infrastructure Specialist. Designers are encouraged to contact the NOAA IT Infrastructure Specialist to discuss proposed alternatives before spending any significant time on an alternative.

F. Telecommunications distribution infrastructure shall fully comply with the current NOAA FITCSG, the current ANSI/TIA/EIA Commercial Building Telecommunications Standards and the current National Electrical Code® (NEC).

G. The following subsections are arranged to mirror the chapter sequence of the BICSI® TDMM (the subsection numbers below are in the form of 4.x where x represents the chapter number in the BICSI® TDMM).

Each NOAA FITCSG subsection contains commentary and requirements regarding the application of the BICSI® TDMM to NOAA Projects. In particular, each section contains limitations and prohibitions on specific materials and methods discussed in the BICSI® TDMM. Where no NOAA FITCSG subsection is written (addressing comments about or requirements for the corresponding BICSI® TDMM subchapter) the Designer can assume that the BICSI® TDMM subchapter applies as written. The *General Information* section of the BICSI® TDMM is not applicable to this document.

4.2 Codes, Standards and Regulations

Please refer to the *Codes, Standards and Regulations* section of the BICSI® TDMM for information regarding the codes, standards and regulations required for telecommunications infrastructure at NOAA facilities.

4.3 Definitions, Abbreviations, Acronyms & Symbols

Please refer to the *Definitions, Abbreviations, Acronyms, and Symbols* section of the BICSI® TDMM for definitions, abbreviations, acronyms and symbols used for describing and documenting telecommunications infrastructure at NOAA facilities.

Other terms are defined in the Glossary located in Section 8 of this document.

4.4 Horizontal Distribution Systems

Please refer to the *Horizontal Distribution Systems* section of the BICSI® TDMM for general information regarding the design of horizontal distribution pathway and cabling. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

4.4.1 Inside Plant Telecommunications Infrastructure

A. The common inside plant (ISP) telecommunications pathway is intended for shared use (to the extent possible) and the common ISP telecommunications media is intended for separate use by the following low-voltage systems, in addition to voice and data systems:

- Building Automation Systems
- Fire Alarm Systems
- Video Systems (Digital)
- Security Systems
  - Access Control Systems
  - Alarm Systems
  - Intrusion Detection Systems
- Energy Management Systems
- Environmental Control Systems

B. The common inside plant telecommunications media shall be 50/125 micron multimode fiber optic cable and 24 AWG unshielded twisted pair (UTP) copper cable (Category 6-rated).

C. Inside plant telecommunications infrastructure intended to support Ethernet communications (or other similar protocols) for security and fire alarm systems shall be designed in accordance with the inside plant telecommunications infrastructure requirements in this document. However, due to the critical nature of these systems, inside plant pathway and cabling serving these systems shall homerun to a central location per location requirements rather than always to a common shared telecommunications room.

4.4.2 Horizontal Pathway Systems

The design and installation practices for NOAA-owned intra-building telecommunications conduit have some unique requirements beyond those normally applicable to standard electrical conduit. The following items are required to be included in the design and installation of intra-building telecommunications conduit in NOAA facilities:

4.4.2.1 Sizing Considerations for Horizontal Pathways

A. The cable pathway shall be sized to support the initial installation of cable, plus a minimum of 35% growth.

B. During the Schematic Design phase, the Designer shall discuss with NOAA the future growth anticipated for the facilities affected by the project and shall increase the spare capacity to be designed accordingly.

C. Conduit runs shall be designed with larger feeder conduits that transition to multiple smaller distribution conduits at strategically located junction boxes.

4.4.2.2 Design Considerations for Conduit Distribution

A. NOAA does not permit conduit runs to be designed using “multi-drop” or “daisy-chain” configurations such as identified in the BICSI® TDMM.

B. Where conduit runs terminate in telecommunications rooms, the conduits shall be arranged in an organized manner to facilitate an orderly cable transition from conduit to backboard.

C. Surface metal raceways and surface non-metallic raceways shall not be used in new construction.

D. NOAA does not permit the use of any non-metallic conduit for horizontal pathways.

4.4.2.3 Conduit Capacity

A. Conduits shall not be filled with multiple cables beyond 40%. The Designer shall refer to the BICSI® TDMM for information regarding conduit capacity and fill. The Designer shall verify the outer diameter of all cable approved for use by NOAA at the time of the design to determine the maximum number of cables that can be placed inside a conduit without exceeding the 40% fill limitation.

B. In new construction, all wall outlets shall have a minimum one-inch trade size conduit routing from the device box to an accessible cable pulling location. Increase the conduit size as necessary for the quantity of cables to be installed. Where new conduit is installed in existing buildings, the Designer shall notify NOAA when existing conditions prevent the use of one-inch trade size conduit as a minimum conduit size.

4.4.2.4 Multi-drop Conduit Systems

NOAA does not permit the use of the Multi-drop Conduit System as identified in the BICSI® TDMM.

4.4.2.5 Pull Boxes (PBs) for Conduits

A. Pull boxes shall be designed for access doors to open from the area where the cable installer will normally work.

B. Ceiling access to the pull box shall be designed to allow full access to the pull box door and adequate working room for both the installation personnel and proper looping of the cable during installation.

4.4.2.6 Access Floors

NOAA design typically places telecommunications cables above equipment racks on cable runways and runs electrical cables in the access floor space. If both are in the access floor space, NOAA requires electrical power circuits to be placed in EMT conduit and adequate separation maintained (according to the *Electromagnetic Compatibility* subsection of this document) to avoid EMI.

4.4.2.7 Ceiling Distribution Systems

A. When considering the possibility of designing a non-conduit ceiling distribution system in NOAA facilities, the Designer shall verify that the locations under consideration will comply with the space, accessibility and clearance requirements identified in the ANSI/TIA/EIA Standards and the BICSI® TDMM. Ceiling distribution systems shall be designed such that all installed cable is conveniently accessible after construction for both cable maintenance and to install subsequent cable additions.

B. Conduit shall be used to route cabling across “hard-lid” ceilings, where ceiling tiles are not readily removable, or where accessibility is less than recommended.

C. Consideration shall be given to specify minimum ceiling heights such that plenums do not crowd cable runs.

4.4.2.8 Cable Tray Design for Ceiling Systems

Cable trays shall not be shared with power cables and shall maintain the minimum separation distances (according to the *Electromagnetic Compatibility* subsection of this document) from these and other potential sources of EMI. Each cable tray section shall be bonded.

4.4.2.9 Distribution from Ceiling Systems – Utility Columns

NOAA requires that utility columns used for both telecommunications and power distribution be metallic and be equipped with a metallic barrier.

4.4.2.10 Wet Locations

A. Wet locations include areas such as slab-on-grade construction, where pathways are installed underslab or in concrete slabs that are in direct contact with soil (e.g., sand, gravel, etc.).

- For the main floor in, “slab on grade constructed buildings” conduit will route in walls and ceilings, not in or under the slab.

B. Intra-building and horizontal pathways shall, where possible, only be installed in “dry” locations where indoor cabling can be protected from humidity levels that are beyond the intended humidity range for use of indoor-only rated cable.

4.4.2.11 Areas Inside Security Perimeter

Intra-building telecommunications pathway in non-restricted areas shall be designed consistent with industry codes, standards, and the guidelines in the BICSI® TDMM. The pathway method selected shall be appropriate for the type of facility. For example:

Surface mounted conduit or tubing might be used in a warehouse or a utility building.

When retrofitting an existing office, distribution above a false ceiling or an aesthetically pleasing surface mounted raceway might be used.

For new construction, conduit shall be concealed in walls and ceilings wherever possible.

4.4.2.12 Tenant Areas

A. The telecommunications substructure supporting tenant locations shall be designed and installed to provide maximum flexibility to meet the needs of the other government tenants or private companies who operate in NOAA facilities as tenants.

B. The horizontal telecommunications pathway supporting tenant locations shall be designed and installed to provide maximum flexibility. Tenant locations are normally NOAA-style buildings and may be outside or inside restricted areas. The Designer shall apply the following guidelines when planning the horizontal telecommunications pathways for Tenant locations:

- The Designer shall review all telecommunications infrastructure designs for Tenant locations with the NOAA IT Infrastructure Specialist to insure full compliance with the requirements of the NOAA policy and IT guidelines. The NOAA Area IT Specialist or designee shall approve the final design.
- The Designer shall include horizontal pathway to and within Tenant location in the design documents. The Designer shall request direction from NOAA regarding the requirements for telecommunications infrastructure serving Tenant locations on a case-by-case basis.
- All low voltage infrastructure installed for Tenants and their contractors shall be in full compliance with the NOAA FITCSG.
- Telecommunications infrastructure in Tenant locations shall be sized to allow a minimum of 35% growth.
- All cabling shall be designed in full compliance with the NOAA FITCSG.
- All telecommunications distribution equipment shall be installed in a lockable telecommunications room or lockable telecommunications cabinets.
- Telecommunications Rooms or Closets (TRs/TCs) serving Tenant locations shall be provided with additional vacant egress pathways (such as sleeves) to

accommodate future changes to the telecommunications cabling design.

4.4.2.13 Bio-Hazard Containment Area

A. The design of the telecommunications substructure supporting bio-containment areas within a facility shall comply with all codes and standards applicable to the project, and as described in the latest version of the *GSA P-100*.

4.4.3 HORIZONTAL CABLING SYSTEMS

4.4.3.1 General

A. The Designer shall work with NOAA program staff and IT staff (both at the project facility and at NOAA headquarters) to identify and understand the needs and requirements for each facility on a project-by-project basis. This includes understanding the current and expected future uses of each facility. The Designer shall design the telecommunications infrastructure accordingly.

- NOAA has standardized on Structured Cabling System product lines from Certified Manufacturers for telecommunications infrastructure. Therefore, telecommunications infrastructure designs and specifications shall be based upon a Certified Manufacturer's Structured Cabling System.

B. For the purposes of this document, references to Category 6 cable shall be interpreted as cable that meets or exceeds the current performance specifications for category 6 cabling published by the TIA/EIA.

C. The basic configuration for providing telecommunications infrastructure for a work area is to provide a minimum of one 4-pair Cat-6 cable. There are many situations that require more or less cables than the basic configuration, for example:

- A full-duplex multi-mode fiber optic cable drop may be required for high-end scientific workstations.
- A wall mounted telephone location might need only one cable.
- A particular work area might require one data and two voice outlets to support a computer, telephone, and fax machine.
- Each information outlet should be Home Run to its associated MDF/IDF
- Additional data cables shall be provided to accommodate LAN-attached printers or other devices.

D. Providing spare ports for an outlet in a work area and providing spare outlets in a room are encouraged within the limitations of the project budget to meet projected future needs.

E. Generally, the eight-position pin/pair assignment for new cabling in new construction shall be the T568B configuration. The T568A configuration shall only be used in the following two cases (but only after receiving written approval from the NOAA IT Infrastructure Specialist):

- For new cabling in a new building on an existing site, when the T568B configuration does not exist anywhere on the campus.

- For new cabling added to existing cabling in an existing building, where the existing cabling is to remain in operation and where the T568B configuration does not exist anywhere in that building.

In all other cases, new cabling shall be terminated using the T568B configuration.

F. Outdoor-rated waterproof cable will not be allowed in horizontal cabling applications.

G. Telecommunication outlets on laboratory workbenches are to be designed and located after consulting with the local user representative on the facility design team. Quantities sufficient to support current and future laboratory equipment LAN connectivity requirements are mandatory. At a minimum, the design shall specify telecommunication outlets at 6 foot intervals along the center of each lab bench. Additionally, telecommunication outlets shall be provided at each end of any center benches.

Close coordination with Laboratory Designers is required to provide telecommunication outlets along wall perimeters to avoid sinks, fume hoods, refrigerators, etc.

4.4.3.2 Horizontal Cabling

A. At NOAA facilities, horizontal distribution copper cable and components for data applications shall be rated and installed to support the IEEE® 802.3ab 1000Base-T Gigabit standard or better.

B. Horizontal distribution cable shall be 4-pair Category 6 copper cable and 50/125-micron multimode fiber optic cable in new installations.

- Category 6 cables shall be terminated at the work area end with Certified Manufacturer's information outlets. The outlets shall be colored white unless the facility has a different preestablished color code for Category 6 outlets. In all cases, Category 6 outlets shall be of a color that is different from other outlet categories.
- Category 6 cables shall be terminated at the telecommunications room end with Certified Manufacturer's SCS Cat-6 compliant distribution hardware.
- Fiber optic cable shall be terminated at the work area end with Certified Manufacturer's information outlets. The outlets shall be colored red unless the facility has a different preestablished color code for Fiber optic outlets. In all cases, Fiber optic shall be of a color that is different from other outlet categories.
- Fiber optic cable shall be terminated at the telecommunications room end with Certified Manufacturer's SCS Fiber optic compliant distribution hardware.

C. In existing buildings, where additions are made to an existing Category 5 or 5e installation, the additions shall be made using Category 6 cable and matching CAT 6 components. The Category 6 cable sheath shall be of a color that is different from other existing cable that is less than Category 6.

- Category 5 cable and components shall not be purchased or installed.
- Existing NOAA inventories of Category 5e cable and components may be used until it is depleted. Additional Category 5e cable and components may only be purchased following approval through an Alternative Design Request.

- Category 6 cables shall be terminated at the work area end with a Certified Manufacturer's Cat-6 compliant information outlet. The outlet shall be colored yellow (to distinguish them from existing cabling) unless the facility has a different pre-established color code for Category 6 outlets. In all cases, Category 6 outlets shall be colored differently from other outlet categories.
- Where only two or three new cables are required, Category 6 cables may be terminated at the IDF end on existing Category 5 patch panels or existing model CAT-5e Modular Patch Panels if those patch panels have existing ports available for the new cabling.
- Where more than three new cables are required or where there is insufficient existing port availability on existing Category 5 or 5e patch panels, the NOAA IT Infrastructure Specialist shall be contacted for specific direction on a case-by-case basis.
- All newly purchased patch panels shall be Category 6 Certified Manufacturer compliant.

D. Under no circumstances will the splitting of data cable pairs be allowed on either side of the information outlet or either side of the outlet panel or patch panel. External line splitting devices shall not be used.

4.4.3.3 Patch Cords

A. Patch cords shall be Certified Manufacturer factory manufactured patch cords. Patch cords shall be certified by the manufacturer to match the cable type used in the horizontal distribution.

- Category 6 patch cords shall be used with all copper horizontal cabling, regardless of "category".
- Field terminated patch cords are not acceptable. Any existing field-assembled patch cords used in areas affected by a project shall be replaced under the project with factory assembled Category 6 patch cords.
- 50/125-micron multi-mode fiber optic patch cords shall be used with all fiber optic horizontal cabling

B. Where the Certified Manufacturer patch system is installed, only Certified Manufacturer factory patch cords shall be used.

4.4.3.4 Horizontal Cable to Support Low Voltage and Building Automation Systems

A. During planning for intra-building telecommunications cabling installations, the Designer shall identify options for supporting power limited (low voltage) and building automation systems with the common structured cabling system, and present the options to NOAA for consideration. (See ANSI/TIA/EIA-862 *Building Automation Systems Cabling Standard for Commercial Buildings*.)

B. By providing a common cabling distribution system for the various building automation systems, it may be possible to reduce construction and operational costs while creating an intelligent building that can contribute many other benefits (see the BICSI® TDMM (11th ed.) for further information). Low voltage systems that are capable of using a common structured cabling system (either backbone or horizontal cabling) shall be designed to use the same Certified Manufacturer Structured Cabling System cable and termination hardware wherever possible.

C. The Designer shall request from NOAA a list of building automation systems that will require telecommunications outlets for operations. The Designer shall then include outlets in the design as necessary to meet the listed requirements.

4.4.3.5 Horizontal Cable Maintenance Loop

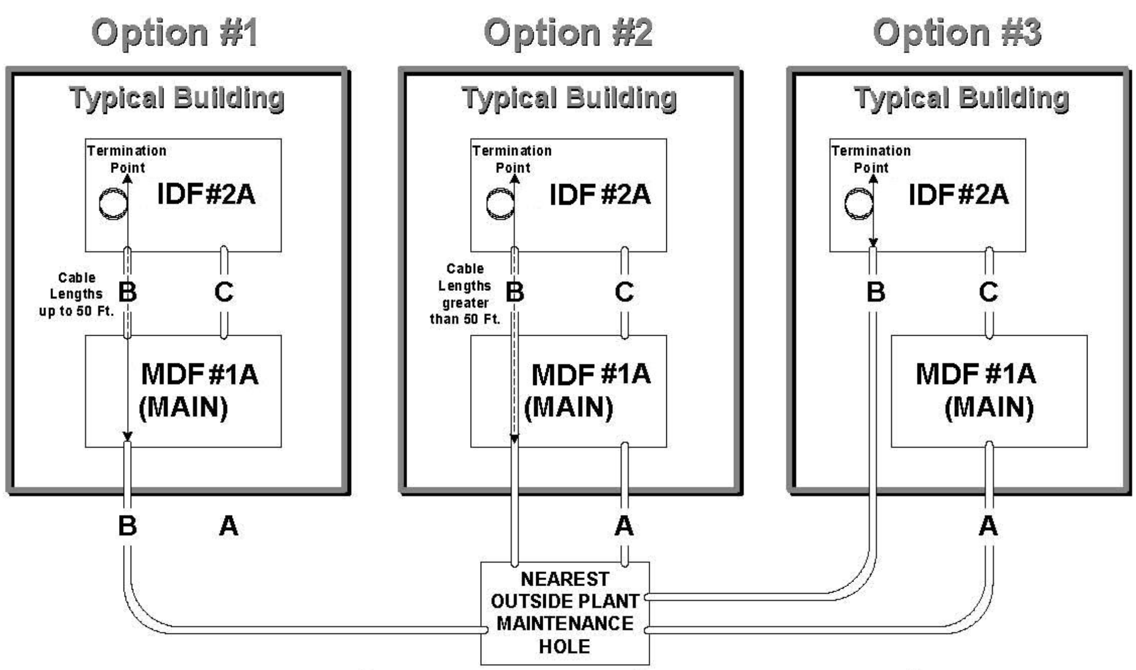
A maintenance loop shall be provided at both ends of all horizontal cable installations per the recommended minimum amount in the BICSI® TDMM.

4.5 BACKBONE DISTRIBUTION SYSTEM

Please refer to the *Backbone Distribution System* section of the BICSI® TDMM, the *Pathways and Spaces* section and the *Cabling* section of the BICSI® CO-OPDM, and the *Installing Backbone Pathways* section of the BICSI® ITSIM for general information regarding the design of backbone distribution pathway and cabling. The following requirements take precedence over the BICSI® TDMM, the BICSI® CO-OPDM, and the BICSI® ITSIM guidelines for telecommunications infrastructure at NOAA facilities:

4.5.1 INTRA-BUILDING BACKBONE PATHWAYS

The diagram below shows three options for routing entrance pathways between the outside plant maintenance holes and each telecommunications room in a building as well as routing intra-building backbone pathways. Please note that while intermediate pull boxes are not shown in the diagram below, they may be required in some applications per BICSI® TDMM requirements.



A: Size = 4”, Qty 4 B: Size = 4”, Qty 1 C: Size = 3”, Qty 2

FIGURE 6: TYPICAL EXAMPLES FOR ROUTING BUILDING ENTRANCE PATHWAYS

OPTION #1 APPLIES WHEN THE FOLLOWING TWO CONDITIONS BOTH EXIST:

- When the most desirable route (between the nearest outside plant telecommunications maintenance hole and a IDF) is to pass through the MDF to reach a IDF.
- When the cable length (including 25 ft. service loops) is 50 feet or less from the point that it enters the main telecommunications room to the point where it terminates in the secondary telecommunications room.

Please note that the cabling in conduit "B" passes through the MDF without terminating or being spliced. While it is permitted for the cable in the MDF to exit the conduit on one wall and reenter conduit on another wall (via a pathway and/or pull box), the only termination for the cable is in IDF #2A.

OPTION #2 APPLIES WHEN THE FOLLOWING TWO CONDITIONS BOTH EXIST:

- When the most desirable route (between the nearest outside plant telecommunications maintenance hole and a IDF) is to pass through the MDF to reach a IDF.
- When the cable length is more than 50 feet from the point that it enters the main telecommunications room to the point where it terminates in the secondary telecommunications room (including 25 ft. service loops).

Please note that the cable remains inside conduit "B" while it passes through the MDF without terminating or being spliced. The cable then terminates in IDF #2A.

OPTION #3 APPLIES WHEN THE MOST DESIRABLE ROUTE (BETWEEN THE NEAREST OUTSIDE PLANT TELECOMMUNICATIONS MAINTENANCE HOLE AND A IDF) DOES NOT PASS THROUGH THE MDF TO REACH A IDF.

A. NOAA requires a quantity of four 4" conduits connecting the main IDF in each building with the nearest OSP telecommunications maintenance hole or handhole. (See the conduits labeled "A" in the diagram above, representing four or more conduits routed between the Main Telecommunication Room in the building to the nearest outside plant telecommunications maintenance hole or handhole.) One of the four conduits shall be fitted with a full set of fiber optic innerducts (three 1 ¼" innerducts). The Designer shall recommend (via the Alternative Design Request process) a smaller quantity of entrance conduits for smaller buildings where four conduits might not be economically justifiable. Core-hole lips must be provided to prevent flooding.

B. Any IDFs in a building shall be provided with at least two 4" conduits that run from the nearest OSP telecommunications maintenance hole or handhole. (See the conduits labeled "B" in the diagram above, each representing one or more conduits routed between a IDF in the building and the nearest outside plant telecommunications maintenance hole or handhole.) This conduit shall be fitted with a full set of fiber optic innerducts (three 1 ¼" innerducts). If more than one conduit is provided here, the others do not necessarily need to be fitted with innerduct if they will initially be empty.

C. The design shall provide for sufficient quantities of 4" conduit to accommodate the low voltage services planned for initial installation plus a minimum of either 35% growth capacity or one spare conduit (whichever is larger).

D. Any IDFs in a building shall also be provided with at least two trade size 4" conduits. (See the conduits labeled "C" in the diagram above, each representing two or more conduits routed between the TEP in the building and another IDF in the same building.)

4.5.2 INTRA-BUILDING BACKBONE CABLING

A. NOAA requires that each MDF/IDF in each building be provided with non-spliced fiber optic backbone cabling that is directly connected to the TEP at the site via the outside plant pathway infrastructure.

B. Generally, the OSP copper backbone cables from the TEP at the site will terminate in the MDF of a building. Copper backbone cabling for voice applications should then be routed from the MDF in a given building to the other IDFs in that building.

C. For new construction, intra-building backbone cabling shall be grouped together in one of the intra-building backbone conduits, leaving the other conduit(s) vacant for future use.

4.5.3 INTER-BUILDING (CAMPUS) BACKBONE PATHWAYS

4.5.3.1 Ductbank

A. The telecommunications distribution pathway system shall accommodate the requirements for signal and low voltage cabling systems at NOAA facilities. The pathway system shall be designed such that telecommunications and other low voltage systems do not share conduits, maintenance holes, handholes with the electrical power distribution system. The telecommunications distribution pathway shall also maintain the minimum separation distance from the electrical power distribution system. The Designer shall inquire with both the local and Headquarters NOAA staff about the potential for future buildings or building expansions that may adversely affect an existing or proposed distribution pathway and accommodate those plans within the design.

B. NOAA requires 4" Schedule 40 PVC for all outside plant pathway, with the exception of the transition to PVC-coated rigid steel (discussed below). Campus distribution conduits shall be buried a minimum of 1 meter deep (from top of conduit).

C. All direct-buried non-metallic conduit/cabling shall be run with coated, #12 tracer wire, labeled and accessible at all handholds and entrances to buildings/structures. Additionally, provide metallic identification tape at 12" below grade, directly above the non-metallic utility.

D. Where the conduit is placed beneath vehicular traffic (i.e., drives, roadways, etc.) or where a bend or sweep is placed in the conduit system, OSP conduit shall be encased in concrete with a minimum compressive strength of 2500 psi, where possible.

E. Conduit to be used for routing entrance cables from the service providers to the Telecommunications Entry Point shall be installed per the service providers' requirements, generally 36 to 48 inches deep. The Designer shall consult with the service providers prior to designing conduits serving the Telecommunications Entry Point.

F. OSP conduit shall transition from PVC to PVC-coated, rigid steel conduit when it enters a 10foot zone of circumference around the building foundation and shall route from that point to the building Telecommunications Entry Point. PVC-coated, rigid steel conduit is intended to provide protection from the shearing effect of excavated ground settling around the building foundation. It also provides protection from future landscaping activities near the building. The best protection against settlement shearing is to require undisturbed soil or 95% compaction.

G. The use of flexible metallic conduit and flexible non-metallic conduit is prohibited.

4.5.3.2 Maintenance Holes and Handholes

Splices in backbone fiber optic cable are not allowed, and while splices in backbone copper cable may be permitted in some cases (through an approved ADR), they are not encouraged. However, when sizing OSP telecommunications maintenance holes and handholes, the design shall provide space for possible future fiber splicing when required (for example, to repair cable breaks when and if possible).

- Telecommunications maintenance holes or handholes shall be placed in outside plant conduit runs at an interval no greater than every 600 feet. The following rules apply to maintenance hole/handhole design:

- Handholes shall not be used as a cable splice point or for a ductbank containing more than 3 conduits

4.5.3.3 Aerial Distribution

Aerial distribution of telecommunications cabling at NOAA facilities is not authorized unless specific approval is granted through the “Alternative Design Request” process. In cases where aerial distribution currently exists and is approved for use, the facility Research Leader, Contracting Officer or designated representatives shall consult with NOAA Security to determine that the use of aerial distribution presents no significant risk to physical security at the facility. The Designer shall review construction of aerial distribution systems for compliance with the design. The design and installation shall also be reviewed, approved, and inspected by the NOAA IT Infrastructure Specialist or designee.

4.5.3.4 Bridge, Railroad and Waterway Crossings

The Designer shall review the construction of bridge, railroad and waterway crossing distribution systems for compliance with the design. The design and installation shall also be reviewed, approved, and inspected by the NOAA IT Infrastructure Specialist or designee.

4.5.3.5 Wireless and Radio System Distribution

A. NOAA facilities occasionally use wireless or radio systems for communications with mobile units, personnel and telemetry; both on and off of the campus. These systems typically use one or more radio antennas connected by cabling to radio transceiver equipment. In many cases, the radio equipment is interfaced into the telephone system. The outside plant telecommunications substructure shall provide adequate cable routing pathways between antenna locations, radio transceiver locations, and the telephone backbone cabling system.

B. Radio antenna transmission cables that connect the antenna to the radio transceiver emit radio frequency (RF) radiation. These cables may be routed through the common telecommunications duct bank and maintenance hole system if necessary, but shall be routed in a separate conduit from other telecommunications cables. Cables containing

RF radiation shall be shielded cables.

C. Radio interconnection cables (for analog or digital signaling to remote radio operating positions or to the telephone system) typically emit low levels of radio frequency radiation. These interconnection cables shall be routed through the common telecommunications duct bank and maintenance hole system. Individual conduits may be shared for these interconnection cables and other telecommunications services, and available cable pairs in telephone backbone cables may be used for these interconnections, provided that the signaling is analog or digital signaling, and is not direct radio frequency signals.

D. The Federal government frequency usage is managed by NTIA. All equipment purchased for radio transmission must comply with NTIA and NOAA radio frequency management requirements and policies. Contact NOAA's Radio Frequency Manager OCIO/IB for further information.

4.5.4 CAMPUS CABLING

4.5.4.1 General

A. As discussed in the *Preface* section of this document, telecommunications distribution systems designed for NOAA facilities shall support and integrate all low voltage, power limited signal systems and Building Automation Systems that convey information within and between buildings to the extent possible.

B. During planning of backbone cable installations, the opportunity for these systems to use the common structured cabling system shall be evaluated by the Telecommunications Distribution Systems Designer and discussed with NOAA. The backbone cabling design shall reflect the needs and requirements identified during these discussions.

C. The common outside plant (OSP) telecommunications cable media shall be designed for shared use, to the extent possible, by the following low-voltage systems, in addition to voice and data systems:

- Building Automation Systems
- Fire Alarm Systems
- Closed Circuit Television Systems (Analog)
- Security Systems
  - Access Control Systems
  - Alarm Systems
  - Intrusion Detection Systems
- Video Systems (Digital)
- Energy Management Systems
- Environmental Control Systems

D. Outside Plant (OSP) cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.

4.5.4.2 Copper Backbone Cabling

A. NOAA requires that copper backbone cabling be designed and installed in an unspliced, home-run configuration.

B. Twisted-pair copper cabling shall not be used for interbuilding data backbone applications.

C. Pressurized cabling and associated pressurization systems shall not be used at NOAA facilities. Where such cabling exists, the Designer shall notify NOAA and evaluate the costs and benefits of replacing it.

D. Outside plant analog voice backbone cabling shall be 24 AWG unshielded twisted pair (UTP) copper cabling (with Category 3 or better rating).

4.5.4.2.1 <u>Voice Backbone Cabling Sizing/Termination</u>

Voice backbone cables shall meet the following requirements:

1. Voice backbone cables shall be sized to support two pairs per work area outlet, plus 35% growth. When calculating size, work area shall also include scientific equipment, fax machines, and approved dial-up modems.
2. Inter-building voice backbone cables shall be terminated with a primary protector panel at each cable end. The protector panel shall be equipped with 4B-EW Series or equivalent Protector Units that provides sneak-current protection.
3. Voice backbone cables shall be terminated to wall-mounted Certified Manufacturer 110 Wiring Blocks, using 110-type Connecting Blocks.
4. A tie cable shall be installed to support the transition of the Backbone OSP 110-type termination blocks to voice grade patch panels.

4.5.4.3 Fiber Optic Backbone Cabling

A. During the Design Development phase, the Designer shall contact Certified Manufacturer fiber optic cable sources and obtain their projections of the lead-time requirements for fiber optic cabling. This information shall be submitted to NOAA IT or EPM to aid project-scheduling efforts and determine whether cable should be pre-ordered.

B. OSP fiber optic cable installed underground shall be loose tube construction and gel-filled or be constructed of appropriate waterproofing compounds.

C. OSP fiber optic cable shall be 50/125 micron for both multimode and single-mode applications.

D. NOAA does not permit the design of any fiber optic cabling solution that is dependent on splices.

E. The Designer shall consult with the NOAA IT Infrastructure Specialist prior to developing the fiber optic design to determine the performance requirements for the network electronics.

1. The Designer shall provide to NOAA IT the estimated cable length between the fiber patch panels of each IDF and the MDF fiber patch panel in the design phase. NOAA IT will base its design of the LAN switches on the estimated lengths of the backbone cable runs between each telecommunications room and the MDF.
2. As early as possible in the construction and installation phase, the Designer shall obtain the actual cable lengths and compare them with the estimated lengths. Any variances shall be reported to the NOAA IT Infrastructure Specialist immediately.

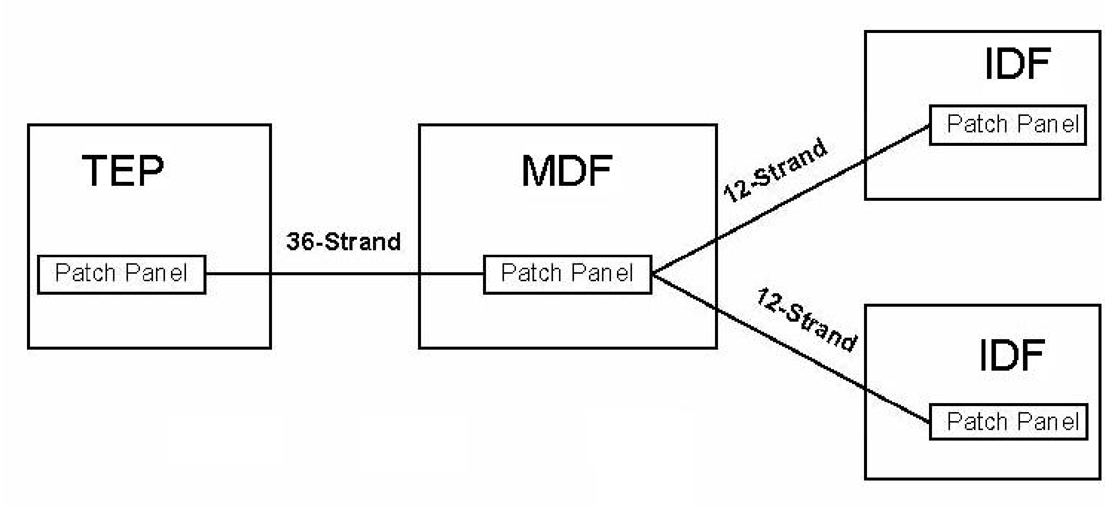
F. Fiber optic cabling shall be terminated in a Fiber Optic Interconnection Unit patch panel. Rack-mounted units that will mount directly into a standard EIA 19-inch equipment rack, or wall-mounted interconnection units that may be mounted on a plywood backboard may be utilized.

1. Where equipment racks are installed, the rack-mountable Fiber Optic Interconnection Units shall be used.
2. The standard fiber optic connector for NOAA is the type 568SC Duplex. When fiber additions are made to existing facilities where type 568ST connectors are in use, new 568SC Duplex connectors and new Duplex SC patch panels shall be used for new fiber.
3. For major renovations and remodeling to existing facilities where type 568ST connectors are currently in use, the existing connectors, patch panels and patch cables shall be replaced with type 568SC Duplex components.
4. All strands of a fiber optic cable shall be terminated using fusion-spliced pigtail connectors. The installation of "dark fiber" is not permitted.

G. Fiber optic cable and components shall be rated and installed to comply with the IEEE® 802.3z 1000Base-X Ethernet Gigabit Standard. NOAA networks depend on Gigabit and higher backbone speeds. Due to the distance limitations of multimode fiber (300m for SX, 550m for LX), singlemode fiber optic cable will be required to support most Gigabit and higher applications in the longer distances encountered in some NOAA locations' networks.

H. Fiber optic backbone cables shall home-run through conduit from each individual IDF to the Main Telecommunications Equipment Room (ER), which should be the location of the data center. Very few if any exceptions will be granted because an alternative design will almost always result in excessive dB losses that violate the IEEE® 802.3z 1000Base-X Ethernet Gigabit Standard. It is desirable to preserve as much dB headroom as possible to allow for splicing in the event of future cable damage.

- If an alternative design is approved for a main backbone cable to interconnect to multiple branch backbone cables, the number of strands in the main backbone cable shall be greater than the sum of all branch backbone cables. For example:



Alternative Design (Requiring Approval)

I. NOAA's general strategy for fiber optic backbone size is to install 12 strands of singlemode fiber optic cable and 12 strands of 50/125 micron graded index multimode fiber optic cable to each building. The fiber strand count shall be increased as required to meet the current and future needs of specific buildings or applications. Fiber optic backbone cables shall be designed with a minimum of 20% spare strands.

J. Where an alternative design has been approved to install fiber optic cable with less than 12 strands to small buildings such as utility buildings, no less than 6-strands of singlemode and 6 strands of multimode fiber shall be installed. However, fiber backbone cable runs exceeding 275 meters shall have at least 12 strands of singlemode fiber included.

K. Where an alternative design has been approved to install multimode-only fiber cable to small buildings, the total cable distance shall not exceed 275 meters from the IDF of the small building to the MDF. The conduit shall also have sufficient capacity to install singlemode fiber in the future. Otherwise, both multimode and singlemode or a composite cable containing both singlemode and multimode fiber shall be used.

L. Prior to designing outside plant fiber optic cabling systems, the Designer shall seek direction from the NOAA IT Infrastructure Specialist regarding the use of composite fiber optic cable versus separate multimode and singlemode cabling for a particular project.

1. Using separate singlemode and multimode cables helps to identify the two fiber types, reducing confusion at patch panels and approved splice points during installation, maintenance, and administration. Singlemode and multimode fiber shall be terminated on separate rows of the patch panels, and clearly identified with labeling and the appropriate industry standard color code (blue for singlemode, beige for multimode).
2. Composite cable containing both singlemode and multimode strands can be useful when retrofitting an existing facility, where existing outside plant conduit space

may be limited. Also, the labor cost for pulling a single composite cable through outside plant telecommunications ductbanks is typically less than the labor cost for pulling two separate fiber optic cables (one multimode and one singlemode).

M. Fiber optic cable with metallic armoring should only be used where the armor may be required for protection against rodents.

N. In new construction and new conduit, fiber optic backbone cables shall be installed in fiber optic innerduct. Normally, three 1¼" innerducts can be placed in a 4-inch conduit. Where fiber optic cable is installed into existing conduits, the use of fiber optic innerduct is required if space is available. Design or installation of fiber optic cabling without the use of innerduct shall require approval through the "Alternative Design Request" process.

4.5.4.4 Fiber Optic Patch Cords

A. Fiber optic patch cables shall be factory manufactured Certified Manufacturer cables

- Fiber optic patch cables shall interconnect with the site backbone using Duplex SC connectors. If low voltage equipment is not available with SC connectors, then Certified Manufacturer SC/ST fiber patch cables shall be used.

B. Mode-conditioning patch cords shall be used for 1000BASE-LX runs over multimode fiber optic cable where the length is between 275 meters and 550 meters:

- Between the work area outlet and the LAN attached device.
- Between the IDF patch panel and the LAN switch.

4.6 WORK AREAS

Please refer to the *Work Areas* section of the BICSI® TDMM for general information regarding the design of work area communications infrastructure. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. Undercarpet telecommunications cabling (UTC) solutions shall not be used at NOAA facilities.

B. There shall be at least one general-purpose convenience power outlet (120VAC, 15 Ampere minimum) located within three feet of every telecommunications outlet. The Designer shall discuss any application-specific needs with NOAA IT staff and adjust the general-purpose convenience power outlet locations and amperage accordingly. Where work area power outlets are intended for dedicated telecommunications purposes, they shall follow the facility color scheme used to indicate the dedicated use.

C. Any Certified Manufacturer approved faceplate, frame, or surface mounted box may be used to mount Modular Information Outlets, as applicable to the particular installation. Telecommunications outlets shall be located to minimize the length of patch cord required to connect to the outlet.

D. Either plastic or stainless steel outlet faceplates may be used throughout a facility at the discretion of each facility. NOAA personnel shall consider the functional implications when selecting the faceplate type. Plastic faceplates can be more easily broken. Stainless steel faceplates can be more difficult to remove.

E. Media converters shall not be used in NOAA installations unless prior approval is obtained through alternative design request process.

H. Telecommunication outlets on laboratory workbenches are to be designed and located after consulting with the local user representative on the facility design team. Quantities sufficient to support current and future laboratory equipment LAN connectivity requirements are mandatory. At a minimum, the design shall specify telecommunication outlets at 6 foot intervals along the center of each lab bench. Additionally, telecommunication outlets shall be provided at each end of any center benches.

Close coordination with Laboratory Designers is required to provide telecommunication outlets along wall perimeters to avoid sinks, fume hoods, refrigerators, etc.

4.6.1 SPLITTING OF CABLE PAIRS

A. In certain situations it may be necessary to use one or two pairs of a four (4)-pair cable to support one telephone device, and to use the remaining pairs to support a different telephone device. In these situations, the splitting of the pairs shall be accomplished with a line-splitting device installed on the outside of the Information Outlet faceplate. At the telecommunications closet, individual cross-connect wires connected to the 110 Termination Field may be used to cross-connect the services.

B. Under no circumstances will the splitting of data cable pairs be allowed. The integrity of all four (4)-pair cables [all eight (8) wires] must be maintained end-to-end for the LAN equipment.

C. Under no circumstances will cable pairs be split or removed from the back of a modular Information Outlet or patch panel. All four (4) pairs of each horizontal distribution cable must be terminated to a single eight (8)-position, eight (8)-conductor jack.

4.7 TELECOMMUNICATIONS ROOMS

Please refer to the *Telecommunications Rooms* section of the BICSI® TDMM for general information regarding the design of telecommunications rooms. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. The Intermediate Distribution Frame (IDF) shall be dedicated to telecommunications functions. It is the location(s) in a building where the telecommunications cabling is terminated. In NOAA facilities, the IDFs in a building may also serve as other low voltage systems equipment rooms, typically containing electronic equipment intended to serve the building or a portion of the building (Security, Fire Alarm Panels, etc.). The IDF shall not be shared with electrical installations other than those necessary for telecommunications.

B. The Designer shall be responsible to inform the Architect of the sizing and location requirements for Telecommunications Rooms during the Schematic Design phase of the project. Specific attention must be focused on the requirements for vertical alignment of rooms.

4.7.1 TELECOMMUNICATIONS ROOM LOCATION

A. Telecommunications Rooms shall not be co-located with any type of electrical room, mechanical room or closet, and shall not be located directly adjacent to these rooms or closets. The IDF location shall maintain the separation distances identified in the *NOAA EMI Source Separation Table* (see the *Electromagnetic Compatibility* subsection of this document).

B. When planning the size and location of IDFs in existing buildings, the Designer shall make every reasonable effort to meet the requirements for telecommunications rooms.

C. TRs and telecommunications cabinets shall not be located within twenty feet of electrical transformers with a winding rated at greater than 480Vrms.

D. Telecommunications Rooms shall be located within the facility so as to not incorporate any outside walls or windows in its design.

4.7.2 TELECOMMUNICATIONS ROOM SIZING

A. ANSI/TIA/EIA-569-A provides Standards for sizing an IDF for normal office buildings. The sizing is based on the “usable floor space,” which is the space on a floor that can actually be used for office activities. Spaces such as mechanical rooms, janitorial closets, and rest rooms cannot be used for office activities, and are therefore not counted as usable floor space. The sizing formula assumes an average of 150-200 square feet of floor space for each person, or “work area.”

B. Many NOAA buildings are not traditional commercial or office buildings, and the sizing standards of ANSI/TIA/EIA-569-A shall be adjusted to accommodate these buildings. When calculating the size required for an IDF in an NOAA building, the following steps shall be followed:

1. Determine the total square footage of all office space in the area to be served by the IDF.
2. Determine all other locations in the area to be served by the IDF, where voice and/or data service will be provided. Other locations would include, but are not limited to Security duty stations, laboratories, and contractor phone locations. Count each location as 100 square feet of usable floor space.
3. Add together the total office space and total “other” usable floor space resulting in the total area to be served by the IDF.
4. Size the IDF based on the following table:

Total Usable Floor Space	Telecommunications Room Size
5,000 SQUARE FEET OR LESS	10 FT. X 8 FT.
5,001 – 8,000 SQUARE FEET	10 FT. X 9 FT.
8,001 - 10,000 SQUARE FEET	10 FT. X 11 FT.

C. There shall be a minimum of one IDF per building. Additional IDFs shall be added when the area to be served exceeds 10,000 square feet or where the cable lengths will exceed 295 feet between the patch panel and the work area telecommunications outlets.

4.7.3 ARCHITECTURAL PROVISIONING FOR TELECOMMUNICATIONS ROOM

A. The Designer shall be responsible to inform the Architect of the tenant requirements for Telecommunications Rooms and to do this early in the Design Development phase of the project.

B. Finished walls should be finished with sheetrock

C. Equipment room floor loading requirements shall support equipment cabinets between 50 pounds per square foot to 200 pounds per square foot.

D. Doorways shall be designed with a minimum measurement of 3 feet wide by 6 feet, 8 inches high. Doorsills should not be used as they impede the movement of heavy equipment containers. Measurements shall be exclusive of a doorsill or center post. Doors shall be hinged to open outward, or slide side-to-side.

In addition to the requirements in the BICSI® TDMM, telecommunications rooms shall be environmentally provisioned as follows:

1. The walls and ceiling shall be treated and sealed to eliminate dust. False ceilings are not allowed in IDFs. Finishes shall be light in color to enhance room lighting.
2. The floors shall be light colored, fire retardant, slip resistant. Carpet is not acceptable for telecommunications spaces.
3. Lighting fixtures shall not be placed where they will be above the equipment cabinets, the termination frames, or other freestanding equipment.
4. Equipment space shall have lighting that provides a uniform light intensity of 30 LM/square foot when taken at floor level.

E. The Designer shall be responsible to determine that the architectural requirements for the telecommunications spaces are met as described in this document. For projects where an architect is involved, the Designer shall coordinate directly with the architect, and verify that the architect's design documentation meets these requirements. For projects without the involvement of an architect, the Designer shall alert NOAA where additional architectural elements are needed to meet these requirements.

4.7.4 ENVIRONMENTAL PROVISIONING

A. The Designer shall be responsible to inform the Mechanical Engineer of the environmental provisioning requirements for Telecommunications Rooms and to do this early in the Design Development phase of the project.

B. In addition to the requirements in the BICSI® TDMM, telecommunications rooms shall be environmentally designed as follows:

1. A fundamental design assumption is that all MDFs and IDFs will, at some point in time, contain active electronic equipment (hubs, routers, switches, etc.) even if the current design does not call for such devices. Network electronics require an HVAC system capable of operating on a 24 hours-per-day, 365 days-per-year basis.

2. MDF / IDF design shall include allowance for increase of 30% in the load on the air conditioning system (HVAC).
3. Minimum clearance height in the IDF shall be eight feet finish-to-finish without obstructions.
4. Smoke detection and fire suppression, based on local fire codes should be installed in the room. A dry-pipe system is the preferred alternative. If used, fire suppression sprinklers shall be equipped with wire cages over the sprinkler heads to prevent accidental discharge. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.
5. Doors shall open out from telecommunications spaces. Doors shall be located in hallways or other common areas. In no case shall the door be located in another building occupants' designated space.

C. The Designer shall be responsible for determining that the mechanical requirements for the telecommunications spaces are met as described in this document. For projects where a mechanical engineer is involved, the Designer shall coordinate directly with the engineer, and verify that the engineer's design documentation meets these requirements. For projects without the involvement of a mechanical engineer, the Designer shall alert NOAA where additional mechanical infrastructure is needed to meet the requirements.

4.7.5 TELECOMMUNICATIONS ROOM SECURITY REQUIREMENTS FOR RESTRICTED IT SPACE

1. Restricted IT space is described in Section 1.2.E.
2. Wall construction of restricted IT space should be slab to slab with minimum 2hr fire rating.
3. Doors should not have glass windows, sidelights or transoms and should have a 2hr fire rating. Entrances shall also be kept to a minimum and locked at all times. Access to the space is to be restricted by card reader or simplex lock.
4. Doors of restricted IT space should open out. Door hinges shall be screwed to the frame with a minimum of three hinges. The hinges should use security hinge bolts with non-removable pins.
5. The doorframe should be permanently fixed and the door should be fitted with a two-stage door closer.
6. General ductwork and utilities should not traverse through the restricted IT space.
7. Smoke detection and fire suppression, based on local fire codes should be installed in restricted IT space.
8. Intrusion detection should be installed at all entrances.
9. Any wiring should be installed in surface-mounted conduit, raceways or wiring trays.
10. Restricted IT space electrical circuits should be connected to a backup generator and/or UPS. The UPS should provide a minimum of four hours on a full load and the backup generator should provide a minimum of eight hours on a full load.
11. Ensure that computing assets are stored in communications or server cabinets with locking capabilities.
12. Ensure that environmental monitoring and alarms are operable for elevated room temperatures.

4.7.6 EQUIPMENT RACKS AND CABINETS

A. When designing the layout for Telecommunications Rooms, it is important to allow adequate space for both "Equipment Footprints" and "Clear Working Space."

B. The following diagram illustrates NOAA's minimum Equipment Footprints and Clear Working Space requirements for Telecommunications Rooms:

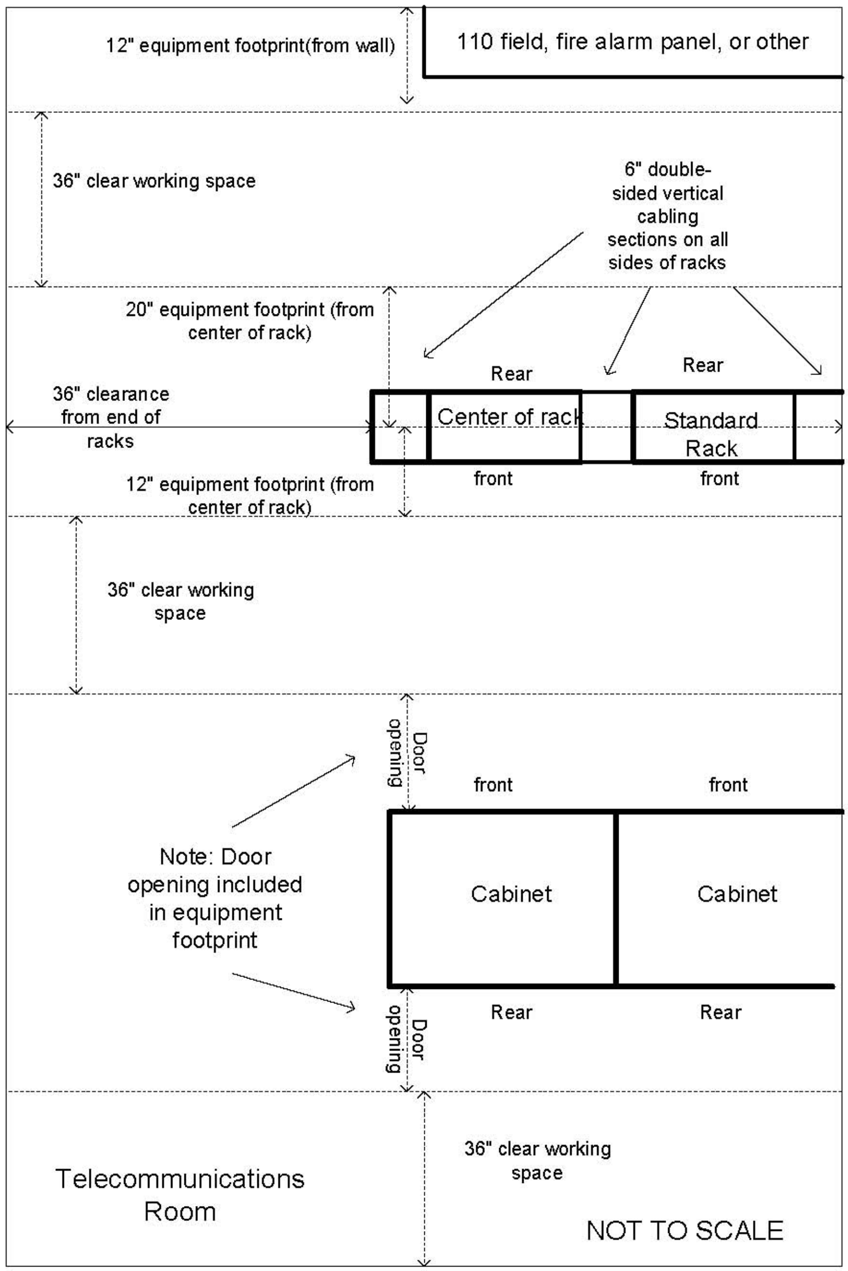


FIGURE 7: TELECOMMUNICATIONS ROOM MINIMUM CLEAR WORKING SPACE REQUIREMENTS

C. Clear Working Spaces are required at both the front and rear of Equipment Footprints and out from walls at the end of at least one rack/cabinet row for maintenance access and installation of equipment. Provide a minimum of 36” clear working space:

- out from Equipment Footprint of wall-mounted equipment.
- out from Equipment Footprint of racks/cabinets (both the front and rear).
- out from cabinet doors at the open position.
- out from at least one end of each rack/cabinet row

D. Equipment Footprints consist of a variable depth to accommodate the overhang of equipment and cabling at the front and rear of racks, outbound from walls where equipment is directly mounted on walls or backboards and telecommunications cabling is terminated. The depth of equipment cabinet doors in their open position are included as part of the Equipment Footprint. The minimum width per rack/cabinet shall be 32 inches.

a. Provide a minimum of 32” (2 ft 8 inches) depth for floor standing racks:
   - Provide a minimum of 12” depth from <u>centerline of rack to front of rack.</u>
   - Provide a minimum of 20” (1 foot, 8 inches) depth from <u>centerline of rack to rear of rack.</u>

b. Provide a minimum of 12” depth off wall for most direct-to-wall mounted equipment and cabling not enclosed in a wall-mount rack or cabinet.
   - Where direct-to-wall mounted equipment exceeds this depth, use the actual depth of the mounted equipment and cabling.

c. For cabinets, as a minimum depth, use the depth of the cabinet plus the depth of the swing of the front and rear doors.
   - Include the depth of standoff brackets for wall-mount racks/cabinets.
   - Note: Wall-mount swing gate racks and cabinets require about double the wall space width to accommodate the gate/door when opened.

d. Provide an additional minimum width of 12” for racks/cabinets to include 6” wide double-sided vertical cabling sections on both the left and right sides. Side-by-side racks shall also have at least one 6” wide double-sided vertical cabling section between each rack.

4.7.6.1 Floor-standing Equipment Racks

A. EIA standard, 19-inch, open-frame equipment racks shall be provided in the IDF. Floor standing racks shall be securely bolted to the floor, and shall be braced to the wall with cable ladder racking. In seismic zones, follow manufacturer’s and engineer’s recommendations. Multiple racks in the same IDF shall be interconnected with cable ladder racks.

B. Wall-mounted racks shall be double-hinged, providing access to both the front and rear of the equipment. Assure strength and load-bearing specifications of wall fasteners are adequate.

C. The Designer shall discuss with NOAA the potential for future requirements for additional racks, and identify spaces for future racks on the plan drawings.

D. Racks shall be equipped with an appropriate number and type of horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and insure that strain relief is maintained for “all” cables.

E. Some IT equipment requires equipment racks with both front and rear mounting rails. The Designer shall discuss with NOAA the network electronics that will be hosted in each rack in each IDF and shall show this equipment on the rack elevation details in the plan drawings.

4.7.6.2 Telecommunications Cabinets

A. In new construction, wall-mounted telecommunications cabinets shall only be permitted in small buildings (security stations, barns, sheds, etc.). All other new buildings shall be designed with IDFs and floor-mounted racks or cabinets.

B. In remodel construction, certain small buildings such as maintenance buildings or security stations may not justify a separate room as the telecommunications room. In some existing buildings, sufficient space may not be available for a telecommunications room. In these instances, a wall-mounted or floor-mounted, lockable telecommunications cabinet may be used, but shall require approval by the NOAA IT Infrastructure Specialist. The location of a telecommunications cabinet shall adhere to:

1. All of the requirements identified under the *Telecommunications Room Location* subsection of this document.
2. Both the Equipment Footprints and Clear Working Space requirements of this document.

C. The size of the cabinet and the conduits serving the building shall include space for future growth, and shall provide space for computer network equipment.

D. Telecommunications cabinets shall meet the following requirements:

- Cabinets shall have a minimum of 24” from the front rail to the wall.
- Wall-mounted cabinets shall be double-hinged, providing access to both the front and rear of the equipment.

E. Computing assets’ cabinets shall provide physical security to protect the contents and prevent unauthorized access. The cabinets shall be constructed of heavy gauge steel, and be lockable. The construction and locking characteristics of the cabinet shall be appropriate for the security rating of the area in which it is installed.

F. Any cabinet containing telecommunications equipment shall have cooling fans installed in the cabinet. The Designer shall coordinate with NOAA and/or the electrical engineer to provide power for the cooling fans.

G. The cabinet shall have a telecommunications main grounding busbar (TMGB) installed in accordance with the grounding requirements discussed in the BICSI® TDMM.

H. The cabinet shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc-welding equipment, radio transmitting antennas, etc.

4.7.7 <u>POWER REQUIREMENTS</u>

A. The NOAA PM shall ensure that the power requirements for the telecommunications spaces are met as described in this document. For projects where an electrical engineer is involved, the Designer shall coordinate directly with the engineer, and verify that the engineer’s design documentation meets these requirements. For projects without the involvement of an electrical engineer, the Designer shall alert NOAA where additional power infrastructure is needed to meet the requirements.

B. Manufacturer specifications shall guide the basic telecommunications system(s) electrical requirement. Additionally, installations shall require specialized bonding and grounding of equipment cabinets. Note, however, that designing to 'plate' data will lead to over specification. Actual power loading must also be taken into consideration.

C. Coordination and design of service provider backup system power requirements is required to provide the continuity of WAN and Voice network access. Network Service Provider equipment power requirements shall be included in the UPS design criteria.

D. Load-bearing consideration shall be determined by a qualified structural engineer. Battery floor loading requirements may vary, depending upon the occupant's requirements, and can be as low as 100 pounds per square foot to as high as 600 pounds per square foot.

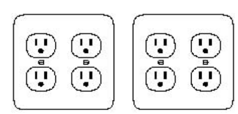
E. Telecommunications UPS shall be governed by NEC, Articles 480 and 503-14, dealing with code requirements for storage batteries and their associated charging equipment. (Local codes may place more rigorous requirements on storage battery installations.)

4.7.7.1 Technical Power Outlets

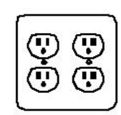
A. Power outlets shall be provided for exclusive use by telecommunications related electronic equipment. These outlets shall be colored orange, labeled as "Technical Power" and shall show the panel and circuit numbers. Technical power outlets shall be equipped for "straightblade plugs" (NEMA® 5-20R, NEMA® 6-20R), rather than twist-lock style receptacles.

B. The Designer shall obtain connection/load requirements from NOAA for each piece of equipment, and tabulate the information for review and confirmation by NOAA.

4.7.7.1.1 <u>Technical Power Outlets for Equipment Racks</u>



A. Each equipment rack shall be equipped with a minimum of two quad power outlets (120VAC, 20 Ampere), each on its own dedicated circuit breaker.



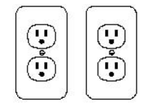
B. Where an emergency power source is available, each equipment rack shall be equipped with an emergency quad power outlet (120VAC, 20 Ampere), each on its own dedicated circuit breaker. These outlets shall be colored red.

C. Outlets shall be located at the base of the rack such that they will not interfere with the placement of equipment (UPS, network electronics, etc.) in the bottom spaces of the rack. It is particularly important to coordinate the location of outlets with "double-railed" equipment racks where applicable. Each outlet shall be equipped with a dedicated #12 AWG, insulated, solid copper, equipment-grounding conductor.

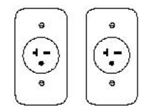
4.7.7.1.2 <u>Power Outlets for Large, Rack-mounted Equipment</u>

A. At NOAA facilities, some IT equipment is fitted with dual power supplies (such as large LAN switches and routers). The Designer shall request that NOAA identify where such equipment will be required and then design accordingly. The design shall indicate where such equipment is intended to reside, and those racks shall have separate power outlets to service the large equipment, in addition to the two quad outlets discussed above. Each outlet shall be equipped with a dedicated #12 AWG, insulated, solid copper, equipment-grounding conductor.

B. Where the equipment requires 120 VAC power, the design shall provide for two duplex power outlets (120VAC, 20 Ampere) per piece of equipment having dual power supplies, each on its own dedicated circuit breaker.



C. Where the equipment requires 208 VAC power, the design shall provide for two separate simplex power outlets (208VAC, 20 Ampere) per piece of equipment having dual power supplies, each on its own dedicated circuit breaker.

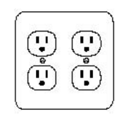


D. Outlets shall be located at the base of the rack such that they will not interfere with the placement of equipment (UPS, network electronics, etc.) in the bottom spaces of the rack.

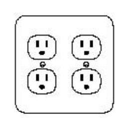
E. These outlets are required in addition to the two quad power outlets required above for each rack.

4.7.7.1.3 <u>Technical Power Outlets for Telecommunications Cabinets</u>

Each telecommunications cabinet shall be equipped with a minimum of one quad power outlet (120VAC, 20 Ampere) installed inside the cabinet, on a dedicated circuit breaker. The outlet shall be colored orange, identified as “Technical Power”, and labeled with the panel and circuit numbers.

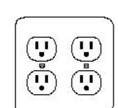


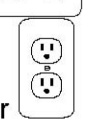
4.7.7.1.4 <u>Wall-mounted Technical Power Outlets</u>

A. One quad power outlet (120VAC, 20 Ampere) that is dedicated to telecommunications equipment shall be located every 3.6M along  each wall.

B. The design shall provide for circuits to the other equipment as required, including:

- Service provider electronics
- PBX
- Contractor telephone equipment
- Voice mail servers or



or 

4.7.7.2 Technical Power Panels

A. The technical power circuits shall originate from a technical power panel, dedicated to serving the IDF. The technical power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel shall be located in the IDF or in close proximity to the IDF.

- Some small buildings (such as greenhouse locations) might not justify a dedicated technical power panel. In these cases, an available general-purpose power panel may be used.
- If standby generator power is available to the facility, the IDF technical power panel shall be served by the generator. Whenever possible, the Designer shall coordinate this with NOAA on a case-by-case basis.
- The technical power panel should be equipped with a Transient Voltage Surge Suppressor (TVSS).

B. Where telecommunications cabinets are used in lieu of an IDF, an available general-purpose power panel may be used to support the telecommunications cabinet power outlet. However, the power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel shall be located in close proximity to the cabinet.

4.7.7.3 Convenience Power Outlets

A. In addition to the technical power outlets described above, the design shall provide for other duplex convenience outlets (120VAC, 15 Ampere) that are available for use with power tools and testing equipment. These outlets shall not be used to power telecommunications equipment. The convenience power outlets shall be placed at 9-foot intervals along the walls in the telecommunications room. These outlets shall be colored consistently with other convenience outlets in the building. Outlets shall be installed just below the bottom of the backboard (where backboards are installed at +6” AFF). Each outlet shall be labeled with its panel identification and circuit number.

B. Where telecommunications cabinets are used in lieu of an IDF, there shall be at least one general-purpose convenience power outlet (120VAC, 15 Ampere) located within 5 feet of each telecommunications cabinet. This outlet shall be colored consistently with other convenience outlets in the building. The general-purpose outlet shall not be used to power telecommunications equipment associated with the cabinet.

4.7.8 GROUNDING, BONDING, AND ELECTRICAL PROTECTION

All equipment racks, metallic conduits and exposed non-current carrying metal parts of telecommunications and information technology equipment in the IDF shall be bonded to the Telecommunications Main Grounding Busbar (TGMB). Refer to the *Grounding, Bonding and Electrical Protection* section of the BICSI® TDMM and this document for more information regarding the design of grounding, bonding and electrical protection systems.

4.7.9 SUPPORT FOR CONTRACTOR TELEPHONE SERVICE

Telecommunications rooms serving contractor telephone locations shall have sufficient backboard space for cables and cable terminations to support contractor telephones that is physically separate from administrative telephone cables and cable terminations.

4.7.10 SUPPORT FOR OTHER GOVERNMENT TENANTS

Telecommunications rooms supporting other government tenants locations shall provide maximum flexibility.

1. Telecommunications Rooms serving tenant locations shall be sized to allow a minimum of 25% growth.
2. All telecommunications distribution equipment shall be in a locked telecommunications room or locked steel telecommunications cabinet.

4.8 EQUIPMENT ROOMS

Please refer to the *Equipment Rooms* section of the BICSI® TDMM for general information regarding the design of equipment rooms. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. The Main Distribution Frame (MDF) shall be dedicated to telecommunications functions. At NOAA facilities, it is the central location on a campus where the major telecommunications equipment is located and where the main campus backbone cables terminate. The MDF typically contains the telephone switching system, the data center with LAN file servers and server farms and wide area network (WAN) communications equipment. The MDF shall not be shared with electrical installations other than those necessary for telecommunications.

B. The Designer shall be responsible to inform the Architect of the sizing and location requirements for Equipment Rooms during the Schematic Design phase of the project.

4.8.1 EQUIPMENT ROOM SIZING

A. The NOAA IT Infrastructure Specialist and the Area IT Specialist (or their designee) shall both be involved in this process, and shall approve the final space requirements and design layout for the equipment and racks.

B. The first step in determining the size required for the MDF, is to identify the systems that will be installed into the MDF. In this process, first identify the size of the area that will be served from the MDF. The area served might be an office suite at an office complex, a single building, or an entire campus at a NOAA facility. Next, identify the quantity, size and variety of systems to be installed to support the area, and the space required for each of the systems.

C. The Designer shall confer with the NOAA IT Infrastructure Specialist to determine any sizing requirements for the MDF on a project-by-project basis.

D. Once the size and quantity of systems are identified, they shall be laid out in a functionally efficient arrangement. Some equipment, such as WAN equipment, LAN servers, tape backup equipment, hubs, switches, and patch panels will require regular access, and shall be located where they are easily accessible.

E. When laying out the arrangement of the MDF, the following requirements and issues shall be addressed:

   1. Equipment shall be grouped together with like equipment (i.e., voice, data for both

LAN and WAN, video.)

2. Insufficient air conditioning can cause electronic equipment to fail or operate unreliably; air conditioning in the IDF shall include allowance for increase of 30% in the load on the air conditioning system (HVAC).
3. Designate wall space and equipment rack space for each specific use. Allocate specific backboard space for the service providers' demarcation areas and any associated equipment. The wall space allocated to the service providers (except contractor telephone services) shall be located adjacent to each other on a common wall and on a single aisle of equipment racks to concentrate the activities of service technicians in areas away from NOAA-owned systems in other areas of the equipment room.
4. Provide a separate wall space area for demarcation of contractor telephone cable pairs, inter-building backbone cables, and intra-building feed cables (see the *Contractor Voice Backbone Cabling* subsection of this document). The Designer shall request additional information about cabling for contractor telephone systems (including schematic diagrams) from NOAA IT.
5. Allocate separate wall and equipment rack space for terminating and cross connecting campus distribution cables (both copper and fiber optic). These areas shall be located adjacent to the equipment providing the services, such as the PBX, voice mail system, and data network electronics.

Once an acceptable equipment layout is developed, the size of the equipment room can be calculated. The design shall provide for a minimum of 25% vacant space for future growth.

4.8.2 EQUIPMENT ROOM LOCATION

A. Once the size has been determined, the location of the equipment room can be selected. To minimize both conduit and cable lengths, the MDF shall be located as centralized as possible to the buildings on the facility campus.

B. In new construction, the MDF shall be sized and provisioned to contain the major voice, data, and video equipment required to support the building or campus, and the other computer based and networked low voltage systems. In a renovation or remodeling project with existing facilities, every reasonable effort shall be made to co-locate these systems in a common equipment room.

C. If the data center is in a location other than the MDF, the NOAA IT Infrastructure Specialist shall be consulted to design appropriately sized fiber optic cables to route from the MDF to the data center. All interconnections between the data center backbone and the campus distribution fiber optic backbone shall be located in the MDF.

D. The Equipment Room shall be located inside a restricted access area of a facility if possible. The building housing the MDF and the MDF itself will be monitored as a part of the overall site security system. Telecommunications equipment should not be located in or directly adjacent to space readily accessible to the public. If it is, it should be adequately protected.

E. Telecommunications equipment in spaces within a security perimeter with general employee access can be treated as normal business operations areas. These same considerations can be given to telecommunications in bio-containment areas or areas where access is restricted for other than IT safety/security reasons, however, telecommunications assets that require access for IT maintenance should not be located where access is restricted for other than IT safety/security reasons.

F. Restricted IT spaces should be secured against access by other than authorized individuals and incorporate procedures and design standards set forth in NOAA Security Policies. Restricted IT spaces may include computing facilities, web farms, telecommunications/magnetic media rooms and spaces that contain firewalls, intrusion detection systems or network nodes.

G. Other major factors that affect the location of the MDF are:

1. Access for delivery and installation of large equipment into the MDF.
2. Access by NOAA and service provider maintenance personnel.
3. Restrictions on unauthorized access.
4. Close proximity to service entrances for telecommunications and power.
5. Close proximity and centralized to the campus telecommunications distribution pathways (conduits and/or aerial distribution) to minimize the backbone cable lengths.

H. The MDF shall *not* be located in any of the locations listed below:

1. Inside a bio-containment area.
2. Areas subject to water or steam infiltration, particularly basements. A floor drain (with a trap primer) is required if there is any risk of water entering the MDF.
3. Areas exposed to excessive heat or direct sunlight.
4. Areas exposed to corrosive atmospheric or environmental conditions.
5. Near or adjacent to potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, or high power radio transmitting antennas.

4.8.3 ARCHITECTURAL PROVISIONING FOR EQUIPMENT ROOMS

A. The Designer shall be responsible to inform the Architect of the architectural provisioning requirements for Equipment Rooms and to do this early in the Design Development phase of the project.

B. Special security consideration shall be given to:

1. The room location which shall exclude exterior walls and windows
2. The use of heavier doors with heavy-duty locks
3. The vents and roof-mounted HVAC units

C. Special security requirements for Equipment Room restricted space are as follows:

1. Signage identifying restricted space is prohibited.
2. Provide lighting with emergency power backup.
3. Provide intrusion detection systems with central monitoring capability.
4. Provide electronic access control to restricted space with the capability of

providing an audit trail. Install intrusion detection systems with UPS on all doors. Entrances shall be kept to a minimum and locked at all times.

5. Ensure that restricted space is not collocated with unauthorized space such as janitor's closets.
6. Utility access is restricted to those necessary to serve the room; emergency power provided to all critical systems.
7. Restricted space electrical circuits should be connected to the backup generator or UPS. The UPS should provide a minimum of four hours on a full load and the backup generator should provide a minimum of eight hours on a full load.
8. Restricted space shall be located in the interior of the building away from exterior windows, public spaces and visitor activities.
9. Wall construction shall be slab to slab with minimum 2hr fire rating and may be required to have a sound transmission class rating of 40 or better if appropriate.
10. Metal doors or solid wood doors with a 2 hr fire rating shall be used. No windows or glass doors shall be used in the restricted space.
11. Doors should open out. Door hinges shall be screwed to the frame with a minimum of three hinges. The hinges should use non-removable security hinge bolts.
12. The doorframe should be permanently fixed and the door should be fitted with a two-stage door closer.
13. General ductwork and utilities should not traverse through the restricted space.
14. The telecommunications or computer room will be protected by a fire detection and suppressant system in accordance with local fire code. Coordinate system with NOAA Safety organization for preferred systems
15. The mail room, storage areas or loading docks shall not be located in close proximity to restricted space.
16. Ensure that computing assets are stored in communications or server cabinets with locking capabilities.
17. Ensure that environmental monitoring is operable for elevated room temperature.

D. The design shall reflect the following important characteristics of the MDF:

1. The MDF shall be dedicated to the telecommunications and information technology function. Shared use of boiler rooms, washrooms, janitor closets, electrical closets, or storage rooms is not allowed.
2. The door to the MDF shall be a minimum 36 inches wide and 80 inches high, with all doors in the most direct route to the outside of the building being the same size, or larger. This sizing is necessary to accommodate delivery and installation of large equipment. Doors shall be located in hallways or other common areas. In no case shall the door be located in another building occupant's designated space.
3. The walls and ceiling shall be sealed to reduce dust. False ceilings are not allowed in MDFs. Finishes shall be light in color to enhance room lighting.
4. Floors shall be sealed to reduce dust, light colored, fire retardant, slip resistant. Carpet is not acceptable for telecommunications spaces. In large equipment rooms, a raised access computer floor is required. The raised floor shall have a minimum of 8 inches clearance to the base floor, and shall not be used as an air plenum.
5. The room shall be free of plumbing and electrical utilities not directly required to

support the telecommunications functions.

6. The MDF at a facility shall have a security system installed to detect and alarm the following three conditions at the facility's major control center: violations of intrusion, high temperature, and loss of electrical power. If the MDF is housed in a building that is separate from other occupied administrative buildings, the security system shall include alarm annunciation lighting mounted on the building exterior.

E. The walls in telecommunications rooms shall be covered with plywood backboards. The backboards shall be ¾" unpainted fire retardant plywood or untreated ¾" plywood painted with white or light colored, non-conductive fire retardant paint. It is not recommended that fire retardant plywood be painted and in no case shall a fire retardant plywood stamp be painted over.

F. In most cases it is preferable that the plywood shall extend from the floor to a height of eight feet above the finished floor. In MDFs where the power conduits are retrofitted in a surface mounted fashion, it might be convenient to mount the plywood at a height of 6" above the finished floor, extending to 8'6" above the finished floor. The 6" space below the backboard can then be used to route the power conduits to the outlets without obstructing plywood backboard space.

G. In new construction, power and telecommunications outlets, and light switches in the MDF shall be surface mounted on the plywood backboard. In some cases where telecommunications backboards are applied to existing walls with existing power outlets and light switches, cutouts in the backboards shall be provided for access to the existing electrical devices.

H. The Designer shall be responsible to determine that the architectural requirements for the telecommunications spaces are met as described in this document. For projects where an architect is involved, the Designer shall coordinate directly with the architect, and verify that the architect's design documentation meets these requirements. For projects without the involvement of an architect, the Designer shall alert NOAA where additional architectural elements are needed to meet the requirements.

4.8.4 ENVIRONMENTAL PROVISIONING

A. The Designer shall be responsible to inform the Mechanical Engineer of the environmental provisioning requirements for Equipment Rooms and to do this early in the Design Development phase of the project.

B. Equipment rooms shall be environmentally provisioned as follows:

1. ERs will require an HVAC system capable of operating on a 24 hours-per-day, 365 days-per-year basis. Electrical power provisions shall be made to allow the HVAC system to operate on emergency power when commercial power is disrupted. If the building HVAC system cannot assure continuous operation, a stand-alone (backup) HVAC unit shall be provided for the MDF and connected to emergency generator power. Where humidity levels exceed the limits allowed in the BICSI® TDMM, provide dehumidification equipment.
2. The HVAC system shall have sufficient capacity to accommodate a 35% increase in demand from equipment room expansion.
3. A high temperature alarm shall be provided and shall be connected to an annunciator located at the Master Control position.

4. Minimum clearance height in the MDF shall be eight feet without obstructions.

5. A clean agent fire suppression system is required in the MDF of medium to large facilities, and strongly recommended for small facility sites. Halon or other ozone-depleting substances are not allowed. If fire suppression sprinklers are also installed in the MDF:

   - A cut-off valve shall be installed where permitted by local code to keep the sprinkler heads dry and charged only in the event additional fire suppression is required after expression of the clean agent.
   - Sprinklers shall be equipped with wire cages on the sprinkler heads to prevent accidental discharge.
   - Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.

6. When sprinklers or other water handling equipment are located in the MDF, or where the potential for ingress of water exists, a free-flowing floor drain shall be installed wherever practical.

C. The Designer shall be responsible to determine that the mechanical requirements for the equipment rooms are met as described in this document. For projects where a mechanical engineer is involved, the Designer shall coordinate directly with the engineer, and verify that the engineer's design documentation meets these requirements. For projects without the involvement of a mechanical engineer, the Designer shall alert NOAA where additional mechanical infrastructure is needed to meet the requirements.

4.8.5 EQUIPMENT RACKS & CABINETS

A. When designing the layout for Equipment Rooms, it is important to allow adequate space for both "Equipment Footprints" and "Clear Working Space."

The following diagram illustrates NOAA's minimum Equipment Footprints and Clear Working Space requirements for Telecommunications Rooms

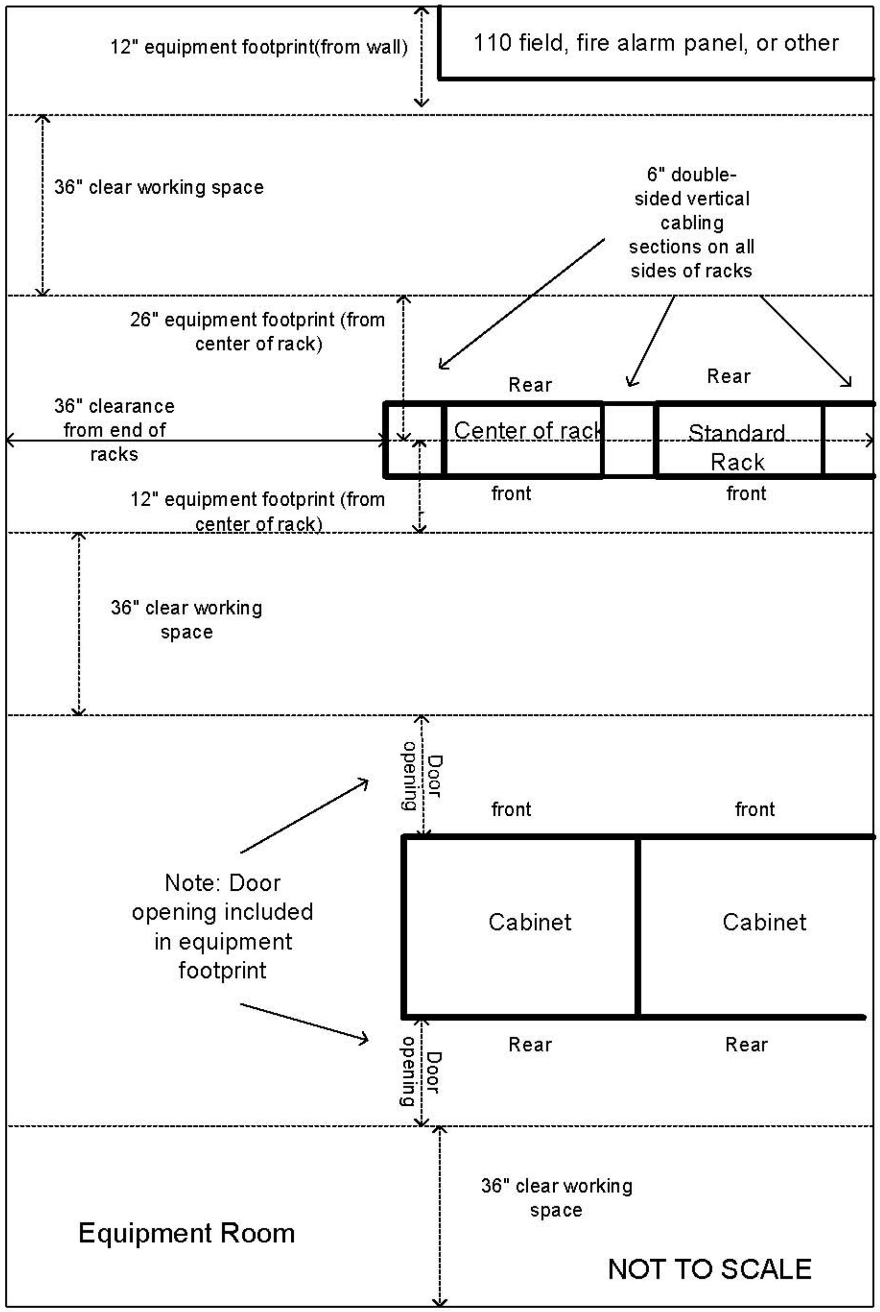


FIGURE 8: TELECOMMUNICATIONS EQUIPMENT ROOM MINIMUM CLEAR WORKING SPACE REQUIREMENTS

B. Clear Working Spaces are required at both the front and rear of Equipment Footprints and out from walls at the end of at least one rack/cabinet row for maintenance access and installation of equipment. Provide a minimum of 36” clear working space:

- out from Equipment Footprint of wall-mounted equipment.
- out from Equipment Footprint of racks/cabinets (both the front and rear)
- out from cabinet doors at the open position.
- out from at least one end of each rack/cabinet row.

C. Equipment Footprints consist of a variable depth to accommodate the overhang of equipment and cabling at the front and rear of racks, outbound from walls where equipment is directly mounted on walls or backboards and telecommunications cabling is terminated. The depth of equipment cabinet doors in their open position are included as part of the Equipment Footprint. The minimum width per rack/cabinet shall be 32 inches.

D. Provide a minimum of 38” (3 ft 2 inches) depth for floor standing racks:

- Provide a minimum of 12” depth from centerline of rack to front of rack.
- Provide a minimum of 26” (2 foot, 2 inches) depth from centerline of rack to rear of rack.

E. Provide a minimum of 12” depth off wall for most direct-to-wall mounted equipment and cabling not enclosed in a wall-mount rack or cabinet.

- Where direct-to-wall mounted equipment exceeds this depth, use the actual depth of the mounted equipment and cabling.

F. For cabinets, as a minimum depth, use the depth of the cabinet plus the depth of the swing of the front and rear doors.

- Include the depth of standoff brackets for wall-mount racks/cabinets.
- Note: Wall-mount swing gate racks and cabinets require about double the wall space width to accommodate the gate/door when opened.

G. Provide an additional minimum width of 12” for racks/cabinets to include 6” wide double-sided vertical cabling sections on both the left and right sides. Side-by-side racks shall also have at least one 6” wide double-sided vertical cabling section between each rack.

4.8.5.1 Floor-standing Equipment Racks and Cabinets

A. EIA standard, 19-inch, open-frame equipment racks or enclosed cabinets shall be provided in the MDF. Floor standing racks/cabinets shall be securely bolted to the floor, and shall be braced to the wall with cable ladder racking. Multiple racks/cabinets in the same MDF shall be interconnected with cable ladder racks.

B. Some IT equipment requires an equipment rack with both front and rear mounting rails. The Designer shall discuss with NOAA the network electronics that will be hosted in each rack/cabinet in the MDF and shall show this equipment on the rack elevation details in the plan drawings. See Appendix 6.4, Sample Combination Rack/Wall Elevation Detail with Cutover Plan)

C. Racks/cabinets shall be equipped with an appropriate number and type of horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and insure that strain relief is maintained for all cables.

D. The Designer shall discuss with NOAA the potential for future requirements for additional racks/cabinets, and identify spaces for future racks/cabinets on the plan drawings.

E. Other styles of equipment racks and cabinets might be used in the MDF, some of which will be proprietary to a particular system or service provider. The Designer shall plan the MDF layout to make allowances for proprietary equipment and racks, and allow expansion room for future equipment.

4.8.6 POWER REQUIREMENTS

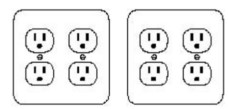
The Designer shall be responsible to determine that the power requirements for the equipment rooms are met as described in this document. For projects where an electrical engineer and an A-E is involved, the Designer shall coordinate directly with the engineer, and verify that the engineer's design documentation meets these requirements. For projects without the involvement of an electrical engineer and A-E, the Designer shall alert NOAA where additional power infrastructure is needed to meet the requirements.

4.8.6.1 Technical Power Outlets

Power outlets shall be provided for exclusive use by telecommunications related electronic equipment. These outlets shall be colored orange, labeled as "Technical Power" and shall show the panel and circuit numbers. Technical power outlets shall be equipped for "straight-blade plugs" (NEMA® 5-20R, NEMA® 6-20R), rather than twist-lock style receptacles.

4.8.6.1.1 Technical Power Outlets for Equipment Racks

A. Each equipment rack shall be equipped with a minimum of two quad power outlets (120VAC, 20 Ampere), each on its own dedicated circuit breaker.

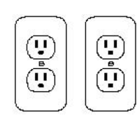


B. Outlets shall be located at the base of the rack such that they will not interfere with the placement of equipment (UPS, network electronics, etc.) in the bottom spaces of the rack. It is particularly important to coordinate the location of outlets with "double-railed" equipment racks where applicable. Each outlet shall be equipped with a dedicated #12 AWG, insulated, solid copper, equipment-grounding conductor.

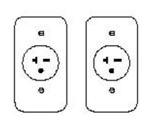
4.8.6.1.2 Power Outlets for Large, Rack-mounted Equipment

A. At NOAA facilities, some IT equipment is fitted with dual power supplies (such as large LAN switches and routers). The Designer shall request that NOAA identify where such equipment will be required, and then design accordingly. The design shall indicate where such equipment is intended to reside, and those racks shall have separate power outlets to service the large equipment, in addition to the two quad outlets discussed above. Each outlet shall be equipped with a dedicated #12 AWG, insulated, solid copper, equipment-grounding conductor.

B. Where the equipment requires 120 VAC power, the design shall provide for two duplex power outlets (120VAC, 20 Ampere) per piece of equipment having dual power supplies, each on its own dedicated circuit breaker.



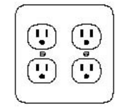
C. Where the equipment requires 208 VAC power, the design shall provide for two separate simplex power outlets (208VAC, 20 Ampere) per piece of equipment having dual power supplies, each on its own dedicated circuit breaker.



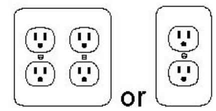
D. Outlets shall be located at the base of the rack such that they will not interfere with the placement of equipment (UPS, network electronics, etc.) in the bottom spaces of the rack.

4.8.6.1.3 Wall-mounted Technical Power Outlets

A. One quad power outlet (120VAC, 20 Ampere) that is dedicated to telecommunications equipment shall be located every 12 feet along each wall.



B. The design shall provide for circuits to the other equipment as required, including:



- Service provider electronics
- PBX
- Contractor telephone equipment
- Voice mail servers

C. Each outlet shall be equipped with a dedicated #12 AWG, insulated, solid copper, equipment-grounding conductor. The design shall provide for not more than one outlet per circuit.

4.8.6.2 Technical Power Panels

The following electrical provisions are required for the Main Distribution Frame (MDF):

A. The MDF shall be equipped with a power disconnect switch located near the main door of the MDF. The switch shall disconnect power to all electronic equipment in the MDF, and is to be used in the event of electrocution or fire in the MDF. There shall also be a similar means to disconnect the power to dedicated HVAC equipment serving the MDF that shall also cause the fire/smoke dampers to close. Refer to the National Electrical Code®, NFPA® 70, Article 645-10 for further information.

B. A separate supply circuit serving the room shall be provided and terminated in its own electrical panel located in the MDF. This power panel shall be designated as “MDF Technical Power.” The MDF technical power panel shall be used exclusively for supplying power to electronics equipment in the equipment room. Sizing of electrical power supply is dependent upon the equipment types and equipment load, and shall be calculated on a case-by-case basis, including sufficient spare capacity for future growth.

C. If standby generator power is available to the facility, the MDF technical power panel shall be linked to the standby generator power supply.

D. In Equipment Rooms at large facilities, a centralized uninterruptible power supply (UPS) is required to support the electronics equipment in the MDF. For smaller facilities, the Designer shall perform a lifecycle cost analysis to evaluate the appropriateness of using of a centralized UPS and make a recommendation to NOAA.

1. A centralized UPS shall be located in a room that is equipped to vent battery gasses that are sometimes emitted by UPS batteries. A centralized UPS shall not be located within the MDF that it serves. It shall provide a minimum of four hours run time for the supported low voltage systems hardware. The Designer shall request direction from the NOAA IT Infrastructure Specialist regarding project specific needs for increased the run time.
2. Upon installation, a qualified electrician shall test new centralized UPS units for correct voltage prior to connecting NOAA equipment. Rooms housing centralized

UPS systems shall have the same environmental provisioning as the MDF.

3. The design shall include a telecommunications outlet located near each UPS system for use with a network interface card that will be provided with the UPS. The UPS will communicate via the network with servers and other equipment to orchestrate a coordinated safe-shutdown of the equipment in the event of an extended power outage.
4. Some battery manufacturers claim that valve-regulated lead acid batteries do not emit gasses and therefore might not require mechanical systems for venting battery gasses. The Designer shall evaluate such claims for applicability on each project.

E. In all cases, power for critical network components such as servers, routers, switches, and telephone systems shall be provided through a UPS.

4.8.6.3 Convenience Power Outlets

In addition to the technical power outlets described above, the design shall provide for other duplex convenience outlets (120VAC, 20 Ampere) that are available for use with power tools and testing equipment. These general-purpose circuits shall not originate from the MDF technical power panel. These outlets shall not be used to provide power to telecommunications equipment. The convenience power outlets shall be placed at 6-foot intervals along the walls in the equipment room. These outlets shall be colored consistently with other convenience outlets in the building. Outlets shall be installed just below the bottom of the backboard (where backboards are installed at +160mm AFF). Each outlet shall be labeled with its panel identification and circuit number.

4.8.7 Grounding, Bonding, and Electrical Protection

All equipment racks, metallic conduits and exposed non-current carrying metal parts of telecommunications and information technology equipment in the MDF shall be bonded to the TMGB. Please refer to the *Grounding, Bonding and Electrical Protection* section of the BICSI® TDMM and this document for more information regarding the design of grounding, bonding and electrical protection systems.

4.8.8 Support for Contractor Telephone Service

The telecommunications pathways and spaces needed for supporting Contractor telephone services shall be planned into the overall architectural design of the facility. Contractor telephone service is provided through contracts with various telecommunications carriers. As contracts expire, different contractors may be used to provide the services. As a result, it is generally in the best interest of NOAA to plan, install, own, and maintain the telecommunications infrastructure supporting contractor telephone services. The Designer shall consider the following requirements when planning the telecommunications infrastructure and substructure to support contractor telephones:

A. The contractor telephone equipment room shall be located outside of IT Restricted Space if possible.

1. Some applications with limited space might require a segregation solution to fence off or partition an area of the MDF for contractor telecommunications equipment.
2. Other applications might require the contractor telephone demarcation point to be located near the demarcation point for administrative telephone services and then

extended from that point to the contractor telephone equipment room.

B. The contractor telephone equipment room shall have sufficient backboard space for the mounting of primary protectors, termination hardware, and cross connection hardware for the service entrance cables and campus distribution cables supporting contractor telephones.

C. Contractor telephone equipment rooms serving contractor telephone locations shall have sufficient backboard space for separate cables and cable terminations to support contractor telephones.

4.9 TELECOMMUNICATIONS ENTRANCE FACILITIES & TERMINATION

Please refer to the *Telecommunications Entrance Facilities & Termination* section of the BICSI® TDMM for general information regarding the design of telecommunications entrance facilities. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

4.9.1 TELECOMMUNICATIONS ENTRY POINT LOCATION (TEP)

A. NOAA requires that the TEP(s) be proximate to the Main Distribution Frame (MDF) for the facility. In cases where diverse connections are specified, a second TEP should be located on another side of the building to minimize likelihood of simultaneous cable damage (due to construction or maintenance activities, etc.).

B. The service providers' technicians will need access to the TEP. Such access is simplified if the TEP is not located within a Restricted IT Area. Typically, the TEP is located in the basement within 50 to 100 feet of where conduit enters the building.

C. NOAA IT requires that the wide area network (WAN) equipment be located in the MDF, which is also the typical location of LAN server farms. NOAA IT requires that services be obtained from the telecommunications service provider to extend the demarc for the WAN telecommunications circuit from the main demarc location to the location of the WAN equipment.

D. Dedicated cabling must be used to extend NOAA services from the service provider's demarc to NOAA's point of interconnect to prevent co-mingling with non-government provided services.

E. The Designer shall coordinate with the local service providers to determine their requirements for entrance facilities. These providers can include the Local Exchange Carrier (local telephone company), a long distance telephone company, a cable TV company, or some other service provider.

F. At NOAA facilities, the Designer shall design a cable pathway (using 4" conduit) from the property line to the TEP. The cable pathway shall be underground conduit, with telecommunications maintenance holes or handholes as necessary. Close coordination with each of the service providers is critical to determine that their requirements for entrance pathway are met. Some service providers will not share conduit or maintenance holes with other service providers. The design shall include *at least* 25% spare conduits.

G. The use of aerial distribution for entrance facilities for new construction is not allowed unless prior authority is obtained through the Alternative Design Approval process.

4.10 FIELD TESTING

Please refer to the *Field Testing* section of the BICSI® TDMM for general information regarding the field-testing of telecommunications cabling. The following requirements take precedence over the BICSI® TDMM guidelines for field-testing at NOAA facilities:

A. The Designer shall review the cable test results submitted by the Contractor. The test results shall be the actual native machine test results downloaded from the test equipment.

B. The final test results shall have been verified by the Designer to be acceptable before submission to NOAA. Test results shall be submitted to NOAA in both electronic and paper forms.

4.11 RESIDENTIAL CABLING

Please refer to the *Residential Cabling* section of the BICSI® TDMM and the ANSI/EIA/TIA-570: *Residential Cabling Standard* for information regarding the design of telecommunications infrastructure to support residential facilities within NOAA facilities.

While this type of facility will be uncommon at NOAA facilities, the Designer shall inquire of NOAA whether a "residential cabling" solution is required for a particular project. Please note that the "residential cabling" solution will not be provided for contractor premises.

4.12 SPECIAL DESIGN CONSIDERATIONS

Please refer to the *Special Design Considerations* section of the BICSI® TDMM for information regarding the design of telecommunications infrastructure in accordance with the Uniform Federal Accessibility Standards (UFAS) requirements at NOAA facilities.

A. The Designer shall request guidance from NOAA regarding the requirements for coin-operated telephones within NOAA facilities.

   1. Coin-operated telephones are typically not provided for use by the contractors/tenants.
   2. Where coin-operated telephones are provided in NOAA facilities, the "shelfette" style shall be used rather than a booth.

B. The Designer shall request guidance from NOAA regarding the requirements for contractor telephones within NOAA facilities.

   1. Contractor telephones are generally not located centrally. The Designer shall coordinate the locations of contractor telephones with the designated security representative at the facility.
   2. Cabling to support contractor telephones shall be connected to a set of 110 blocks in the IDF that is physically separated from the terminations for administrative telephone and data cabling.
   3. Cabling serving contractor telephones located outside shall not be routed aerially to the telephone locations. Instead, the cable shall be routed using underground conduit that is permanently attached to the telephones.

4. Typically, the manufacturer of the contractor telephone system will install the contractor telephones at the locations indicated on the drawings and will connect the NOAA Contractor-provided un-terminated, UTP cable to the telephone.

C. The Designer shall require guidance from NOAA regarding the particular spaces within NOAA facilities intended to include Uniform Federal Accessibility Standards (UFAS) features. The design shall comply with the requirements of UFAS, in part to accommodate non-contractor employees and visitors.

4.13 TELECOMMUNICATIONS ADMINISTRATION

Please refer to the *Telecommunications Administration* section of the BICSI® TDMM and ANSI/TIA/EIA-606-A: “Administration Standard for the Telecommunications Infrastructure of Commercial Buildings” for general information regarding the documentation and labeling of telecommunications infrastructure. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

4.13.1 IDENTIFICATION STRATEGY

A. The “identifier” is the unique name or description assigned to a telecommunications infrastructure component. The Designer shall assign identifiers to the telecommunications infrastructure components listed below and clearly show the identifier assignments on the Construction Documents. The Construction Documents shall include a tabulated report of the identifiers assigned within the scope of the project. The report shall include space for the Contractor to provide actual values for cabling and conduits (length, attenuation, etc.) that are obtained during the construction and testing processes.

B. While it is the Contractor’s responsibility to provide marked-up drawings to the Designer indicating any construction-related changes to the identifiers, the Designer shall verify that the identifiers are clearly and accurately shown on the record drawings.

C. Telecommunications components shall not be labeled with an application-specific identifier. Ports shall not be labeled with the name or function of the device that is served by the port (server names, computer types. Also, the use of “V-#” and “D-#” are inconsistent with the industry standards-based philosophy of designing cabling systems that are independent of the application, and are therefore not permitted.

D. The ANSI/TIA/EIA 606-A contains a comprehensive listing of the identification strategy requirements.

4.13.1.1 New Telecommunications Distribution Systems

The Designer shall assign the identifiers to the telecommunications components based on the following identification strategy:

A. The Designer shall evaluate any existing identification strategy for Maintenance holes and handholes, considering the pros and cons of using the existing strategy versus applying a new strategy as follows: Maintenance holes and handholes shall be identified based on an alphanumeric grid system. A grid shall be superimposed over the site plan with gridlines shown at 100-foot intervals. The origin of the grid shall be in the lower left corner of the site plan (typically the south-west corner of the site). The vertical axis of the grid shall be labeled alphabetically and the horizontal axis shall be labeled numerically. Maintenance holes or handholes that lie within a square shall be labeled with an identifier based on the letter and number of that grid square. The format for these identifiers shall be "VHHX" where "V" represents the letter of the alphabet associated with the row (vertical axis) and "HH" represents a two-digit number (leading "0" if necessary) associated with the column (horizontal axis) wherein the maintenance hole or handhole is located. The "X" represents a sequentially assigned letter to distinguish between multiple maintenance holes or handholes located within the same grid square.

- For example, a maintenance hole or handhole located in the square identified by the row "K" and the column "8" shall be identified as "K08A" (always use two digits for the column number). A second maintenance hole or handhole located in the same square shall be labeled "K08B" and so forth. A maintenance hole or handhole located in the square identified by the row "G" and the column "12" shall be identified as "G12A".

B. Campus Backbone cables shall have identifiers in the form of "M##" where "M" represents the media type and is either "F" (for fiber backbone media) or "C" (for copper backbone media) and "##" is a unique, two-digit sequential cable number.

- For example: The first three outside plant fiber backbone cables designed on a project shall be identified as "F01", "F02" and "F03". The eleventh, twelfth and thirteenth outside plant copper backbone cables designed on a project shall be identified as "C11", "C12" and "C13".

C. Telecommunications rooms (and Equipment Rooms) shall have identifiers in the form of "FX", where "F" is the floor number on which the telecommunications rooms resides and "X" represents a sequentially assigned letter to distinguish between multiple rooms on the floor.

- For example: A building with two telecommunications rooms on the third floor would have rooms labeled "3A" and "3B".

D. Racks in telecommunications rooms shall have identifiers of the form "R#" where "R" stands for "Rack" and "#" is the sequential rack number within a given IDF.

- For example: The first rack in a given telecommunications room would have the label "R1", the second "R2" and so on.

E. Patch Panels shall have identifiers sequentially numbered in the form of "PP#" where "PP" stands for "Patch Panel" and "#" is the sequential patch panel number terminated within a given telecommunications room, regardless of media type (horizontal copper or horizontal fiber).

- For example: The first patch panel (terminating horizontal fiber optic cabling in duplex SC ports) would be labeled "PP1".

- For example: The second patch panel (terminating horizontal copper cabling) would have the label "PP2".

F. Ports on Patch Panels for Horizontal Cabling are typically pre-labeled by the manufacturer with sequential numbers (i.e. 1 to 48). For ports which are not pre-labeled, label each port in the form "##" where "##" is the sequential port number within the panel. The ports in each patch panel shall start at number "01".

- For example: The ports on a patch panel terminating horizontal fiber optic cabling in duplex SC ports would be labeled starting with "01" for the first duplex port (one label per pair of fiber strands) and continue sequentially through the remainder of the duplex ports.

G. Work Area Connectors (Ports) connected to patch panels in the telecommunications room shall have identifiers in the form of "TR-PP#-##" where "TR" is the IDF at which the horizontal cable terminates (see TELECOMMUNICATIONS ROOMS above), "PP#" is the patch panel identifier at which the horizontal cable terminates (see, PATCH PANELS above) and "##" is the port within the patch panel in which the horizontal cable terminates.

- For example: A work area with two copper connectors terminates in the second telecommunications room on the fourth floor, in the third copper patch panel, in ports 5 and 6. The connectors would have the labels "4B-PP3-05" and "4B-PP3-06."

H. Work Area Connectors (Ports) connected to termination blocks in the telecommunications room shall have identifiers in the form of "TR-110-###" where "TR" is the telecommunications room at which the horizontal cable terminates (see TELECOMMUNICATIONS ROOMS above), "110" refers to the 110-termination blocks (as opposed to a patch panel identifier) and "###" is the sequential termination block port, within a given termination block column, at which the horizontal cable terminates.

- For example: A work area with two copper connectors terminates in the second telecommunications room on the fourth floor on termination block ports 5 and 6. The connectors would have the labels "4B-110-005" and "4B-110-006."

4.13.1.2 Moves, Adds and Changes (MAC)

The only exception to the above identification strategy is that for small projects relating to moves or changes to existing cabling, or the addition of new outlets terminated among other existing cables in existing IDFs. In such cases, the cable identification scheme for the new cables shall be consistent with the existing identification strategy. If no identification scheme exists, the MAC activity shall be identified in a manner consistent with that described for new distribution systems above.

4.14 Design, Construction and Project Management

Please refer to the *Design, Construction and Project Management* section of the BICSI® TDMM for information regarding design, construction and project management of telecommunications infrastructure at NOAA facilities that does not involve the Facilities Division. For Facilities Division-managed projects, please refer to the FD's Project Manual for information.

4.15 Fire Stopping

Responsibility for fire stopping should be specifically assigned in the building specifications because it is typically uncoordinated with data wiring plans, resulting in significant delay and additional cost. In cases of data intensive facilities, NOAA requires the use of fire stops like the Wiremold Flame Stopper or equivalent.

Refer to the *Fire Stopping* section of the BICSI® TDMM for general information regarding the design of fire stopping for telecommunications infrastructure. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. Penetrations through fire-rated walls and floors shall be fire-stopped in accordance with the requirements of the manufacturer of the fire-stopping materials and satisfy local code officials.

B. The Designer shall avoid design solutions calling for "poke-thru" penetration of fire-rated walls and floors when other reasonable cable-routing options exist.

4.16 POWER DISTRIBUTION

Please refer to the *Power Distribution* section of the BICSI® TDMM for general information regarding the design of power distribution for telecommunications infrastructure. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. The Designer shall be responsible to determine that the power requirements for the equipment rooms are met as described in this document. For projects where an electrical engineer is involved, the Designer shall coordinate directly with the engineer, and verify that the engineer's design documentation meets these requirements. For projects without the involvement of an electrical engineer, the Designer shall alert NOAA where additional power infrastructure is needed to meet the requirements.

1. Please refer to the *Work Areas* section of the BICSI® TDMM and also in Section 2.6 of this document for information on the power outlet requirements for work areas.
2. Please refer to the *Telecommunications Rooms* section of the BICSI® TDMM and also in Section 2.7 of this document for information on the power outlet requirements for IDFs.
3. Please refer to the *Equipment Rooms* section of the BICSI® TDMM and also in Section 2.8 of this document for information on the power outlet requirements for MDFs.

B. The design shall include a rack-mountable uninterruptible power supply (UPS) for each telecommunications rack and cabinet, unless a centralized UPS is used. The UPS shall be appropriately sized for the electrical load expected at each location.

4.17 GROUNDING BONDING AND ELECTRICAL PROTECTION

Please refer to the *Grounding, Bonding and Electrical Protection* section of the BICSI® TDMM for general information regarding the design of grounding, bonding and electrical protection systems. See also the *Grounding, Bonding and Electrical Protection* section of the BICSI® CO-OPDM for more information. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

4.17.1 TELECOMMUNICATIONS GROUNDING AND BONDING INFRASTRUCTURE

A. A Telecommunications Main Grounding Busbar (TMGB) shall be installed at an accessible and convenient location in each Telecommunications Entry Point. A Telecommunications Grounding Busbar (TGB) shall be installed at an accessible and convenient location in each Equipment Room and Telecommunications Room. TMGBs and TGBs shall be sized to accommodate 30% future growth.

B. A green insulated stranded copper cable (sized between a minimum of #6 AWG and a maximum of 3/0 AWG) shall be provided between each TGB and TMGB and from the TMGB to the building main electrical service ground electrode. The Designer shall evaluate the grounding cable size that will be appropriate for each application.

4.17.2 TELECOMMUNICATIONS CABLING BONDING

While NOAA does not permit telecommunications design solutions to include splices to fiber optic cabling and also prefers that copper backbone cabling not be spliced, occasionally it becomes necessary to splice cables. Where any splices are made to backbone cables, the metallic shields of those cables shall be bonded together to maintain shield continuity.

4.18 ELECTROMAGNETIC COMPATIBILITY

Please refer to the *Electromagnetic Compatibility* section of the BICSI® TDMM for general information regarding the electromagnetic interference with and clearance requirements for telecommunications infrastructure. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

Telecommunications infrastructure shall maintain minimum separation distances from sources of electromagnetic interference (EMI) as listed below. Where the NEC or local codes require greater separation distances than those listed below, the largest separation distance shall be maintained.

4.18.1 TELECOMMUNICATIONS & EQUIPMENT ROOMS

TRs shall not be located in or adjacent to areas containing sources of electromagnetic interference or radio frequency interference (RFI) such as photocopy equipment, large electric motors, power transformers, arc-welding equipment, radio transmitting antennas, fluorescent lighting, etc. This is a critical consideration, as EMI and RFI can render data networks inoperable. No point within the IDF or MDF shall be closer than 6 m (20 ft) to power panels or equipment rated at greater than 480 V.

4.18.2 INSIDE PLANT PROXIMITY TO SOURCES OF EMI

A. For the purposes of this document, sources of electromagnetic interference (EMI) are categorized with three different operating ranges:
   - Less than or equal to 220 V_{rms}
   - Greater than 220 V_{rms} and less than or equal to 480 V_{rms}
   - Greater than 480 V_{rms}

B. Allowable proximity to the various sources of EMI is defined for each of four categories of telecommunications infrastructure:
   - Cross-connect locations that are shielded (such as swing racks enclosed in metal

cabinets)

- Cross-connect locations that are unshielded (such as floor-standing equipment racks)
- Telecommunications cabling that is shielded (cabling routed through metallic conduit or a metallic raceway that completely encloses the cabling).
- Telecommunications cabling that is unshielded (cabling routed through any raceway that does not completely enclose the cabling in metal).

C. The factory twist and lay of conductors within the sheath will be maintained end-to-end throughout all telecommunications cabling runs.

D. The following table lists the required minimum separations between the different categories of EMI sources and telecommunications infrastructure. (To minimize the effects of EMI, telecommunications pathways shall cross perpendicular to electrical power cables, electrical power conduits and fluorescent lighting.)

Source of Electromagnetic Interference	**Telecommunications Infrastructure**			
	Cross-connect Locations		**Horizontal Cabling**	
	Unshielded	**Shielded**	**Unshielded**	**Shielded**
Power Circuits Not in Metallic Raceway				
Less than 220 V_{rms}	2”	2”	2”	2”
Greater than 220 V_{rms} but less than 480 V_{rms}	10 ft	5 ft	5 ft	3 ft
Greater than 480 V_{rms}	20 ft	10 ft	10 ft	5 ft
Power Circuits in Metallic Raceway				
Less than 220 V_{rms}	2”	2”	2”	2”
Greater than 220 V_{rms} but less than 480 V_{rms}	5 ft	5 ft	3 ft	2 ft
Greater than 480 V_{rms}	10 ft	10 ft	5 ft	3 ft
Lightning Protection System Conductors	6 ft	6 ft	6 ft	6 ft
Ballasted Light Fixtures	1 ft	1 ft	1 ft	6”
Motors or Transformers				
Less than 220 V_{rms}	4 ft	2 ft	4 ft	1 ft
Greater than 220 V_{rms} but less than 480 V_{rms}	10 ft	5 ft	4 ft	2 ft
Greater than 480 V_{rms}	20 ft	15 ft	10 ft	5 ft
Metal Enclosed Electrical Panelboards Motor Controls and Switchboards				
Less than 220 V_{rms}	4 ft	2 ft	2 ft	1 ft
Greater than 220 V_{rms} but less than 480 V_{rms}	10 ft	4 ft	4 ft	2 ft
Greater than 480 V_{rms}	20 ft	20 ft	10 ft	5 ft

FIGURE 9: MINIMUM SEPARATION REQUIREMENTS FOR EMI SUPPRESSION

4.18.3 OUTSIDE PLANT PROXIMITY TO OTHER UTILITIES

The vertical and horizontal separation requirements for outside plant telecommunications pathways from other underground utility infrastructure are as follows:

4.18.3.1 Proximity to Power or Other Foreign Conduits

Outside plant telecommunications conduits shall not be installed closer to power conduits or other unidentified underground conduits than:

- 3” where the surrounding material is concrete
- 4” where the surrounding material is masonry
- 12” where the surrounding material is well-tamped earth

4.18.3.2 Proximity to Water, Gas or Oil Conduits

Outside plant telecommunications conduits shall not be installed closer to conduits that can be identified as not containing electrical power distribution conductors than:

- 6” where the conduits cross
- 12” where the conduits run in parallel with each other

4.19 PRINCIPLES OF TRANSMISSION

Please refer to the *Principles of Transmission* section of the BICSI® TDMM for general information regarding the design of telecommunications distribution infrastructure.

4.20 LOCAL AREA NETWORKS AND INTERNETWORKING

Please refer to the *Local Area Networks and Internetworking* section of the BICSI® TDMM for general information regarding the design of telecommunications infrastructure for serving local area networks. The following requirements take precedence over the BICSI® TDMM guidelines for telecommunications infrastructure at NOAA facilities:

A. All NOAA facilities use the Ethernet LAN protocol. Telecommunications infrastructure for all NOAA facilities shall be designed, installed, and tested to support the Institute of Electrical and Electronic Engineers, Inc.® (IEEE®) Ethernet 802.3 standards. NOAA IT is in the process of migrating to the 1000Base-X Gigabit Ethernet protocol based on the IEEE® 802.3z standard. All newly installed cabling shall support this protocol.

B. Fiber optic cable to the desktop may be required if mission requirements for the work area include: data rates above that which Category 6 cabling is designed to support, specific security requirements, or specific environmental constraints. The Designer shall give careful consideration to the multimode fiber optic distance limitations and signal loss limitations (less than 2.5 dB end-to-end) necessary to support the IEEE® 802.3z protocol.

C. NOAA networks are typically based on Cisco switches, with 1GB backbones and 100MB service to the work area. The Designer shall coordinate with the NOAA IT Infrastructure Specialist to determine the requirements for supporting the network electronics in each space. The design shall include the infrastructure for hosting this equipment.

D. Media converters shall not be used in NOAA installations unless submitted and approved though the Alternative Design Approval process.

4.21 BUILDING AUTOMATION SYSTEMS

Refer to the *Building Automation Systems* section of the BICSI® TDMM for information regarding the design of telecommunications infrastructure to support building automation systems at NOAA facilities.

4.22 PRIVATE CATV DISTRIBUTION SYSTEMS

Refer to the *Private CATV Distribution Systems* section of the BICSI® TDMM for information regarding the design of telecommunications infrastructure to support private CATV distribution systems at NOAA facilities.

4.23 OVERHEAD PAGING SYSTEMS

Refer to the *Overhead Paging Systems* section of the BICSI® TDMM for information regarding the design of telecommunications infrastructure to support overhead paging systems at NOAA facilities.

4.24 WIRELESS SYSTEMS

Refer to the *Wireless* section of the BICSI® TDMM and the BICSI® Wireless Design Reference Manual (WDRM) for information regarding the design of telecommunications infrastructure to support wireless and microwave communications systems at NOAA facilities.

The Federal government frequency usage is managed by NTIA. All equipment purchased for radio transmission must comply with NTIA and NOAA radio frequency management requirements and policies. Contact the NOAA Radio Frequency Manager in OCIO **< ? >** for further information.

4.24.1 WIRELESS CONNECTIVITY (WIRELESS FIDELITY – WI-FI)

Wireless communications devices are proliferating throughout the world, and can pose significant security risks to non-wireless networking infrastructures if not properly implemented. Since wireless technology has emerged there has been an increased demand in the use of wireless communications devices. With this demand, wireless communications also become a major source of new security vulnerabilities. Today Wireless Fidelity, better known as WiFi, is one of the wireless technologies that present great opportunities as well as major security concerns. In the future, technologies such as Ultra-wideband (UWB), 3G, Software Defined Radio (SDR), Mobile Ad Hoc Networks (MANET), and 802.16 fixed broadband will all require security assessments prior to incorporating them into a wired LAN infrastructure.

4.24.1.1 Background

Modern wireless communications can trace its origins to the late 1800s and wireless technologies have continued to grow in popularity since the 1983 introduction of the cellular telephone. In the early 1990s, multiple vendors offered wireless networking technologies to link groups of computers and peripherals within a local area. The increased popularity of mobile telephones and personal mobile computing devices has driven the need for secure, convenient and reliable wireless connectivity. The publication of WLAN standards by the Institute of Electrical and Electronics Engineers, Inc.® (IEEE®) and advances in wireless technologies have made it easier for network planners to incorporate wireless solutions into their designs.

Wireless mobile technologies are becoming more pervasive throughout the personal use and business communities. NOAA is also experiencing the same phenomenon. The rapid introduction of a broad range of commercial wireless technologies by service providers, manufacturers and software application developers, has not gone unnoticed by NOAA Line Offices and Laboratories. Interest in exploring these technologies is rapidly leading to stovepipe acquisitions of cellular, PCS, paging, satellite, land mobile radio, microwave and infrared systems and services throughout the Department. Without Agency standards and guidelines we are building network security vulnerabilities that will no doubt “bite” us in the very near future.

4.24.1.2 The Challenge

The challenge is to provide NOAA Scientists and other agency users with the flexible and convenient wireless connectivity they require. However, this must be accomplished using design principles and standards that secure and protect our information technology assets.

4.24.1.3 Today’s Reality

In 2007, NOAA established a strategic goal for implementing a uniform set of standards-based guidelines for designing, installing and maintaining a wireless LAN infrastructure. Many locations have deployed wireless technology to address a mission-critical need and must evaluate their installations with respect to these guidelines. Incorporating the guidelines in the continuing use of this technology will minimize the risk of producing ongoing policy, interoperability and security issues.

Since wireless connectivity is a rapidly evolving LAN technology, please be sure to check with the NOAA OCIO for latest wireless policies plus, the latest applicable NIST and FIPS security requirements.

4.24.1.4 General Wireless Design Considerations

Numerous considerations must be addressed prior to the initial design and implementation of a wireless system. While all design considerations may not apply in every instance, they should be taken into account for each project. Many of these considerations also should be discussed with the site-user community prior to finalizing any formal recommendations for a wireless solution.

<u>Technological Considerations</u>
Technological considerations in the design of a wireless network include scalability, compatibility, and standardization.

Scalability – The scalability of the network should always be considered in the initial design. This includes analyzing the number of current users and considering any potential future users. Consider any potential system upgrades also, and design a plan for growth.

Compatibility – Overall network compatibility also should be considered. Ensure that the proposed system integrates with the current network. Take into account other nearby wireless systems and their potential for interference.

Standardization – A wireless network based around standards is preferable to a proprietary system that ties the design to any one vendor or technology. Because there are many wireless standards from which to choose, consider backward compatibility as well as present and future acceptance.

Business Considerations

Business considerations in the design of a wireless network include applications, network flexibility, long-term growth, and network security.

Applications – As wireless can have many different uses on a network, one must first determine the various applications. These can include data collection, wireless local area networks (WLANs), building-to-building connectivity, and wireless voice services.

Flexibility - While also a technological consideration, the flexibility of the wireless network should be considered from a business perspective. Issues to consider include:

- What applications can/should run on this network.
- Who can access the network.
- Whether existing systems can integrate with this network.
- Will security issues on the wireless network segment compromise the integrity of the wired LAN.

Long-Term Growth – Additionally, the long-term growth of the wireless system should be considered. This includes sustained growth, compatibility with future applications, and operational growth considerations.

Security – Finally, the security of the network must be considered. While all wireless networks should be designed for the secure transfer of information, the degree of security must follow departmental and government guidelines for the protection of information in any environment. Additional security factors include who is allowed access, where they are allowed access, and what level of access is allowed.

4.24.1.5 Major Wireless Standards Development Organizations

Several organizations are charged with writing and setting the standards used in the various wireless technologies. The ones most closely related to the wireless technology used in local telecommunications distribution networks within NOAA are listed below:

Electronics Industries Alliance / Telecommunications Industry Association (EIA/TIA)
Institute of Electrical and Electronics Engineers, Inc.® (IEEE®)
American National Standards Institute (ANSI)

In addition to the guidance provided in the applicable NOAA OCIO Directives listed in Section 4.24.1.3 above, the BICSI® *Wireless Design Reference Manual* (WDRM) (2nd Edition) is the reference document to be used to design, install and maintain wireless networks within NOAA facilities.

4.24.1.6 Wi-Fi Phrasebook

Entering the world of wireless fidelity, or Wi-Fi, requires knowing just a little local lingo. Here are some of the the most important terms:

- 802.11: We're covering this term only because you'll run across it in learning about Wi-Fi. Pronounced "eight-oh-two-dot-eleven," it's usually followed by a letter (mostly a, b, g). Essentially, this is Wi-Fi's technical name. It refers to a family of specifications for wireless LANs. Higher letters indicate more recent, and presumably improved, versions of the technology.
- Base station: The heart of a Wi-Fi network, it's equipped with an antenna that sends a low-powered, short-range radio signal. Wi-Fi-enabled devices within a certain radius detect the signal, letting users access the network.
- Bluetooth: A specification for very short-range wireless transmission (within 30 feet).
- Hot spot: Wi-Fi access point. The term usually refers to coffee shops, airports, hotels, and other public locations with local area networks (LANs) that Wi-Fi-equipped users can access free or for a fee.
- LAN: Local area network. A WLAN is a wireless local area network.
- Wi-Fi Protected Access (WPA): Wireless network security technology; replaced an older, more vulnerable mechanism known as Wireless Equivalent Privacy (WEP).

For more terms defined, visit the Wi-Fi Alliance's glossary by clicking on the link provided.

4.24.2 MICROWAVE SYSTEMS

Please refer to the *Wireless* section of the BICSI® TDMM for information regarding the design of telecommunications infrastructure to support microwave communications systems at NOAA facilities.

5.0 CONSTRUCTION DOCUMENT CONTENT

A. This section of the NOAA FITCSG describes the content requirements that the Designer shall include when creating the Construction Documents. This content is in addition to the content found in some generally accepted document sets.

B. NOAA's philosophy with respect to Construction Documents is that a fully detailed and coordinated design (rather than making adjustments in the field during construction) should result in reduced construction costs and fewer change orders.

C. The Designer shall include the following content in the Construction Documents:

5.1 PLANS AND DRAWINGS

5.1.1 GENERAL

A. The drawing set shall include the following:

- Cover Sheet
- Sheet List
- Site Map
- Symbol Schedule
- List of Abbreviations

B. All plan sheets shall be scaled, shall indicate the scale and shall show a north arrow. All plan sheets shall show a key plan when the building or site is too big to fit on a single sheet. All units shall be metric.

C. Construction Document telecommunications drawings are described as T-series drawings. The organization varies by A-E or Designer preference and custom. They are described as follows:

T0 -GENERAL OR OUTSIDE PLANT TELECOMMUNICATIONS SITE PLAN
Symbols, legends, abbreviations, index and notes and/or drawing(s)
T0 can be used for: Campus or site plans showing exterior pathways and inter-building backbones.

T1 -INSIDE PLANT TELECOMMUNICATIONS PLAN DRAWINGS
Layout of complete building by floor – Serving zone boundaries, backbone systems, access points, horizontal pathways and other systems that must be viewed from the complete building perspective. Topology and riser diagrams, including the Intra-building backbone.

T2 -SERVING ZONES DRAWINGS
Drop locations, cable identifiers, communications equipment rooms, access points and detail keys called out for equipment rooms and other congested areas by serving zones.

T3 -TELECOMMUNICATIONS ROOM PLAN DETAILS
Communications equipment rooms – Detailed plan views, technology layout (racks, ladderracks, etc.), telecommunications, Architectural, Mechanical, Electrical and Plumbing elevations – Racks, backboards and walls. May enlarge a congested area.

T4 -TYPICAL OR KEYED DETAIL DRAWINGS
Faceplate type and labeling, detail racking, raceway details, firestopping, safety, grounding, hangers, installation procedures, wiring blocks. Maintenance hole/handhole butterfly diagrams.

T5 -SCHEDULES
Spreadsheets of cabling, material or equipment including cutovers and cable management.

5.1.2 GENERAL OR OUTSIDE PLANT TELECOMMUNICATIONS SITE PLAN DRAWINGS

D. Provide drawings showing a scaled telecommunications distribution site plan. These drawings shall show the following:

- Maintenance hole or handhole locations (labeled with their identifiers)
- Maintenance hole or handhole details
- Complete ductbank routing, details and elevations
- Section cuts
- Existing and new surface conditions
- Outside plant telecommunications cabling

E. These sheets should also identify coordination arrangements where possible conflicts could arise with site work for other disciplines, in particular indicating the separation distances between telecommunications and power or steam. The sequencing of site work also should be shown, if applicable.

F. The site plan shall show the cabling from the service providers (cable television, telephone, etc.) and shall indicate the requirements for owner-provided maintenance holes or handholes and pathway to the point of demarcation.

5.1.3 INSIDE PLANT TELECOMMUNICATIONS PLAN DRAWINGS

A. Scaled plan drawings shall be provided for each building showing the horizontal and intra-building backbone telecommunications infrastructure. These drawings shall show the following:

- Routing of new pathway to be constructed during the project (the information on the drawings shall be coordinated with other disciplines and shall be representative of the actual route that the Contractor shall use, rather than a schematic depiction).
- Approximate locations of junction boxes and conduit bends.
- The size of each junction box.
- The cable quantities and the raceway at any given point in the system.

B. Where new cabling will be pulled into existing homerun conduits, it is desirable but not required to show on the drawings the route of each *existing* homerun conduit, unless the Contractor will encounter unusual conditions. The Designer shall have identified such conditions during the Fieldwork phase.

5.1.4 TELECOMMUNICATIONS ROOM PLAN DETAILS

Construction drawings for NOAA projects shall show scaled plan details for the telecommunications spaces. The details shall show the footprint and location of each of the major components in the room including at least the following:

- Backboards
- Backbone Cable Routing
- Contractor Phone Equipment
- Ladder Racking
- Entrance Conduits
- Entrance Protection Equipment
- Work Area
- Space for Future Racks
- Racks and Vertical Cable Mgmt
- Grounding Busbar
- Termination Blocks
- Space for other low voltage systems
- UPS Equipment
- PBX and Voice Mail
- Space Reserved for Utility Demarc

5.1.5 INTRA-BUILDING BACKBONE ELEVATION DIAGRAMS

A. Most NOAA buildings are of a size and structure that requires only one MDF per building. Where there are multiple IDFs in a given building, NOAA requires that each IDF have dedicated fiber optic backbone cables connecting it to the MDF.

B. An intra-building backbone riser diagram is required where copper backbone cable for voice is to be distributed between multiple IDFs within a building. An intra-building backbone riser diagram is also required for fiber optic backbone cable distributed among multiple IDFs within multistory buildings. In these cases, the Designer shall include an intra-building backbone riser diagram showing new cabling as well as existing cabling and pathways (both to remain and to be removed) in proximity to the new cabling.

5.2 PROJECT MANUAL

A. The NOAA *Facilities Design Standards (P&P 242.1-NOAA)* lists requirements for the Project Manual.

B. In addition to these requirements, the Project Manual shall contain the following items as described below:

- Maintenance Hole/Handhole Butterfly Diagrams
- Elevation Diagrams
- Cutover Plans

- Cable Records
- Fiber Link-Loss Budget Analyses.

C. The Project Manual shall also contain a summary of the telecommunications work on the project, a description of the demolition requirements (if applicable), a discussion of the utility coordination requirements and the Specifications outlined in Section 5.2.1 following.

5.2.1 SPECIFICATIONS

A. Specifications are a written description of the work organized into industry accepted Divisions and Sections by trade. Each Section is divided into 3 parts – General, Products and Execution. The NOAA FACILITIES DIVISION Project Manual contains these specifications.

B. The General Services Administration (GSA) promulgates voluntary standards for creating and organizing specifications – the written “instructions” for putting together a building—and other written data about the structure.

C. NOAA has adopted the GSA P-100 Facilities Standards specifications .

D. Telecommunications cabling was traditionally specified in Division 16 of the Construction Specification Document or Manual with Sections on Wire and Cable, Raceways, and Devices and a Section on Interior Distribution Systems based on a Section called “Basic Electrical Materials and Methods”. This can vary by A-E firm.

E. “Division 17” was a proposal to organize categories and sections of construction specifications based on the CSI format into sections taken out of other divisions, mainly Division 16 and containing all Telecommunications work. This term is outdated with the release of the CSI MasterFormat™ 2004 edition (Nov 2004).

F. The CSI MasterFormat™ 2004 edition (Nov 2004) has been adopted and expands the former 16 specification Divisions (1 through 16) to include Divisions in Subgroups 21-28, Facility Services; Subgroups 31-35, Site and Infrastructure; and Subgroups 41-48, Process Equipment. Divisions 15 and 16 are no longer used. Some new subgroups are listed below:

Division 21 -Fire suppression
Division 22 -Plumbing
Division 23 -HVAC
Division 25 -Integrated Automation
Division 26 -Electrical
Division 27 -Communications
Division 28 -Electronic Safety and Security
Division 33 -Telecommunications Outside Plant
Division 40 -Fiber Optic Cable

The latest GSA P-100 Facilities Standards guide is available for download from the General Services Administration web site at

http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentId=14796&contentType=GSA_OVERVIEW.

5.2.2 MAINTENANCE HOLE/HANDHOLE BUTTERFLY DIAGRAMS

A. Butterfly diagrams are a combination of tabular information and schematic diagram used to organize and communicate information related to the conduits and cabling in each maintenance hole and handhole.

B. The Designer shall provide a set of butterfly diagrams depicting each maintenance hole or handhole affected by the project and showing new cabling as well as existing cabling to remain in the maintenance hole or handhole.

C. A second set of butterfly diagrams shall be provided for each maintenance hole or handhole that contains existing cabling intended to be demolished under the project.

D. Typically, butterfly diagrams shall be provided on 8½ x 11”-sized sheets in the Project Manual. However, it may be desirable to show this information on large-format drawing sheets.

E. The diagrams shall be formatted as shown in the sample butterfly diagram in Appendix 6.2.

5.2.3 ELEVATION DIAGRAMS

A. The Designer shall provide scaled wall elevation details for each IDF and MDF affected by the project. The Designer should consider (on a project-by-project basis) whether the plan drawings are better suited for depicting the elevation diagrams, in lieu of the Project Manual.

B. The Designer shall produce digital photographs of each wall depicting the existing conditions where future IDFs and MDFs will be located. These photos shall be provided with the wall elevation details in the Construction Documents.

C. The wall elevation details shall show the components that are mounted on the walls in the room including at least the following:

- Backboards
- Backbone Cable Routing
- Wall-mounted Electronic Equipment
- Ladder Racking
- Cable Management
- Wall-mounted Swing Racks and Contents
- Cable Slack Loops
- Termination Blocks
- Racks and Vertical Cable Mgmt
- Grounding Busbar
- Power Receptacles
- Entrance Protection Equipment
- Existing Devices □ Entrance Conduits
- Contractor Phone Equipment
- Work Area □ Space for Future Racks
- Other low voltage systems
- UPS □ PBX and Voice Mail
- Space for Future Equipment
- Entrance Pit
- Space Reserved for Utility Demarc

D. These details shall also show elevation details for the telecommunications racks in each IDF and MDF. The rack elevation details shall show the racks and any components that are mounted on or near the racks including at least the following:

- Patch Panels
- Shelves / Drawers
- Space for Future Equipment
- UPS Equipment
- Termination Blocks
- Electronic Equipment
- Existing Devices
- Power Receptacles
- Cable Management

E. The details shall depict the telecommunications materials that are listed in the specification.

F. Where a project involves additions to existing racks, the elevation details shall show the existing equipment in the racks and indicate which items are existing, in addition to indicating which items are "new, to be provided under the Contract".

G. See Appendix 6.4 for an example of a rack and wall elevation detail.

5.2.4 CUTOVER PLAN

A. The Designer shall provide a detailed cutover plan that is coordinated with other disciplines on the project as well as with NOAA data and telephone equipment cutover requirements. Verbiage describing the sequence of work and the cutover plan shall be provided in this section. Limitations on the permissible downtime allowed and temporary service arrangements shall be discussed in the cutover plans. The Designer should consider (on a project-by-project basis) whether the plan drawings are better suited for communicating the cutover requirements, in lieu of the Project Manual.

B. For a new campus or a telecommunication infrastructure replacement project, the cutover plan shall show the main telecommunications equipment room (ER / MDF) to be the first facility to be made accessible to NOAA to allow time for telephone and network equipment to be installed, configured, tested and activated.

C. Typically, elevation details shall be provided on 8½ x 11"-sized sheets in the Project Manual. However, it may be desirable to show this information on large-format drawing sheets.

D. The cutover plan may include allowance for NOAA to make partial use of the telecommunications infrastructure prior to substantial completion so that NOAA IT staff can start up and configure their equipment in preparation for cutover. The schedule for these activities shall be coordinated during the design process with the NOAA IT Infrastructure Specialist and then revisited with the Contractor during construction.

E. See Appendix 6.4 for an example of a cutover plan (combined with the rack and wall elevation detail).

5.2.5 CABLE RECORDS

The Designer shall prepare cabling records (included in the Construction Documents) showing the following information for each of the cable links on the project, and referencing the label identifiers for the project as specified below. The header of the table will show the following fields for each record:

5.2.5.1 Copper Cable

- Cable Identifier
- End locations of cable (TEP and/or MDF/IDF ID)
- Link Type (i.e. backbone, riser, horizontal)
- Media type
- Proposed usage (i.e.: voice, data, lighting control . . . paging)
- As-designed values for link length.
- As-constructed values for link length and headroom (to be recorded by installation contractor based on final test results).

5.2.5.2 Fiber Optic Cable

- Cable Identifier
- End locations of cable (TEP and/or MDF/IDF ID)
- Link Type (i.e. backbone, riser, horizontal)
- Media type (MM, SM)
- Proposed usage (i.e.: voice, data, lighting control . . . paging)
- As-designed values for link length, link attenuation at design frequency (indicate frequency used for design calculations), splice loss, connector loss and calculated link loss
- As-constructed values (to be recorded by installation contractor based on final test results) for link length and link attenuation (measured link loss) as tested with test frequency.

See Appendix 6.5 for an example of a cable record form. Upon request, NOAA will provide an electronic spreadsheet of this form to be used as a template.

5.2.6 FIBER LINK-LOSS BUDGET ANALYSIS

A. The Designer shall provide (in the Construction Documents) a link-loss budget analysis for each strand of fiber.

B. The link-loss budget analysis shall be formatted as shown in Appendix 6.6. Upon request, NOAA will provide an electronic spreadsheet file to be used as a template.

5.3 RECORD DRAWINGS AND DOCUMENTATION

- Record Drawings and documentation are important for the transition of the project from Design and Construction to Operation and Maintenance. They should include drawings annotated with all change orders, clarifications, requests for information (RFI's), and as-built field conditions. Record documentation should also include a copy of all approved submittals of shop drawings, catalog cuts, samples, test results and product data.
- The Record Drawings shall show the identifiers for the telecommunications infrastructure components as constructed.
- One set of 8½x11"-sized butterfly diagrams on bond media shall be delivered to NOAA

Engineering Project Manager.

- An Operation and Maintenance manual should be compiled and provided at the completion of the project containing operating instructions, safety precautions, starting and shut-down procedures, service requirements, environmental conditions, preventive maintenance, corrective maintenance, troubleshooting and diagnostic techniques, wiring diagrams, removal and replacement procedures, spare parts and accessories lists, parts and any other necessary and appropriate information.
- A copy of the certified manufacturer's and/or installer's warranty for all materials, equipment and workmanship should be included in the record documents.
- These should be bound into a volume. Record Documents, O&M Manuals and Warranties are usually described in Division 1 of the specifications in general and in each specification section in detail.
- One CDROM containing the digital photographs taken by the Designer during the project shall be delivered to NOAA Engineering Project Manager (EPM).
- All designs, drawings and specifications in CAD file format.
- Statement regarding removal of abandoned cables
- Configuration Management policy and procedures

6.0 APPENDIX

6.1 Review Comment Report

The following page shows the Review Comment Report form that will be used. The Designer shall respond to the comments on this report in the column provided and submit the completed report form to NOAA electronically. Upon request, NOAA will provide an electronic document for this form to be used as a template.

Project Name:

Reviewer: Date:

Type of Submittal

( ) Environmental Assessment
( ) Investigative Report
( ) Program of Requirements

( ) Drawings
( ) Specifications
( ) Code Analysis
( ) Other

Review Stage / Area of Review

( ) Engineering (IT) ( ) Final ( ) Architectural ( ) Safety ( ) Other ( ) Real Property ( ) Other

Action Legend: C-Concur D-Do not agree E-Exception (see comment) X-DELETE COMMENT

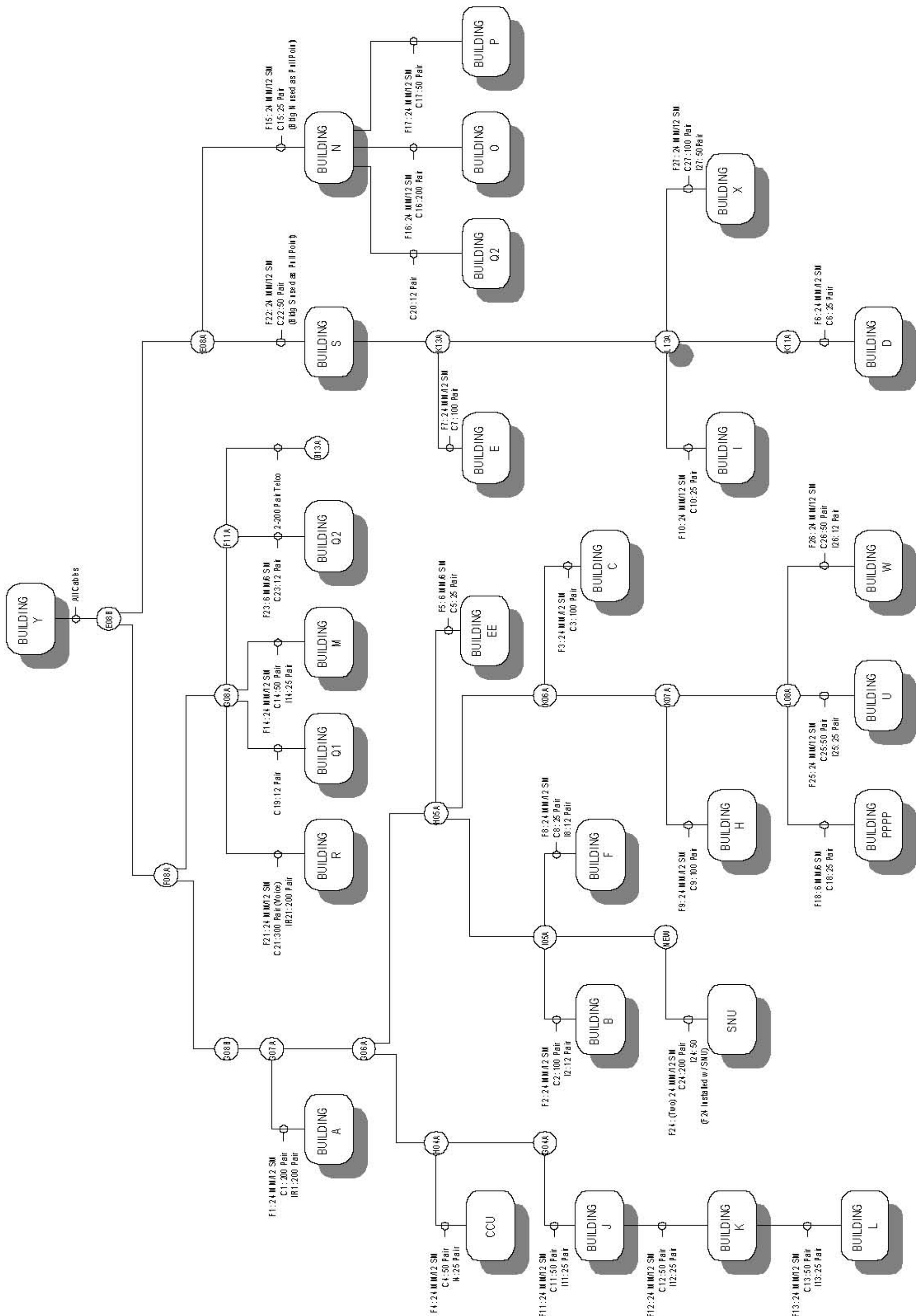
Comment No.	Dwg., Page #, or Spec. Section	Comment	Action
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

6.2 SAMPLE BUTTERFLY DIAGRAM

The following is a sample maintenance hole / hand hole Butterfly Diagram. The Designer shall follow this format and produce a butterfly diagram for each new or existing maintenance hole or hand hole that is affected by an outside plant communications project. The Designer shall submit the completed diagrams to NOAA in both electronic and paper forms.

6.3 SAMPLE BACKBONE SCHEMATIC DIAGRAM

The following is a sample Backbone Schematic Diagram. The Designer shall follow this format and produce backbone schematic diagram for each project that includes new outside plant communications infrastructure.



6.4 SAMPLE COMBINATION RACK/WALL ELEVATION DETAIL WITH CUTOVER PLAN

The following is a sample elevation detail combining rack and wall elevations with a cutover plan for an existing telecommunications room.

The Designer shall provide similar information for each new or existing telecommunications room and new or existing equipment room affected by the project.

This information shall be provided either as a portion of the Project Manual or on the drawings, and shall be considered part of the Construction Documents.

Building ZZZ -Main Telecommunications Room "1A"

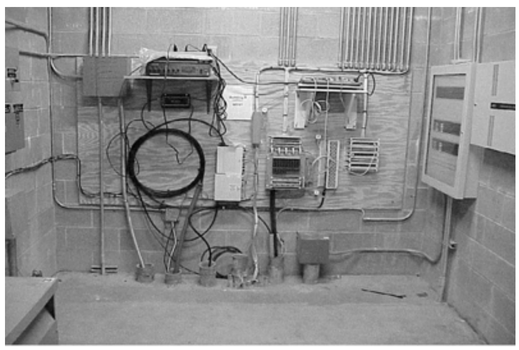


FIGURE 1. EXISTING WEST WALL COMMUNICATIONS BACKBOARD

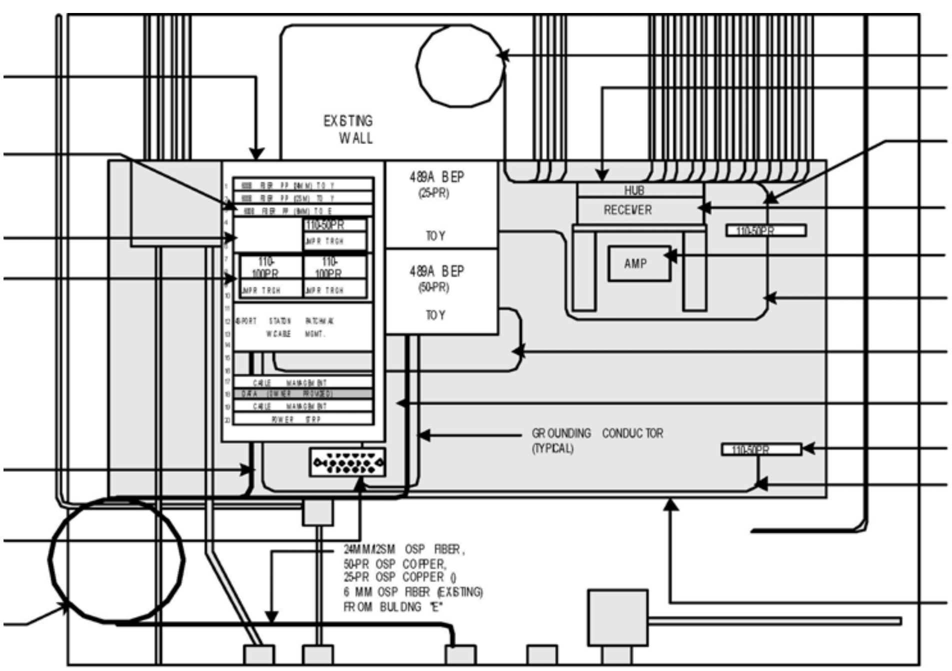


FIGURE 2. REVISED WEST WALL COMMUNICATIONS BACKBOARD

(1/2" = 1)' (GRAYED-OUT EQUIPMENT IS EXISTING –TO REMAIN OR PROVIDED BY OTHERS)

6.5 SAMPLE CABLE RECORD

The following page shows an example Cable Record that the Designer shall use for recording information about each cable that is installed during a project. The Designer shall submit the completed cable records to NOAA in both electronic and paper forms. Upon request, NOAA will provide an electronic document for this form to be used as a template.

Cable Identifier (ID):			
End Location ID:		**End Location ID:**	
Link Type:	☐ Campus ☐ Intra-Building Backbone ☐ Riser ☐ Horizontal		
Media Type:	☐ MM ☐ CAT3 ☐ CAT5 ☐ SM ☐ CAT5e ☐ CAT6	# of Conductors	☐ Strands ☐ Pairs
General Usage:	☐ Voice ☐ Data ☐ Video ☐ Other:____________________		
# Pairs/Strands In Use:			
# Damaged PRs/STDs:			
# Available PRs/STDs:			

As Designed (Calculated):	
Cable Length:	ft
(Fiber) Splice Loss:	Attenuation: dB
(Fiber) Connector Loss:	Attenuation: dB
(Fiber) Link Attenuation:	Attenuation: dB at Wavelength: nm
(Fiber) Link Loss:	Attenuation: dB

As Constructed (Measured):	
Cable Length:	ft
(Copper) Headroom:	dB

Pair / Std #	**Link Loss (Fiber)**	**Usage Description**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

Pair / Std #	**Link Loss (Fiber)**	**Usage Description**
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		

6.6 SAMPLE FIBER OPTIC LINK-LOSS BUDGET ANALYSIS

The page shows an example Fiber Optic Link-Loss Budget Analysis that the Designer shall use for each new fiber optic cable designed in the project. The Designer shall submit the completed link-loss budget analyses to NOAA in both electronic and paper forms. Upon request, NOAA will provide an electronic spreadsheet of this form to be used as a template.

Fiber Optic Link Loss Budget

Cable ID: *cable identifier* From: *Building A* To: *Building B*

			MM 850	MM 1300	SM 1310	SM 1550	
Passive Cable System Attenuation							
Fiber Loss at Operating Wavelength		Cable Length (in kilometers)					km
	x	Attenuation per km	x 3.40	x 1.00	x 0.40	x 0.30	dB/km
	=	**Total Fiber Loss**					dB
Connector Loss		Number of Connector Pairs					pairs
(Excluding Tx & Rx Connectors)	x	Individual Connector Pair Loss	x 0.30	x 0.30	x 0.30	x 0.30	dB/pair
	=	**Total Connector Loss**					dB
Splice Loss		Number of Splices					splices
	x	Individual Splice Loss	x 0.15	x 0.15	x 0.20	x 0.20	dB/splice
	=	**Total Splice Loss**					dB
Other Components Loss		**Total Components Loss**					dB
Total Passive Cable System Attenuation		Total Fiber Loss					dB
	+	Total Connector Loss	+	+	+	+	dB
	+	Total Splice Loss	+	+	+	+	dB
	+	Total Components Loss	+	+	+	+	dB
	=	**Total System Attenuation**					dB
			MM 850	**MM 1300**	**SM 1310**	**SM 1550**	
Link Loss Budget							
From Manufacturer's Specifications		Average Transmitter Output	-18.0	-18.0	-18.0	-18.0	dBm
		Receiver Sensitivity (10^{9} BER)	-31.0	-31.0	-31.0	-31.0	dBm
System Gain		Average Transmitter Power	-18.0	-18.0	-18.0	-18.0	dBm
	-	Receiver Sensitivity	- -31.0	- -31.0	- -31.0	- -31.0	dBm
	=	**System Gain**	= 13.00	= 13.00	= 13.00	= 13.00	dB
Power Penalties		Operating Margin	2.0	2.0	3.0	3.0	dB
# of Fusion Splices Loss per Splice	+	Receiver Power Penalties	+ 0.0	+ 0.0	+ 0.0	+ 0.0	dB
2 X 0.3 =	+	Repair Margin	+ 0.6	+ 0.6	+ 0.6	+ 0.6	dB
	=	**Total Power Penalties**	= 2.60	= 2.60	= 3.60	= 3.60	dB
Link Loss Budget		System Gain	13.00	13.00	13.00	13.00	dB
	-	Power Penalties	- 2.60	- 2.60	- 3.60	- 3.60	dB
	=	**Total Link Loss Budget**	= 10.40	= 10.40	= 9.40	= 9.40	dB
			MM 850	**MM 1300**	**SM 1310**	**SM 1550**	
Performance							
System Performance Margin		Link Loss Budget	10.40	10.40	9.40	9.40	dB
	-	Passive Cable System Attenuation	-	-	-	-	dB

6.7 SAMPLE ALTERNATIVE DESIGN REQUEST FORM

The following is an example of the Alternative Design Request form. The Designer shall provide the information requested on the form and submit the completed request electronically. Upon request, an electronic document of this form will be provided for use as a template.

IT Infrastructure Alternative Design Request Form

Project Number / Task Order No.

Project Name: Location:

Submitted By: Date: Organization: Phone No: E-Mail:

Current Project Stage: Area(s) Impacted By Request:

( ) Program of Requirements ( ) Engineering (IT) ( ) Specifications

% Design Review ( ) Architectural ( ) Drawings ( ) Final ( ) Equipment ( ) Safety ( ) Other _______

Other Attachments Included With This Request: (Please Describe)

Nature of Request: In the narrative below, cite how the project will differ from the guidelines set out by the NOAA Telecommunications Distribution Design Guide (FITCSG) or BICSI® manuals in sufficient detail to allow evaluation of the request. It is frequently useful to provide drawings to illustrate the differences between what is being requested and what is in the guidelines. More than one page can be submitted.

Note: Any work that would be above the minimum standards set out in the FITCSG does not require a waiver. For example, the use of fiber optics in lieu of copper does not in itself require a waiver.

Please e-mail this request as an attachment to: OCIO, NOAA at **<provide address>.** Your request will be assigned to someone for review.

IT Infrastructure Project Number / Task Order No. Project Name: Location: Nature of Request:

(Description)

- *The type of facility (Admin Ofcs., Lab., Commercial Space, etc.)*
- *The conditions at the facility (e.g. New construction, multiple tenants; Renovation of 50-yearold facility; etc.)*
- *The approved design solution as described in the FITCSG document or as described in the standards referenced in this document (Describe)*
- *The proposed alternative design (Describe)*
- *A list of the guidelines and standards referenced in the FITCSG document with which the alternative design will not be in compliance, and the effect of non-compliance, both short and long term*
- The reason for the alternative design
- The estimated cost impact of this request (+/-)
- The contractor or personnel performing the construction
- *A statement identifying the impact to the physical security of the NOAA facility*

7.0 TABLE OF FIGURES

8.0 GLOSSARY

ANALOG

Analog comes from the root word “analogous,” which means “similar to.” In telecommunications, analog is a way of sending signals—voice, data, or video—in which the transmitted signal is analogous to the original signal. In other words, if you spoke into a microphone and saw your voice on an oscilloscope; took the same voice as was transmitted on the phone line and viewed that signal on an oscilloscope, the two signals would look the same. See Digital.

AWG (AMERICAN WIRE GAUGE)

The standard measuring gauge of the diameter of copper wires in telecommunications and electrical cables.

BACKBOARD

A plywood sheet mounted to the wall where telecommunications distribution equipment is installed. The backboards shall be ¾” unpainted fire retardant plywood or untreated ¾” plywood painted with white or light colored fire retardant paint. It is not suggested that fire retardant plywood be painted and in no case shall a fire retardant plywood stamp be painted over.

BACKBONE CABLING

Backbone cable is defined as a major service cable that is used to interconnect various buildings on a campus, connect equipment rooms to telecommunications closets within a building, or connect one telecommunications closet to another within the same building. Backbone cables are typically large capacity (high pair-count) copper cables, or fiber optic cables.

BANDWIDTH

A range of frequencies, usually the difference between the upper and lower limits of the range, expressed in Hz. It is used to denote the potential capacity of the medium, device, or system. In copper and optical fiber cabling, the bandwidth decreases with increasing length.

BEND RADIUS

The maximum radius that a cable can be bent to avoid physical or electrical damage or cause adverse transmission performance.

BONDING

The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely to ground any current likely to be imposed.

BUS

An electrical connection which allows two or more wires to be bonded together.

BUSBAR

A copper bar, drilled and tapped, to allow the bonding together of wires or cables.

CABLE PAIR

Each telecommunications circuit is made up of two copper wires, or a pair of wires. Traditional analog telephone service uses one-pair of wires. Some modern digital telephone systems, and most computer networks operate over two or four pairs of wires. The ANSI/TIA/EIA-568-A standard requires a four-pair cable to each work-area information outlet.

CABLE PLANT

A term which refers to the physical connection media such as optical fiber cable or copper cable. See Telecommunications Infrastructure.

CABLE PULL TENSION

Stated by the manufacturer as the maximum limit at which the cable’s performance characteristics are altered, experiencing electrical or mechanical degradation. Also known as maximum recommended installation load (MRIL).

CABLE TENSILE STRENGTH

Is the limit point where the cable is pulled apart.

CHANGE ORDER (CO)

Change Orders document the modifications to an existing contract. The change order procedure can be initiated by the Owner, Contractor, or the A/E. The A.E will generally start the process using the Change Order/Change Order Proposal form. A Change Order is a modification to the contract and must be executed by the Contracting Officer

CAMPUS

The buildings and grounds of a complex or facility.

CATV (COMMUNITY ANTENNA TELEVISION)

CATV is commonly referred to as "cable TV." In the traditional sense, CATV is a master antenna that receives television signals, and distributes the signal over cables to a limited geographical area, such as a campus, or neighborhood (community). Some NOAA facilities receive cable TV service from a local service provider for a subscription fee. Other NOAA facilities have their own TV antennas, including satellite antennas, and distribute the signals throughout the facility over fiber optic and/or copper cables.

CCTV (CLOSED CIRCUIT TELEVISION)

CCTV is a system where one or more cameras send a television signals to television monitors at another location in the same building or campus. NOAA commonly uses CCTV for security monitoring at strategic locations, with TV monitors located in officer's stations or control booths. It may also used within major building complexes for non-security purposes.

CHAIN OF PRIVITY

A mutual or successive relationship that exists between two or more contracting parties.

CONTRACTORS AND CONTRACTOR BUILDINGS

Contractor buildings/areas are facilities located at an NOAA facility where certain private companies or industries on contract to NOAA can utilize a labor force to provide goods and services. Contractor buildings may have additional unique requirements for telecommunications systems.

1. The systems must be protected from unauthorized access
2. The private companies who operate in NOAA buildings are usually on fixed duration contracts. When the contract expires, it is likely that another company, with different telecommunications needs, will use the NOAA buildings. Therefore, the telecommunications infrastructure must be designed to be flexible.
3. The private companies who operate in NOAA buildings will typically be responsible for their own telecommunications services, including purchasing and installing telephone service and any data services required by the company.
4. When the NOAA owns the buildings, the NOAA will provide the basic telecommunications infrastructure, designed and sized to support the basic function of the building.

CONTRACTOR TELEPHONES

Telephone service for contractor use is provided through a contract with the Local Exchange Carrier and/or Long Distance Carrier. The telecommunications infrastructure to support contractor telephone service is normally part of the overall facility infrastructure, and is owned by NOAA. Provisions must be made at the Main Cross-connection point or Main Equipment Room to separate contractor telephone services from official NOAA services.

CROSS-CONNECT (XC)

A cross-connect, or cross-connection, is where individual cable pairs from two different cables are connected together with jumper wires. An XC is intended to be easily reconfigured, as opposed to a cable splice which is permanent.

DATA SERVICES

Data service generally refers to the computer network. For future planning purposes, data shall be considered to be any information that is transferred in digital form. Advances in technology are blending together traditional voice, data, and video services. Eventually, a single telecommunications system may process all forms of telecommunications (voice, data, and video) over a common infrastructure.

DEMARC

The point of demarcation between the service provider and the customer. The demarc is actually a cable termination block with an orange cover where the service provider's cable terminates. The services are then cross-connected to the customer's cable for distribution throughout the facility. See Telecommunications Service Telecommunications

Entry Point.

DIGITAL

In telecommunications or computing, digital is the use of a binary code to represent information. In binary code, the information is represented by a series of "on" or "off" states (a signal, or an absence of a signal). Analog signals—like a voice—are encoded digitally by sampling the voice analog signal many times a second and assigning a number to each sample. During transmission, the signals will lose strength and progressively pick up noise or distortion. In analog transmission, the signal (along with any noise that is picked up) is simply amplified to maintain the proper signal strength at the distant end. In digital transmission, the signal is regenerated, cleaning off any noise, and restoring the signal to its original form. Then the signal is amplified, and sent to the destination. At the destination, the digital signal is again regenerated, and restored to its original form for processing. See Analog.

EMI Electro Magnetic Interference

Electro Magnetic Interference is a signal distortion directly related to a foreign signal being imposed through coupling onto a transmission path that the foreign signal is not physically connected to.

Ethernet 10/100/1000 Base-TX Pin Assignments

At the outlet Ethernet 10/100 Base-TX uses pins 1 and 2 for transmit and pins 3 and 6 for receive in the associated 4 pair cable. The LAN switch transmits the signal over pair 3 and receives the signal over pair 2. In the jack at the workstation and the patch panel pair 3 is terminated with its tip side on pin 1 and its ring side on pin 2 while pair 2 is terminated with its tip side on pin 3 and its ring side on pin 6. For further information see section 4.3.5.

Existing Buildings

The vast majority of telecommunications projects involve installing or upgrading the telecommunications infrastructure in existing buildings to make use of new technology. Most buildings older than 15 or 20 yeNOAA do not have adequate space for equipment rooms, telecommunications closets, or cable routing pathways. Older buildings also usually do not have adequate electrical power to support large quantities of electronics equipment such as computers, copiers, fax machines, etc. Upgrade projects in existing buildings are frequently impacted by inadequate requirements analysis and insufficient funding.

Facility Control and Monitoring

It is becoming increasingly common for heating, ventilation, air conditioning, power distribution, and water distribution systems to be computer controlled. These computer-controlled systems can be networked on the same LAN, or the same telecommunications infrastructure, as the traditional data services.

Fire and Life Safety

As with Facility Control and Monitoring systems, Fire and Life Safety systems such as smoke detectors, sprinkler systems, and fire alarms are increasingly becoming computer controlled and networked. These systems can also communicate over the common telecommunications infrastructure. Local codes may have certain restrictions on the manner in which Fire and Life Safety systems are networked, and shall be consulted prior to system design.

GROUND

A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounding, Bonding, and Electrical Protection

Proper grounding and bonding serves three very important purposes. First, from a life safety aspect, the ground connection insures that voltages from a malfunctioning system are routed directly to ground to prevent an electrocution hazard to people who may come in physical contact with the system. Secondly, from a telecommunications standpoint, grounding and bonding of telecommunications equipment and systems is an important measure for controlling electromagnetic interference (EMI). Ungrounded systems can pick up energy that is radiated from another electrical source, such as a large electric motor, an arc welder, or a large copy machine. If this energy is absorbed into the telecommunications system, it can result in annoying interference on the signal, or at worst, corruption and loss of critical data. Thirdly, the telecommunications ground may be used as a reference voltage for electronics equipment. The telecommunications ground potential must be consistent to insure reliable system performance.

Grounding Electrode

The metallic component that is placed in the earth to form the electrical connection with the earth. A grounding electrode is usually a metal rod at least eight (8)-feet long driven into the earth. Refer to NFPA® 70, Article 250, Part H for acceptable electrical service grounding electrodes.

HANDHOLE

A small cast concrete box placed in an outside plant conduit run as an access point to facilitate pulling cable into the conduit.

HEAD END

In a CATV system, the head end is a term that refers to the electronics equipment that receives the television signals from the antennas, and distributes them over the copper and/or fiber optic cables.

HORIZONTAL DISTRIBUTION CABLING (HDC)

Horizontal distribution cable is defined as the cable that routes from the telecommunications closet to the work area. Generally, these cables are routed horizontally on the same floor of a building, as opposed to a backbone or "riser" cable that may route vertically in a building. Occasionally, a telecommunications closet will also serve the floor above and/or below. In this case, the cables routing from the telecommunications closet to a work-area on the floor above or below are still considered to be horizontal distribution cabling.

HUB

An older LAN device that is used as the core of a star distribution to work-area computers. Generally, data service is delivered from the Equipment Room to the Telecommunications Closet over fiber optic cable. The fiber optic cable is connected to a hub. Patch cords connect from the hub to the patch panel to distribute data communications to the work-area computers over copper cable. NOAA is migrating from LAN hubs to LAN switches.

IDENTIFIER

A unique descriptive name or number that identifies a specific telecommunications infrastructure component. For example, telephone (voice) wall outlet number 23 would probably have a label with the identifier "V-23."

INFRASTRUCTURE

The ISP and OSP pathways, spaces, cable plant, and associated electronic devices comprising the low voltage signaling systems including but not limited to voice, data, building controls, security etc.

INFORMATION OUTLET (IO), (OR OUTLET JACK, OR OUTLET CONNECTOR)

A wiring device used to terminate horizontal distribution cable at the work-area, normally housed in an outlet box. Commonly referred to as an outlet jack, or outlet connector. The IO jack will accept the modular eight (8)-position, eight (8)-conductor plug that is normally installed on the end of a patch cord or equipment cord.

INSIDE PLANT (ISP)

That part of the telecommunications infrastructure that is contained within a building.

INTERMEDIATE DISTRIBUTION FRAME (IDF)

A point where a backbone cable originating from the Main Cross-connect (MC) is cross-connected to another backbone cable routing to the final destination. The IC is usually located in a Telecommunications Closet (TC). The IC was previously referred to as the Intermediate Distribution Frame (IDF).

INTERNET 2®

Internet2® is a not-for-profit consortium, led by over 200 US universities, developing and deploying advanced network applications and technology, accelerating the creation of tomorrow's Internet. With participation by over 60 leading companies, Internet2® recreates the partnership of academia, industry and government that helped foster today's Internet in its infancy.

IT RESTRICTED AREAS

IT Restricted Areas are defined as those areas containing mission-critical telecommunications systems, information processing systems, telecommunications distribution systems and other infrastructure essential to the operations of the government. These areas must be protected from unauthorized access and monitored for intrusion alarms or other threats.

JACK (OR OUTLET JACK)

A wiring device used to terminate horizontal distribution cable, normally housed in an outlet box. See Information Outlet.

JUMPER WIRE

A short length of wire used to route a circuit by linking two cross-connect points.

LOCAL AREA NETWORK- (LAN)

The LAN is the network that interconnects all data services for an organization within a building or campus. There may be one or more LANs in any given building or campus.

LOCAL EXCHANGE CARRIER (LEC)

The local telephone company.

MAIN CROSS-CONNECT (MC)

The Main Cross-connect is the point where all telecommunications services are cross-connected to the building or campus backbone cables for distribution to other buildings, and ultimately, to the users work-area. The MC is usually located in the Main Main Distribution Frame.

MAIN DISTRIBUTION FRAME (MDF)

The Main Distribution Frame is the central location on a campus or in a building where the major telecommunications equipment is located. The MDF typically contains the telephone switching system, the data center with computer servers and network equipment, the CATV "head end" distribution equipment, or all of these systems. It is preferred that all low voltage systems be centralized in the MDF.

MAXIMUM RECOMMENDED INSTALLATION LOAD (MRIL)

Stated by the manufacturer as the cable strength or maximum cable pull tension. It is based on the conductor strength within the cable sheath.

MODULAR JACK

A "female" telecommunications connector that accepts a mated male modular plug.

MODULAR PLUG

A "male" telecommunications connector that is inserted into a mated female modular jack.

MPOP

Minimum-Point-of-Presence. This is a policy statement, where it is generally the service provider's policy to locate the Point-of-Presence (POP) the minimum distance possible in from the street. The service provider usually prefers the POP to be at the street. However, the customer usually prefers the POP to be in the Equipment Room. See POP, Demarc, and Telecommunications Service Telecommunications Entry Point.

NEMA®

National Electrical Manufacturers Association®.

NEW CONSTRUCTION

New construction projects, either for an individual building, or a complete campus, provide an opportunity to properly design the telecommunications substructure, infrastructure, and systems. It is critically important that telecommunications professionals be involved in the early planning and conceptual design of any new construction projects. Anticipating that a new NOAA building or facility may have a useful life of 100 years or more, the proper sizing and placement of equipment rooms, telecommunications closets, and telecommunications substructure will have a major impact on the long term utility and cost effectiveness of the building.

NTIA

National Telecommunications and Information Administration.

OUTLET BOX

An enclosure mounted in the wall, or surface mounted on a wall, floor or furniture, into which an information outlet jack may be installed.

OUTLET CONNECTOR (OR INFORMATION OUTLET)

A wiring device used to terminate horizontal distribution cable, normally housed in an outlet box. See Information Outlet.

OUTSIDE PLANT (OSP)

The part of the telecommunications infrastructure that is outside. Usually in an underground conduit system, direct bury cable, or aerial cable.

PATCH CORD

A short length of telecommunications cable with modular plugs on each end used to connect between an Information Outlet and a work-area device such as a telephone or computer, or to connect between a patch panel and an electronics device in the Telecommunications Closet or Equipment Room.

PATCH PANEL

A panel mounted in an equipment rack in the Telecommunications Closet or Equipment Room containing modular jacks. The TC or MDF end of the horizontal distribution data cable is terminated at the patch panel. Patch cords are used to connect work-area devices to hubs, routers, or switches located in the TC or MDF.

PATHWAY (OR CABLE PATHWAY)

A raceway, conduit, sleeve, or reserved location for the placing and routing of telecommunications cable.

PBX

Private Branch eXchange. A large full feature telephone switching system that usually serves a large building or campus.

POKE-THRU

A penetration through a structure's fire-resistive floor or wall to permit the installation of electrical and/or communications cables.

POP

Point-of-Presence. The physical location where a service provider delivers telecommunications service. See MPOP, Demarc, and Telecommunications Service Telecommunications Entry Point.

PRIMARY PROTECTOR (OR PROTECTOR BLOCK, OR PROTECTOR PANEL)

A device interconnected to the telecommunications service providers' access line, or to each end of an outside plant campus distribution copper cable, to protect the connected equipment and personnel from over-voltage and/or over-current conditions. Hazardous voltages and currents are shunted to ground through the protector block.

PULLBOX

A box, located in an inside plant cable pathway, intended to serve as an access point to facilitate pulling cable through the conduit.

RADIO FREQUENCY MANAGEMENT – NOAA & NTIA

The NTIA Office of Spectrum Management (OSM) within the Department of Commerce is responsible for managing the Federal Government's use of the radio frequency spectrum by establishing and issuing policy regarding allocations and regulations governing the Federal spectrum use, assigning frequencies, participating in all aspects of the Federal Government's communications related emergency readiness activities, etc. NOAA's Radio Frequency Manager -OCIO/IB is responsible for managing and implementing these policies within NOAA.

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER (RCDD®)

The internationally recognized professional designation of Registered Communications Distribution Designer (RCDD®) is presented by BICSI®, a Telecommunications Association, to its members that have proven their ability through on the job experience and having passed a through exam.

RFI

Radio Frequency Interference is a signal distortion directly related to a foreign radio signal being imposed through coupling onto a transmission path that the foreign radio signal is not physically connected to.

RACEWAY

A metal or plastic channel used for loosely holding telecommunications or electrical cables. See Pathway.

RISER CABLE

An obsolete term referring to backbone cable.

ROUTER

A device that connects between two networks, and routes data traffic from one network to the other.

Security Systems

Security systems such as intrusion alarms, remote door locks, and magnetic strip identification cards may be computer controlled and networked. Some new technology employs Biometric systems that scan the retina of the eye, or make an optical image of the fingerprint, and compare that image to a computer database as a means of identification. Many of these systems have proprietary components, but many can be networked on the common telecommunications infrastructure and shall be taken into consideration in any design.

Service Provider

The company or utility that provides telecommunications services to a customer.

Sneak Current

Unwanted but steady currents that seep into a communication circuit. These low-level currents are insufficient to trigger electrical surge protectors and therefore are able to pass them undetected. They are usually too weak to cause immediate damage, but if unchecked will create harmful heating effects. Sneak currents may result from contact between communications lines and AC power circuits or from power induction, and may cause equipment damage due to overheating.

SPLICE

A permanent joining of conductors from separate cables.

Splice Box

A box, located in a pathway, intended to house a cable splice.

Splice Closure

A device used to enclose and protect a cable splice.

Star Topology (or Star Distribution)

A topology where all phones and computers in a given area are wired directly to a central service location in the telecommunications closet. Star topology is the standard wiring topology for the NOAA.

Structured Cabling System

A Structured Cabling System (SCS) is a group of integrated communications cabling products for voice, data, and video networks within a building or campus of buildings. The SCS is comprised of modular components that have been engineered and tested together as a system to deliver optimum performance. The SCS is based on the star wiring topology, using 24AWG unshielded twisted pair (UTP) copper cable, and multimode and singlemode, graded-index fiber optic cables.

SUBSTRUCTURE

Is a term used to describe the ISP and OSP pathways and spaces used by low voltage signaling systems; including but not limited to voice, data, building controls, security etc. Substructure does not include the cable plant and electronic devices (see infrastructure).

SWEEP

A conduit bend that meets ANSI/TIA/EIA-569-A bend-radius requirements forming a gentle arc rather than a sharp bend.

Switch-LAN

A device that interconnects networked data devices through port-to-port switching.

TELECOMMUNICATIONS

Any transmission, emission, or reception of signs, signals, writings, images, and sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems.

Telecommunications Bonding Backbone (TBB)

The grounding conductor (cable) that interconnects the Telecommunications Main Grounding Busbar (TMGB), Telecommunications Grounding Busbar (TGB), various telecommunications equipment, equipment racks, and cable shields to the building's electrical service grounding electrode.

Telecommunications Closet (TC)

The Telecommunications Closet is a location in each building, or each floor of a building, where backbone cables transition to horizontal distribution cables. The TC may also contain certain items of network electronics equipment such as hubs or routers. A large building, with large floors, may have multiple TCs on a floor. Depending on the size of the building, a TC may be a separate room, or it may be simply be a cabinet containing telecommunications equipment.

TELECOMMUNICATIONS ENTRY POINT (TEP)

The Telecommunications Entry Point is the point where the telecommunications service enters the customer's property. The TEP may contain electronics equipment and line protection equipment required by the service provider. The TEP may be combined with the Main Distribution Frame (MDF), or the TEP may be an outdoor pedestal or cabinet near the street. Other terms that are used in conjunction with the TEP include:

1. Demarc – The point of demarcation between the service provider and the customer. This is actually a cable termination block where the service provider's cable terminates, and is cross-connected to the customer's cable. It is usually located in the TEP.
2. POP – Point-of-Presence. The physical location of the demarc.
3. MPOP – Minimum-Point-of-Presence. This is a policy statement, where it is generally the service provider's policy to locate the POP the minimum distance possible in from the street. The service provider usually prefers the POP to be at the street. However, the customer usually prefers the POP to be in the Equipment Room.

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

In buildings with multiple Telecommunications Closets, each TC is equipped with a TGB. All of the TGBs in the building are bonded together, and to the Telecommunications Main Grounding Busbar (TMGB), with the Telecommunications Bonding Backbone (TBB).

TELECOMMUNICATIONS INFRASTRUCTURE

The telecommunications infrastructure is defined as the cable and connecting hardware necessary to support the signaling between telecommunications devices. The infrastructure must be designed to support the known present, and reasonably certain future, signaling requirements of the telecommunications systems. With the rapid advances in telecommunications technology, the telecommunications infrastructure will likely require replacement or upgrade several times over the life of a building, with an average life expectancy of 10 to 20 yeNOAA. Therefore, the design of the substructure has a major impact on the cost of future infrastructure upgrades. ANSI/TIA/EIA-568-B provides the standards to be applied to telecommunications infrastructure. See Telecommunications Substructure.

TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A busbar placed in a convenient and accessible location in the Telecommunications Entry Point (TEP), Equipment Room (ER), and all Telecommunications Closets (TC). All telecommunications equipment, equipment racks, protector blocks, metallic cable shields, and exposed noncurrent-carrying metal parts of information technology equipment are bonded to the TMGB, which is then bonded by means of the Telecommunications Bonding Backbone (TBB) to the main electrical service grounding electrode.

TELECOMMUNICATIONS SUBSTRUCTURE

The telecommunications substructure is defined as the equipment rooms, telecommunications closets, cable pathways, or other physical structures such as antenna towers, necessary to support telecommunications. Cable pathways include aerial pole lines, underground conduit systems, utility vaults, interior conduit systems, interior cable trays, or other methods of routing and supporting telecommunications cable. The telecommunications substructure shall be designed for the life of the building. ANSI/TIA/EIA-569-A provides the standards to be applied to telecommunications substructure. See Telecommunications Infrastructure.

TELECOMMUNICATIONS VAULT (UTILITY VAULT)

A large pre-cast concrete enclosure buried in the ground at a point not to exceed every 500-feet along an outside plant conduit run. Commonly referred to as a "maintenance hole." Telecommunications vaults are used as access points to facilitate pulling cable into major conduit duct banks, distributing cable from main conduit duct banks to branch conduits, and as the location for cable splices. "Manhole" is an obsolete term. See Handhole.

TERMINATION FIELD

A space on the plywood telecommunications backboard where termination hardware is mounted. The termination field is arranged into areas where different types of cables are terminated based on their purpose and use.

TERMINATION HARDWARE

Any device used on the end of a cable to connect or cross-connect cables to other cables, or to telecommunications equipment.

VOICE SERVICES

Voice services supported by the telecommunications infrastructure include telephone services, either directly from the Local Exchange Carrier (LEC), or from a NOAA owned telephone system, voice mail services, intercom and paging services, and some radio systems. Fax services and individual computer modems usually operate over the voice system.

VOICE SWITCH

An electronic device that establishes or disestablishes circuits between telecommunications systems or devices.

WIDE AREA NETWORK (WAN)

A WAN is a network that interconnects various geographically separated sites that share common telecommunications requirements. A WAN usually supports a common organizational structure; e.g.., Department of Agriculture, NOAA, other agencies. WANs can provide separate services for voice, data, and video, or combine all services into a common WAN.

WORK AREA

The work area is defined as the location where telecommunications service is provided for people to use. This is the area where a computer, telephone, or other telecommunications device is located and where people will use these tools to do their work.