Washington State Department of Corrections

Telecommunications Distribution Infrastructure Standards (TDIS)

Telecommunications Distribution Design Guide (TDDG)

Revision 5.2
June 15, 2005

And

Telecommunications Construction Guide Specifications (TCGS)

Revision 5.3
April 30, 2008

TABLE OF CONTENTS

1 PREFACE

A. The goals of the Washington State Department of Corrections' **Telecommunications Distribution Infrastructure Standards (TDIS)** are to design and construct telecommunications distribution infrastructure at DOC owned and leased facilities that:

1. Complies with the Telecommunications Architectural Standards as directed by the Washington State Department of Information Services.
2. Complies with telecommunications industry Standards and best practices.
3. Complies with security requirements at all agency locations including special requirements at prison and work-release facilities.
4. Best accommodates implementation of both current and future agency telecommunications needs with the least amount of change and disruption to operations.
5. Is designed and constructed to last, the right way the first time.

B. The **Telecommunications Distribution Infrastructure Standards (TDIS)** for the Washington State Department of Corrections consists of the following two-part document:

- **Telecommunications Distribution Design Guide (TDDG)**

  The TDDG is written to communicate the requirements of DOC for design and installation of telecommunications distribution systems at both DOC-owned and leased facilities. The TDDG is written for architects, engineers and designers responsible for the design of new or remodeled facilities for DOC where telecommunications infrastructure currently exists or will be installed. It is also intended for other low voltage systems contractors installing telecommunications infrastructure at DOC facilities, including DOC personnel and inmate assistants, when a formal design may not be developed.

- **Telecommunications Construction Guide Specification (TCGS)**

  The TCGS is written for designers and installers of DOC telecommunications distribution systems. For Designers, it is intended to assist in developing project specifications. For contractors and installers, including DOC personnel, it is intended to communicate DOC's requirements for the appropriate construction and installation of telecommunications distribution systems and materials at DOC owned and leased facilities. The TCGS consists of five sections written based on the Construction Specifications Institute (CSI) format, using Master Format, Section Format, and Page Format structure. The TCGS reflects DOC and industry standards in effect as of this publication.
  - ***Except where modified by a Designer for construction project***

specifications, the TCGS can not be used alone without possessing thorough knowledge of DOC's design requirements that are contained within the TDDG.

C. This edition of the TDIS has been developed from information contained in previous versions and reflects current industry methods, materials and Standards in effect as of this publication.

D. It is the responsibility of the telecommunications distribution designer to coordinate with the other designers on a project (architectural, electrical, mechanical, HVAC, etc.) to determine that other systems are both compatible with and complementary to the communications cabling system. DOC agrees with BICSI's design philosophy that it is critical to coordinate between disciplines during the design phase of a project, rather than making adjustments in the field during construction.

1.1 LOW VOLTAGE SYSTEMS

In the past, the traditional construction process has separately installed each of the building low voltage systems disciplines (see below) under various divisions of a mechanical or electrical specification. Each system has typically been cabled separately using different cable types and pathways, and often using totally separate low voltage duct banks throughout a campus.

- Fire alarm (FA).
- Security and access control (SAC), including closed circuit TV (CCTV).
- Heating, ventilating, and air conditioning (HVAC).
- Energy management systems (EMS), including lighting controls.

In today's environment, low voltage systems are referred to as Building Automation Systems (BAS). Each of the BAS categories are:

- Low-speed data networks or local area networks (LANs) typically transmitting at rates of less than 1 Mb/s in the horizontal and up to 10 Mb/s in the riser and backbone.
- Monitoring and controlling various aspects of the building's environment.
- Communicating with the fire alarm system to control building functions in the event of fire.
- Communicating with each other to share information and common devices (e.g., room occupancy sensor turns on lights and opens damper to heat or cool room).

By providing a common cabling distribution system for the voice, data, video, and BAS, it is possible to reduce construction and operational costs, and create an intelligent building that can provide many other benefits throughout its life.

Today, it is possible to select the telecommunications cabling as the first system, instead of the systems equipment and active electronics, and incorporate the BAS into the telecommunications cabling distribution system. This allows the telecommunications infrastructure investment for the building to correspond more closely to the building's desired life-cycle, rather than corresponding to any of the individual systems. This also corresponds to the intent of ANSI/TIA/EIA-568-B (see Chapter 4: Horizontal Distribution Systems), which states:

- Horizontal cabling should be designed for "other building signaling systems."
- Consideration should be given to accommodating a diversity of user applications in order to reduce or eliminate the probability of requiring changes to the horizontal cabling as user needs evolve.

To this end, telecommunications pathway and/or cabling systems designed for DOC facilities shall support and integrate low voltage systems that convey information within and between buildings in accordance with the requirements in this document and as specifically identified in Section 4.21 *Building Automation Systems (BAS)*. For IT equipment and IT systems inherent to or required by BAS/LV systems, refer to Section 2.2.10 *IT Equipment & Systems Used by BAS/Low Voltage*.

1.2 DOCUMENT INTENT

A. The Department's TDIS is a Standard based on the ANSI/TIA/EIA *Commercial Building Telecommunications Standards* series.
   1. The Department is mandated to adhere to the ANSI/TIA/EIA[1] *Commercial Building Telecommunications Standards* series by the Washington State Department of Information Services (DIS) per their Architectural Standard effective 12/29/2000.
   2. Additionally, the Washington Administrative Code (WAC), Chapter 296-46B *Electrical Safety Standards, Administration, and Installation*, specifically 296-46B-010 *General,* adopts by reference the ANSI/TIA/EIA Standards: 568-B, 569-A, and 607.

B. DOC also adopted the following BICSI[2] manuals as the basis for communications distribution design and construction practices in DOC facilities:

   - *Telecommunications Distribution Methods Manual* (TDMM)
   - *Customer-Owned Outside Plant Design Manual* (CO-OSP)
   - *Telecommunications Cabling Installation Manual* (TCIM)

C. The DOC TDIS (TDDG and TCGS) is the guide to application of the ANSI/TIA/EIA Standards and the BICSI installation practices. The DOC TDIS is not intended to replace, detract from, or be used in lieu of the Standards and recommended practices manuals. Rather, the TDIS is to be used in conjunction

[1] Per statutory authority RCW 43.105.041, effective December 29, 2000, DIS mandated all Washington State Agencies adopt the ANSI/TIA/EIA Commercial Building Telecommunications Standards as the basis for communications distribution design and construction in State facilities (see *Computing and Telecommunications Architecture Standards – Building Wiring,* http://www.wa.gov/dis/portfolio/).

[2] The BICSI manuals are the industry references for the design and construction of standards-compliant communications distribution systems (see http://www.bicsi.org/manuals.htm). BICSI, 8610 Hidden River Pkwy, Tampa, FL 33637-1000 USA; 1-800-242-7405; http://www.bicsi.org

with them in order to reinforce selected content as well as highlight any restrictions and limitations in order to meet the specific requirements of DOC facilities and DOC design criteria.

D. The TDDG addresses communications distribution system design for use within a building and between buildings on a contiguous site for all telecommunications and BAS 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, duct banks, ducts (conduits), communications and low voltage media requirements

E. Unless otherwise stated, the requirements defined in the DOC TDIS apply to both new construction, renovation and remodel projects, as appropriate to leased facilities, and for telecommunications cable moves, adds, and changes.

F. Some areas within DOC facilities are described as either "***secured areas***" or "***non-secured areas***":

- **Secured areas** are defined as those areas where inmates are housed, confined, contained, and have routine unescorted access. The secured area is typically the entire area (and all buildings) within the fenced security perimeter of a correctional institution. Telecommunications cabling and equipment shall be protected from inmate access in the secured area. Access to telecommunications cabling and equipment could provide an inmate with an opportunity to sabotage critical telecommunications or security monitoring systems, and could also provide the inmate with an opportunity to use cable or equipment as a weapon.

- **Non-secured areas** do not have the same stringent security requirements, and in general, can be treated as a normal business operations area.

G. The TDDG 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 telecommunications infrastructure within a project. The TDDG shall be used in conjunction with the DOC **Telecommunications Construction Guide Specification (TCGS).** Drawings shall conform to the requirements contained in this document for content and completeness, and the specifications shall be based upon the TCGS.

H. The TDDG uses many terms and abbreviations that are common in the telecommunications industry. While a glossary is included in the Appendix at the end of this document, please refer also to the glossary of the BICSI manuals for further, more detailed information.

I. Requests to deviate from the DOC requirements may be submitted on a case-by-case basis in accordance with the instructions under *Alternative Design Request* in Section 3 *Project Procedures* of this document. For further information regarding codes and standards, please refer to the BICSI manuals and the ANSI/TIA/EIA Commercial Building Telecommunications Standards series.

J. The requirements contained in the TDDG are considered to be in addition to those listed in *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services* and the *State of Washington Conditions of the Agreement*. Where the requirements differ, the issue shall be brought to the attention of the DOC Capital Planning and Development (CPD) Project Manager and DOC IT Infrastructure Specialist - otherwise the more stringent requirement shall apply.

1.3 DOCUMENT STRUCTURE

The TDDG is organized in six sections:

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.
1. Preface
2. DOC Telecommunications Policies
3. Project Procedures
4. Design Criteria
5. Construction Document Content
6. Appendices

B. The **DOC Telecommunications Policies** section describes DOC telecommunications policy requirements, standard practices, and processes associated with designing, installing and operating telecommunications infrastructure.

C. The **Project Procedures** section describes the required qualifications for telecommunications designers as well as the procedures that Architects, Engineers, and Designers must follow when working on projects at DOC facilities that include telecommunications infrastructure. It includes activities that are required throughout the project as well as phase-specific requirements.

D. The **Design Criteria** section is formatted to follow the chapters of the BICSI TDM manual 9th Edition (the TDDG does not follow the format changes of the TDM manual 10th Edition) and serves two purposes. The first is to describe the general requirements for DOC telecommunications 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 TDM and CO-OSP manuals. While the TDM and CO-OSP manuals describe many materials and methods that are generally accepted in the industry for providing telecommunications infrastructure, DOC facilities have some unique characteristics that impose limitations on some of the materials and methods that otherwise might be acceptable. Some of the practices discussed in the TDMM and CO-OSP manuals are expressly prohibited in DOC facilities. Other practices are permitted in certain areas (non-secured areas, for example) but prohibited in other areas (secured areas).

Generally speaking, if the BICSI TDM and CO-OSP do not describe a particular material or method for use with telecommunications distribution infrastructure, and the material or method is not described within this document, it will not be allowed for DOC facilities. In addition, the DOC TDDG places further restrictions on the use of some materials and methods that the BICSI design guidelines support.

- *The DOC TDIS takes precedence over the BICSI recommended guidelines.*

E. The **Construction Document Content** section defines the minimum level of detail that DOC requires to be present 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 TCGS for producing the specification for a particular project. More detailed instructions for producing a project specification based on the TCGS are included with the TCGS.

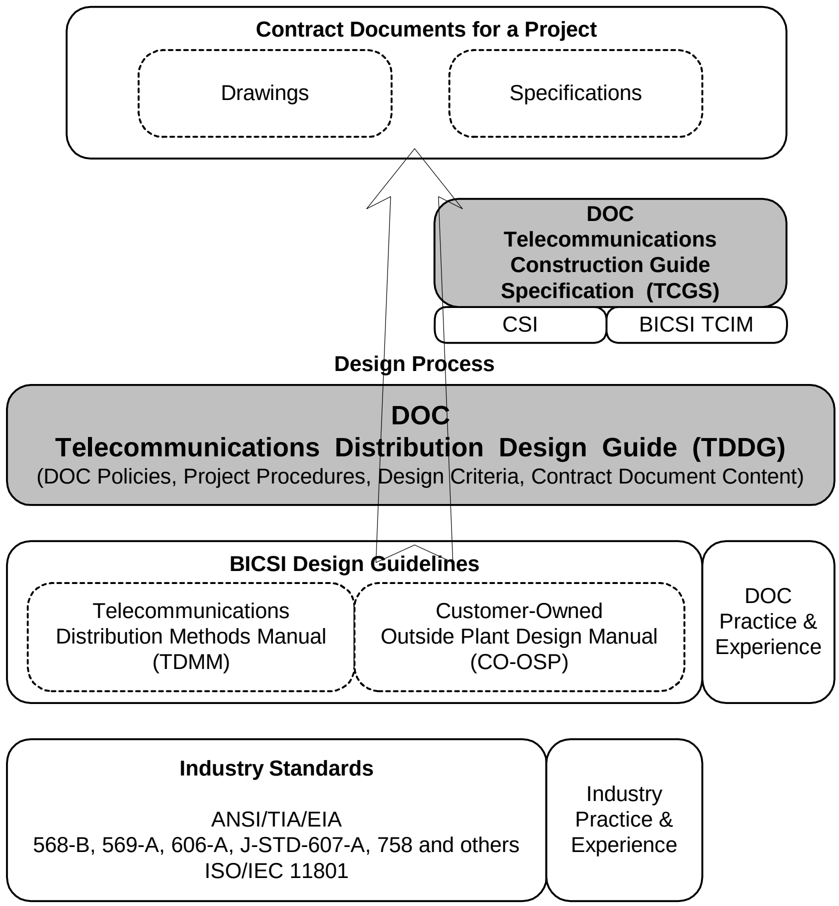
F. The **Appendices** section provides standard forms and diagrams along with example forms and diagrams that are required for DOC telecommunications infrastructure designs.

1.4 HOW TO USE THIS DOCUMENT

The following diagram depicts the relationships between the ANSI/TIA/EIA Standards, the BICSI Design Guidelines, the DOC TDIS documents (TDDG, TCGS) and the project-specific Construction Documents:

FIGURE 1.1 DOC TELECOMMUNICATIONS DESIGN PROCESS

DOC Telecommunications Design Process



Telecommunications distribution infrastructure at DOC facilities shall be designed based on the BICSI design guidelines (TDMM, CO-OSP, TCIM) and be compliant with the ANSI/TIA/EIA Standards as applied by and illustrated in the DOC TDDG. Designers shall use the TCGS **"as written"** for creating specifications for a particular project according to the instructions in the TDDG. **Rewriting the TCGS or modifying the format or requirements will not be accepted.** Please refer to the *TCGS Preface* section for additional information on modifying TCGS content. Designers shall also follow the guidance in the TDDG to create the Construction drawings for a particular project.

2 DOC TELECOMMUNICATIONS POLICIES

A. Adherence to and compliance with the codes, standards, policies, and industry practices listed below, along with the DOC TDIS requirements contained in the TDDG and TCGS documents are mandatory, and includes:

- National Electrical Safety Code (NESC), American National Standard C2
- National Electrical Code (NEC), NFPA 70
- ANSI/TIA/EIA Commercial Building Telecommunications Standards series
- Fiber Optic Test Standards, TIA/EIA 455 (Series)
- Optical Fiber Systems Test Procedures, TIA/EIA 526 (Series)
- Local Area Network Ethernet Standard, IEEE 802.3 (Series)
- Washington State Rules and Regulations for Installing Electrical Wires and Equipment (RCW 19.28, WAC 296-46B and WAC 296-401A)
- Washington State Department of Labor and Industries Safety Standards for General Safety and Health (WAC 296-24 Volume 1 Part L)
- DOC Policy Directive *Electrical Construction and Maintenance*, DOC 700.130

B. All references to the following manuals within the TDDG and TCGS shall specifically address only the editions specified below. Newer editions can generally be used for reference, but changes from previous editions shall first be reviewed with the DOC IT Infrastructure Specialist for authorization in writing or through a revised edition of the DOC TDIS (TDDG and TCGS):

- BICSI Telecommunications Distribution Methods Manual (2003 10th Edition)
- BICSI Customer-Owned Outside Plant Design Manual (2004 3rd Edition)
- BICSI Telecommunications Cabling Installation Manual (3rd Edition)

C. Management of DOC's Enterprise Network is the responsibility of the IT personnel at DOC Headquarters. This includes wide area network (WAN) design, operations, performance monitoring, optimization, troubleshooting, and disaster recovery. The IT personnel at DOC Headquarters are also responsible for the planning and development of operational and design standards for local area networks (LANs) at all DOC facilities, including the telecommunications distribution infrastructure.

D. DOC regional IT personnel are responsible for installation and support of the administrative LAN hardware, software, data communications, and certain enterprise network hardware and software.

E. The installation and support of the inmate LANs, which includes inmate educational systems and Correctional Industries systems, varies throughout the state.

F. The installation and support of voice systems for both administration and inmate telephones vary between IT and Plant personnel throughout the state.

G. Acquisition of IT services, hardware, software, and related products is the responsibility of DOC IT personnel. IT acquisition rules, licensing agreements, and contracts fall under the authority of the Washington State Department of Information Services (DIS), with very detailed delegated authority granted to DOC. All DOC personnel acquiring IT goods and services are accountable for ensuring the procurements meet DOC technology standards and the acquisition process is conducted in compliance with DOC policy, delegated authority, and statutory requirements.

H. The DOC facility Superintendent or designee shall review and approve all Alternative Design Requests that relate to security.

2.1 TEAM STRUCTURE

The Architects, Engineers and Designers shall work closely (as a team) with the following DOC personnel throughout the entire project life cycle, starting at the preliminary design phase:

- DOC IT Infrastructure Specialist (DOC-ITIS)
- DOC Regional Information Technology Operations Manager (DOC-RITM) and assigned personnel
- DOC Capital Planning and Development (CPD) Project Manager (DOC-CPDPM)
- DOC Plant Manager and assigned personnel

The A/E and Designer shall bring the DOC-ITIS into the project at its earliest stage to ensure the requirements of the DOC TDIS are incorporated at the onset to minimize changes to the design concept.

2.1.1 DOC IT INFRASTRUCTURE SPECIALIST (DOC-ITIS)

The responsibilities of the DOC-ITIS are to:

- Improve communication on all projects involving telecommunications infrastructure.
- Improve the quality of telecommunications infrastructure on capital projects by working as a team member with DOC Project Managers and contracted A/Es.
- Improve the quality of telecommunications infrastructure on non-capital projects and maintenance by working with DOC OCO staff and contractors to review and approve/reject designs and construction.
- Ensure that relevant DOC IT regional management and specialized technical personnel are informed and involved on all telecommunications infrastructure activities (design, construction, support, and maintenance).
- Ensure that all agency telecommunications infrastructure meets the design and construction requirements of the DOC TDIS.
- Keep the DOC IT Enterprise Network Services Manager informed of pertinent telecommunication infrastructure activities.
- Evaluate and approve/reject requests for alternative design solutions.
- Maintain and publish the agency Telecommunications Infrastructure Standards.

2.1.2 DOC REGIONAL IT OPERATIONS MANAGER (DOC-RITM)

Within their assigned state region, the DOC-RITM's are responsible for:
- All information technology issues and support services relating to DOC facilities.
- IT liaison to the Office of Correctional Operations management.
- Reviewing all telecommunication infrastructure activities.
- Reviewing requests for alternative design solutions forwarded by the DOC-ITIS.

2.2 TELECOMMUNICATIONS DESIGN REQUIREMENTS

A. An engineered telecommunications design 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 shall also be developed for projects where DOC personnel with or without inmate work crews will be used for construction.

B. DOC requires the use of BICSI Registered Communications Distribution Designers (RCDD) to design the telecommunications distribution infrastructure for all new construction, major renovation or remodeling, major telecommunications upgrades, and all telecommunications infrastructure work performed by DOC personnel with or without an inmate assistant. The RCDD designation is recognized worldwide as a design professional that has met specific professional design experience requirements, has successfully completed an extensive examination on the subject of telecommunications distribution design, and fulfills a required number of continuing educational requirements. RCDD's are employed by architectural and engineering firms and also by telecommunications infrastructure installation contractors.

C. 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 DOC 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 DOC facilities.

D. Telecommunications infrastructure design shall be incorporated during the preliminary design phase of each project. This will provide DOC IT the opportunity to influence the design from the start to address telecommunications requirements at appropriate points in the design process.
   1. The A/E firm shall work closely with the designated project RCDD (Designer) and the DOC-ITIS from the start of each project through completion. The A/E shall include both the Designer and DOC-ITIS in all design and construction meetings.

E. Telecommunications infrastructure installation projects may be large standalone projects to replace failing infrastructure or in preparation for the installation of new technology, or a separate project concurrent with a locally managed public works project.

F. Depending on the size and scope of a small project, the DOC-ITIS will determine whether an RCDD is required to develop a telecommunications distribution design.

1. For small projects or installation of additional cabling, a certified SYSTIMAX® SCS installation contractor (VAR) may be hired for a limited scope installation. The SYSTIMAX® VAR must be on the approved list maintained by the DOC-ITIS, and be currently listed as a contractor on the DIS Master Cabling Contract.
    a. The only alternative to using a certified SYSTIMAX® SCS contractor (for copper cabling installation only) is to use DOC personnel who are certified as SYSTIMAX® SCS "self-maintainers". There shall be no exceptions to this requirement.
        1. DOC personnel shall not install fiber optic cable.
    b. Use of certified SYSTIMAX® SCS installation contractors not on the DIS Master Cabling Contract shall be selected through a competitive bidding process that satisfies the DIS acquisition requirements.

2.2.1 DESIGN REVIEW PROCESS

A. The Design Review Process will be conducted by DOC at the following points in the design process:
- Schematic Design
- Design Development
- Review Set (99% CD)
- Construction Documents (100% CD)
- Record Drawings

B. The following people will participate in the Design Review Process:
- DOC-ITIS
- DOC-RITM or designee
- DOC Plant Manager or designee
- DOC Facility Superintendent or designee
- DOC CPD Project Manager
- Architect/Engineer (Prime Consultant)
- Designer - RCDD
- DOC-selected RCDD "Review Consultant" (optional)
- Other DOC personnel as appropriate

C. For more information, see Section 3.2 *Design Review Process* of this document.

2.2.2 ALTERNATIVE DESIGNS

A. Requests to deviate from industry standards or DOC TDIS design requirements 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 DOC-ITIS for consideration. The Alternative Design Request (ADR) will follow the review process as shown in the flow chart in Section 3.4.3 *Alternative Design Request*. Approval will only be granted in writing. Approval must also be authorized by the DOC CPD Project Manager if capital funding is involved, and the DOC facility Superintendent or designee if related to security. Upon receipt of complete information, a decision on the ADR should be made within 2-3 weeks.

2.2.3 NEW CONSTRUCTION

New construction projects shall include telecommunications infrastructure designed in detail and incorporated into the design specifications and drawings, and installed in accordance with the requirements of the DOC TDIS. It is the responsibility of the sponsor of the new construction to ensure that all aspects of the DOC TDIS are adhered to.

2.2.4 RENOVATION TO EXISTING STRUCTURES

DOC facilities undergoing renovation or remodeling projects shall include telecommunications infrastructure designed in detail and incorporated into the design specifications and drawings, and installed in accordance with the requirements of the DOC TDIS. It is the responsibility of the sponsor of the renovation to ensure that all aspects of the DOC TDIS are adhered to.

2.2.5 UPGRADING INFRASTRUCTURE TO SUPPORT NEW TECHNOLOGY

DOC will occasionally install new information technology systems at a facility where the existing telecommunications infrastructure is inadequate for a new application. It is the responsibility of the sponsor of the installation of the new technology to ensure that the existing telecommunications infrastructure is capable of supporting the new technology, or that it be upgraded to support the new technology. Any upgrades made to the telecommunications infrastructure shall meet the requirements of the DOC TDIS.

2.2.6 UPGRADING INFRASTRUCTURE TO MEET NEW STANDARDS

Unless an upgrade is required to correct a code violation, address a security issue, or correct an operational problem, there is no requirement to upgrade existing telecommunications infrastructure at any DOC facility simply to meet enhanced industry standards or the requirements of the DOC TDIS.

However, upgrades to existing buildings or entire campuses may be required to correct deficiencies in telecommunications infrastructure that was improperly designed and/or installed prior to development and enforcement of the DOC Telecommunications Infrastructure Standards.

Additional problems can occur within the telecommunications system when subsequent installations of electrical cable and/or equipment fail to follow the telecommunications clearances for EMI reduction identified within this document. In these situations, it may be necessary to change the electrical cable/equipment or the telecommunications infrastructure to alleviate the problems.

2.2.7 INFRASTRUCTURE TO SUPPORT OTHER AGENCIES OR TENANTS AT DOC FACILITIES

Other state agencies (such as the Department of Natural Resources or the Department of Social and Health Services) often occupy buildings at DOC facilities or institutions. Some private businesses have contracts with Correctional Industries (CI). The potential exists for CI or one of their private businesses to establish a Call Center at any of their locations. Inmate telephone service is provided on DOC property under contract with a telephone company.

As the owner of the property, it is normally incumbent on the DOC to provide the telecommunications infrastructure to support other agencies or tenants at DOC facilities. The terms and conditions for reimbursement of any expenses incurred by the DOC to provide telecommunications support to other agencies shall first be negotiated and documented in a contract or an interagency support agreement with the tenant.

2.2.8 ENTRANCE FACILITY - DOC RESPONSIBILITIES

A. DOC is responsible for providing a cable pathway from the property line to the demarcation point at the Entrance Facility (EF) for service providers, such as the local telephone company. At DOC-leased facilities, this responsibility falls to the building owner who may require passing on the costs as leasehold improvements to DOC.
   - The cable pathway shall be underground conduit, with telecommunications maintenance holes and handholes as necessary.
   - 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 an appropriate number of spare conduits within the Entrance Facility pathway for future services.

B. The service providers' technicians will need access to the EF and DOC is responsible to coordinate and provide escorts as required. Service provider technician access is simplified if the Entrance Facility and Equipment Room are located outside of the Secured Area.

C. DOC is responsible for the installation, maintenance, and troubleshooting of all telecommunications equipment and infrastructure from the demarcation point throughout the facility.

2.2.9 ENTRANCE FACILITY - SERVICE PROVIDER RESPONSIBILITIES

The 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, DOC contracts with the service provider to extend the demarcation point from the EF 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 DOC-owned equipment and infrastructure.

2.2.10 IT EQUIPMENT & SYSTEMS USED BY BAS/LOW VOLTAGE SYSTEMS

A. When building automation systems (BAS) and low voltage (LV) systems require information technology hardware and software, DOC's agency standards for IT equipment, software compliance, and security policies shall be followed. All of the IT equipment, operating systems, and application software required by the BAS/LV systems shall be identified by A/E's or Designers and brought to the attention of the DOC-RITM prior to finalizing designs and ordering BAS/LV systems. This shall include, but not be limited to:
   - PC's, printers, modems, file servers, routers, LAN hubs or switches, operating system software, and all application software.

B. The A/E or Designer shall work with the DOC-RITM to determine the acceptable manufacturers and appropriate models of equipment and software, including configurations, methods of deployment, accessibility to the DOC Administrative LAN and/or DOC inmate LAN, access to outside telephone lines and the Internet, security procedures and protocols, etc.
   1. Per *IT Decision Document #29* (approved 9/23/03), if the DOC-RITM approves non-compliant hardware or software, he/she will complete a DOC IT Request Form and forward for agency approval/denial of an exemption.

C. For IT equipment and software receiving an agency approval to be used for BAS/LV systems, the DOC-RITM shall meet with the recipient DOC organization and Superintendent to:
   1. Obtain agreement on identifying the organization responsible for supporting, maintaining, and future upgrading the IT hardware and software.
   2. Determine if the hardware will be connected to a LAN at the facility and insure the hardware and software are compatible and its use does not pose potential operational or security problems.
   3. Insure proper security measures are taken for:
      - placement of the equipment based on who requires access (staff or inmates)
      - access to network connections (LANs and outside telephone lines)
      - incoming dial-in access from outside entities such as vendors or utilities

to gather information or perform maintenance

4. Document all of the above in a service level agreement with the appropriate parties.

2.3 DAMAGE TO TELECOMMUNICATIONS INFRASTRUCTURE

A. To prevent construction, maintenance and other activities from resulting in damage to telecommunications infrastructure, before breaking ground on "**any project**," including non-telecommunications projects, a locate service shall be employed for the specific activity of finding and marking telecommunications ductbanks.
   - The industry standard uniform color code for utility flagging, painting, or marking located in the BICSI CO-OSP Design Manual shall be used.

B. In the event of damage to telecommunications infrastructure, regardless of the cause or party responsible, the local DOC personnel shall immediately contact the DOC-ITIS, who will determine the repair or replacement strategy for the damaged infrastructure.
   - Contractors shall not be allowed to make this determination nor be allowed to make temporary repairs unless directed to do so by the DOC-ITIS.
   - In the event of an emergency and the DOC-ITIS can not be contacted, the DOC-RITM or designee shall be contacted to make a decision "**<u>only</u>**" for a temporary repair.

C. The DOC-ITIS shall:
   1. Work with the local DOC personnel to identify any potential methods of emergency, interim repairs.
   2. Identify the steps necessary to assess whether the damaged infrastructure can be repaired or whether it must be replaced.

D. The party responsible for the damage to the telecommunications infrastructure shall be responsible for the total cost of all emergency interim repairs, permanent repairs and/or all replacement costs.

E. All damaged infrastructure shall be restored to 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 SYSTIMAX® Value Added Reseller (VAR) of DOC's choosing, all testing and re-certification of the infrastructure for full compliance to DOC's Telecommunications Standards and applicable SYSTIMAX® SCS warranty.

F. The Designer shall insure the boiler plate sections of all DOC Contract Documents related to outside plant construction activities shall reference the above language.

2.4 TELECOMMUNICATIONS CONSTRUCTION & INSTALLATION

2.4.1 PRIOR DOC IT APPROVAL REQUIREMENTS

Where telecommunications infrastructure is involved, "**all**" design, construction, installation, and maintenance activities at DOC facilities, whether defined as a project or not, regardless of type, scope, or size, and regardless of who performs the work activities, must have prior written approval from authorized DOC IT personnel before proceeding with design and/or construction and installation.

A. Approval is required from the DOC-ITIS prior to performing work on any DOC telecommunications infrastructure. This includes 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 DOC facilities, and all moves, adds, and changes (MAC's) at DOC facilities affecting infrastructure, including MAC work performed by DOC personnel.

   1. Requests for approval of simple MAC's for horizontal cabling that requires no conduit or involves only minimal conduit and no construction activity shall be submitted to local IT by completing a "Help Desk Incident" form along with any additional process as prescribed by the local DOC-RITM. Contact the local Site IT Coordinator for assistance in completing the Help Desk Incident Form.
      a. Local IT shall review the request and forward to the DOC-ITIS if approved.
   2. Requests for approval of all other types of telecommunications infrastructure work shall be submitted to local IT by completing a DOC "Information Technology Request Form", form number (DOC 08-058 (6/11/2003) IT), and any additional process as prescribed by the local DOC-RITM. Contact the local Site IT Coordinator for assistance in completing the IT Request Form.
      a. Local IT shall review the request and if approved, forward to the IT Request Gatekeeper. If approved through the Gatekeeper processes, the request shall have a final review and approval/denial by the DOC-ITIS for compliance to the DOC TDIS.

B. DOC personnel authorized by the DOC-ITIS, DOC-RITM, and DOC Plant Manager (where applicable) to perform wiring cross-connects as on-going maintenance of telephone systems is exempt from this requirement unless prior approval is required by the DOC-RITM.

2.4.2 CONTRACTORS AND CABLING INSTALLERS

Contractors and cabling installers involved in projects without a formal engineering and design process shall adhere to the requirements of the DOC TDIS (TDDG & TCGS). Telecommunications distribution systems shall be designed per the TDDG and requirements for telecommunications distribution system materials and installation methods shall be constructed and installed per the TCGS.

2.4.3 TELECOMMUNICATIONS WORK BY DOC PERSONNEL

A. DOC personnel performing any telecommunications design, construction, or cabling activities shall become thoroughly familiar with the ANSI/TIA/EIA Standards, the BICSI recommended practices, and the entire contents of the DOC TDIS (TDDG and TCGS). This requirement shall be adhered to for both large and small scale telecommunications projects as well as “move/add/change” activities for in-house operations and maintenance. DOC personnel performing any of the above shall have a current copy and be familiar with the following BICSI manuals prior to conducting any telecommunications work:

For installation of telecommunications cable:

- BICSI Telecommunications Cabling Installation (TCI) Manual

For installation of telecommunications pathways:

- BICSI Telecommunications Distribution Methods (TDM) Manual

For any OSP telecommunications work:

- BICSI Customer-Owned Outside Plant (CO-OSP) Manual

B. Telecommunications pathway work (both inside plant and outside plant), when performed by any DOC personnel (with or without an inmate assistant), shall require prior approval of both the DOC-RITM and DOC-ITIS.

1. All telecommunications pathway work shall comply with DOC Policy Directive *Electrical Construction and Maintenance* DOC 700.130.
2. DOC personnel installing metallic pathways shall be a licensed electrician possessing a current valid class “EL01-General Electrical License” or “EL06-Limited Energy Systems.”
3. Use of an inmate assistant must also comply with additional DOC policies and state regulations.
4. All telecommunications pathway work, when performed by any DOC personnel not under direct supervision of the DOC Plant Manager, shall also require prior approval by the facility Plant Manager or designee.

C. Use of an RCDD is required for all telecommunications infrastructure work performed by DOC personnel (with or without an inmate assistant).

1. Payment for RCDD services is not part of the DOC IT budget.
2. Prior to constructing telecommunications infrastructure, drawings and specifications shall be prepared by DOC personnel and forwarded to the contracted RCDD.
3. The RCDD shall work with the DOC personnel to prepare an engineered design and specifications that includes the RCDD’s logo stamp and signature for submittal to the DOC-ITIS for review and approval.
4. The DOC-ITIS may agree to waive the requirement of using an RCDD on a case-by-case basis. Requests for a waiver must be submitted to the DOC-ITIS in writing through or by the DOC Plant Manager, with a copy to the DOC-RITM. This waiver will generally not be granted for most outside plant telecommunications pathway and/or telecommunications maintenance hole/handhole work.
   a. When a waiver is approved, the drawings and specifications identified

above are still required and the DOC personnel shall work with the DOC-ITIS to develop an approved design prior to starting work.

D. Prior to initiating construction of telecommunications pathways by DOC personnel, the engineered design and specifications identified above shall be approved by the DOC-ITIS in writing.
1. The DOC personnel performing approved telecommunications work shall insure the DOC-ITIS and/or RCDD periodically observes the construction work while in progress at specific points and at completion as requested by the DOC-ITIS and/or RCDD.
    a. Any problems found during an inspection shall immediately be corrected by DOC personnel or others as appropriate.
2. RCDD's shall provide written observation reports to the DOC-ITIS following each visit.
3. DOC personnel (when no RCDD is used) or an RCDD (when used) shall produce as-built drawings and submit to the DOC-ITIS and DOC CPD Project Manager assigned to the facility for review and final approval. As-builts produced by an RCDD shall include the RCDD's logo stamp and signature.

E. All work shall be in full compliance with all state regulations (NEC, NESC, RCW's, and WAC's) and local building codes.
1. L&I electrical and/or telecommunications permits shall be obtained as required, prior to initiating construction or installation, with a copy provided to the DOC-ITIS.
    a. Per WAC 296-46B-900 (14), annual electrical permits cover <u>"only" maintenance for existing electrical systems; they</u> do not cover telecommunications systems work.
    b. Annual permits for the inspection of telecommunications installations can be obtained per *RCW 19.28.470 (1) (c)* and *WAC 296-46B-900 (9)-(13)*.
    c. New cabling shall be limited to the maximum number of outlets within a 90-day period as defined by WAC 296-46B-900 (a).
2. L&I electrical and/or telecommunications inspections shall be requested as required per RCW's and WAC's.
    a. Any problems found during an inspection shall immediately be corrected.

F. All telecommunications infrastructure work shall be in full compliance with the SYSTIMAX® Design and Installation Guidelines. DOC personnel installing or maintaining telecommunications cable shall be certified as DOC SYSTIMAX® Self-Maintainers and approved by the DOC SYSTIMAX® Owner Administrator as indicated in the section below prior to installing any telecommunications cable.
1. New cabling shall be limited to the maximum number of installations within the time period established by the SYSTIMAX® Regional Account Manager as indicated in the section below.

2.4.4 <u>DOC SYSTIMAX® "SELF-MAINTAINERS"</u>

A. SYSTIMAX® telecommunications cabling systems installed at DOC facilities are covered by a manufacturer's 20-year extended warranty and application assurance program. Installation labor performed by a SYSTIMAX® Value Added

Reseller (VAR) is also covered under the SYSTIMAX® warranty. The SYSTIMAX® warranty becomes void if anyone other than a SYSTIMAX® VAR or certified SYSTIMAX® installer performs any type of maintenance (move, add, or change) to a SYSTIMAX® system.

1. Personnel performing "only" wiring cross-connects on 110 blocks as on-going maintenance of telephone systems are not required to have SYSTIMAX® certification.

B. To satisfy the SYSTIMAX® manufacturer's requirements that will allow DOC personnel to perform authorized maintenance on SYSTIMAX® systems, the following requirements shall be met:

1. A SYSTIMAX® Maintenance contract with the "Owner Organization" (DOC IT) shall be executed.
2. An "Owner Administrator" for the SYSTIMAX® Maintenance contract shall be designated.
    a. This shall be the DOC senior IT Infrastructure Specialist.
3. Owner maintenance personnel shall be certified by SYSTIMAX® as "Self-Maintainers and shall retain an active certification while performing work on a SYSTIMAX® SCS system."
    a. Owner maintenance personnel shall successfully complete the SYSTIMAX® SCS "*Installation and Maintenance"* manufacturer training course.
        i. At the preparation of this document, this course is typically offered annually at Anixter in Kent, Washington, is priced at $1,700, and is three days in length. The course is offered more frequently out of state and at SYSTIMAX® training center locations. For course scheduling and available locations, contact:
            - Doug Kulm, doug@cablingscience.com
    b. Every four (4) years, the certified Owner maintenance personnel shall attend the SYSTIMAX® SCS manufacturer refresher training course #ND3351: "*Master Class (Installation & Maintenance and Design & Engineering Recertification)."*
        i. At the preparation of this document, this course is typically offered annually in Kent, Washington, is priced at $450, and is one day in length.
    c. SYSTIMAX® occasionally releases new products that require manufacturer training before authorized installation is allowed. This mandatory training will be scheduled for the DOC Self-Maintainers by the SYSTIMAX® Regional Account Manager through the senior DOC-ITIS and is typically at no cost to DOC.
4. All work by Self-Maintainers shall be performed in compliance with current SYSTIMAX® Design and Engineering requirements including Design Guidelines and Installation Guidelines, ANSI/TIA/EIA Telecommunications Standards, and all requirements of the DOC TDIS.
5. Installation of additional, new SYSTIMAX® cabling by certified Self-Maintainers shall be limited to a maximum number of installs within a specific time period as established by the SYSTIMAX® Regional Account Manager below:

a. DOC Self-Maintainers shall install <u>no more than five (5) new horizontal voice or data cables per request, not to exceed ten (10) new cables per month per facility.</u>
b. The <u>total of moves, adds, and changes to the horizontal voice or data cables by DOC Self-Maintainers shall not exceed 20 per month per facility.</u>

6. All work performed by Self-Maintainers shall be subject to inspection by the DOC SYSTIMAX® Owner Administrator, the DOC-ITIS, an RCDD, and the SYSTIMAX® Regional Account Manager. Work performed by Self-Maintainers found to be unsatisfactory shall immediately be corrected. Repeat problems with work performed by Self-Maintainers can result in cancellation of the SYSTIMAX® Maintenance contract and denial of warranty claims.

C. DOC personnel shall possess the same level of additional training and knowledge of structured cabling systems as expected of certified SYSTIMAX® telecommunications installation technicians who work under journeyman telecommunications installers. DOC personnel can obtain some of this additional training from the courses listed below.

1. SYSTIMAX® Design & Engineering course #ND3321.
   a. At the preparation of this document, this course is three days in length, priced at $1,700, and is typically offered annually in Kent, Washington, when there are a sufficient number of students, and at numerous other locations around the country, including the SYSTIMAX® training center in California. For course scheduling and available locations, contact:
      - Doug Kulm, doug@cablingscience.com
2. The following two courses are offered at both Clover Park Technical College in Lakewood, Washington, and at Bellevue Community College in Bellevue, Washington. Both classes are also available through the IBEW union at a discounted rate for IBEW members.
   a. BICSI certified course “IN100: Installer, Level 1”, priced at $950 plus a $300 exam fee (as of 2003), is six days in length with the four hour exam (2 hour written, 2 hour hands-on) given on the sixth day.
   b. BICSI certified course “IN200: Installer, Level 2”, priced at $950 plus a $300 exam fee (as of 2003), is six days in length with the four hour exam (2 hour written, 2 hour hands-on) given on the sixth day.

D. DOC personnel shall not perform moves, make changes to, or perform any installations of SYSTIMAX® systems or cabling at DOC facilities unless they are presently in compliance with the SYSTIMAX® Self-Maintainer certification program and have been authorized as DOC SYSTIMAX® Self-Maintainers by the DOC SYSTIMAX® Owner Administrator. DOC personnel shall be certified as SYSTIMAX® Self-Maintainers and be authorized by DOC as follows:

1. A training request (approved through the normal channels) must be submitted for review to the DOC SYSTIMAX® Owner Administrator, through the DOC Plant Manager (where applicable), prior to applicants attending the SYSTIMAX® SCS “Installation and Maintenance” course. The DOC SYSTIMAX® Owner Administrator shall review the training request and approve or deny.

2. DOC personnel applying to become a DOC SYSTIMAX® Self-Maintainer should also be a licensed electrician possessing a currently valid "EL01-General Electrical License," or a specialty class "EL06-Limited Energy Systems" or "EL09-Telecommunications Electrical License."
3. Within sixty (60) days of successfully completing the above SYSTIMAX® course and becoming familiar with the DOC TDIS and the BICSI manuals identified earlier, applicants shall request a meeting with the DOC SYSTIMAX® Owner Administrator, through the DOC Plant Manager (where applicable), to demonstrate competence in structured cabling. Successful applicants will be authorized by the DOC SYSTIMAX® Owner Administrator as DOC SYSTIMAX® Self-Maintainers.
   a. Unsuccessful applicants will be informed of the areas where additional training or knowledge is required in structured cabling and can request another meeting after the additional training requirements are obtained.

E. DOC SYSTIMAX® Self-Maintainers who continue to fail to follow practices required by the ANSI/TIA/EIA Standards, BICSI recommended practices, or this document as determined by the DOC SYSTIMAX® Owner Administrator, DOC-ITIS, or the SYSTIMAX® Regional Account Manager shall surrender their SYSTIMAX® Self-Maintainer certificate to the DOC SYSTIMAX® Owner Administrator. The DOC SYSTIMAX® Owner Administrator shall notify the person in writing they are no longer authorized to perform maintenance activities or install new telecommunications cable on SYSTIMAX® systems at DOC facilities. The notification shall be copied to their immediate supervisor, the DOC Superintendent and DOC Plant Manager (at appropriate facilities), the DOC-RITM, the DOC IT Enterprise Network Manager, and the SYSTIMAX® Regional Account Manager.
   1. Requests for reinstatement as a DOC SYSTIMAX® Self-Maintainer shall be forwarded to the DOC SYSTIMAX® Owner Administrator by the immediate supervisor through the DOC Superintendent and DOC Plant Manager with a plan to resolve the previous work problems. The DOC SYSTIMAX® Owner Administrator shall review the request and approve/deny. Additional requirements may be assigned as a conditional approval.

F. All telecommunications work performed by DOC personnel shall be in full compliance with all state regulations (NEC, NESC, RCW's, and WAC's) and local building codes.
   1. L&I telecommunications permits shall be obtained as required, with a copy provided to the DOC-ITIS, prior to initiating installation activity.
      a. Per WAC 296-46B-900 (14), annual electrical permits cover <u>"only" maintenance for existing electrical systems; they</u> do not cover telecommunications systems work of any kind.
      b. Annual permits for the inspection of telecommunications installations can be obtained per *RCW 19.28.470 (1) (c)* and *WAC 296-46B-900 (9) through (13)*.
      c. New cabling shall be limited to the maximum number of outlets within a 90-day period as defined by WAC 296-46B-900 (a).
   2. L&I telecommunications inspections shall be requested as required per RCW's and WAC's.

2.5 TELECOMMUNICATIONS OPERATIONS AND MAINTENANCE

2.5.1 MOVES, ADDS, AND CHANGES (MAC'S)

A. Moves, adds, and changes to the telecommunications infrastructure shall be performed in accordance with the requirements of the DOC TDIS. This includes but is not limited to: all copper or fiber optic cables for the LAN, telephones, workstation area outlets, patch panels, patch cords, etc. All MAC's must be coordinated with the DOC-ITIS and follow all procedures as required by DOC-RITM.

B. DOC personnel shall not install fiber optic cable.

2.5.2 SPLITTING OF CABLE PAIRS

A. In certain situations it may be necessary to use one or two pairs of a four (4)-pair horizontal cable at a work area to support a second telephone device on a temporary basis. In these situations:
1. The second telephone device shall be accommodated with a "*line-splitting module*" plugged into the work area outlet jack on the outside of the Information Outlet faceplate.
2. At the TR, if the horizontal cable from the work area outlet jack is terminated at a modular patch panel, the horizontal cable pairs terminated at the rear of the patch panel shall not be changed. The additional telephone service shall be accommodated "only" by cross-connect wiring beyond the modular patch cable connected to the patch panel.
3. At the TR, if the horizontal cable from the work area outlet jack is terminated at a 110 Termination Field, individual cross-connect wires connected to a 110 Termination Field may be changed to cross-connect for the additional telephone service.

B. Under no circumstances will cable pairs be split or removed from the back of a modular Information Outlet or the back of patch panels for voice or data. All four (4) pairs of each horizontal distribution cable must be terminated to a single eight (8)-position, eight (8)-conductor jack at the work area.

C. Under no circumstances will multiple data devices be allowed to connect to the LAN by splitting of data cable pairs or by a "line-splitting device." The integrity of all four (4)-pair cable [all eight (8) wires] must be maintained end-to-end from the jack at the work area to the jack at the patch panel in the TR for the LAN equipment.

2.5.3 ELECTRICAL OUTLETS IN TELECOMMUNICATIONS ROOMS

A. Each telecommunications room (TR) will be equipped with orange-colored "technical" electrical outlets that are dedicated for use by telecommunications equipment. These outlets shall be used exclusively for telecommunications equipment and shall not be used for general-purpose or utility devices such as electric drills, vacuum cleaners, coffeepots, etc.

B. Each TR shall also be equipped with white, gray, or beige-colored “utility” electrical outlets that are available for use with non-telecommunications equipment. Critical telecommunications equipment such as modems, routers, LAN switches, servers, etc., shall not use the utility power outlets.

2.5.4 TELECOMMUNICATIONS ADMINISTRATION

A. Administration of the telecommunications infrastructure includes documentation of just about everything: cables, MHs, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications closets, and other telecommunications spaces. ANSI/TIA/EIA-606-A, the Administration Standard for the Telecommunications Infrastructure of Commercial Buildings is the industry standard for administering and documenting the telecommunications infrastructure. 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. The TDDG and TCGS establish guidelines and requirements for DOC personnel, end users, installers, and facilities administrators involved in the administration of the telecommunications infrastructure at DOC facilities.

B. Designers and DOC personnel performing telecommunications infrastructure work shall insure all telecommunications components are properly labeled and tagged. These shall be Punch List review items on every project.

C. All DOC facilities shall maintain a system for documenting and administering the telecommunications infrastructure. DOC personnel shall be responsible for maintaining the telecommunications-related documentation and it is the responsibility of the DOC-RITM to ensure that cable and equipment records are maintained for each facility within his/her region. The administration system shall include cable records, and equipment records for all information technology systems. The administration system shall follow the ANSI/TIA/EIA-606-A standard as defined later in this document under the *Design Criteria* section and in the TCGS sections.

D. DOC’s telecommunications administration system is based on “records” and “identifiers.” Records are a collection of information about each specific component of the telecommunications infrastructure. Drawings, details, diagrams, specifications, spreadsheets and databases are all examples of telecommunications records.

E. Records shall be maintained electronically. Paper records are encouraged, but are optional. Record drawings (as-built drawings) are a vital component of the telecommunications administration system, and must be kept current as adds, moves, and changes take place. It is the responsibility of the DOC-RITM and DOC Plant Managers (where applicable) to ensure that as-built drawings are maintained on telecommunications distribution infrastructure for each facility within his/her region/facility.

F. For more information about telecommunications records, see Section 5.2.5 *Cable Records* of this document.

G. Telecommunications records show unique "identifiers" for each component of the telecommunications infrastructure. For more information about identifiers, see Section 4.13 *Telecommunications Administration* of this document and also the TCGS Sections.

2.6 TELECOMMUNICATIONS PROCUREMENT AND INSTALLATION

A. The primary responsibility for the management and use of Information Technology systems, telecommunications, and information technology equipment, software, and services rests with each state agency head. Equipment is defined as machines, devices, and transmission facilities used in information processing, such as computers, telephones, and cables. This section highlights certain procurement policies applicable to the telecommunications infrastructure. Readers should consult the Department of Information Services Policy and DOC Policy for the current Acquisition and Disposal of Information Technology Equipment for complete details.

B. There are two general methods used for the procurement and installation of the telecommunications infrastructure. In most construction projects, the telecommunications substructure installation is part of the general construction contract, but in most cases, DOC issues a separate contract for installation of both OSP and horizontal cabling and components.

C. Use of the DIS Cabling Master Contract is recommended whenever possible. A competitive acquisition should still be pursued with the SYSTIMAX® contractors listed on the DIS Cabling Master Contract web site[3]. The procurement of telecommunications cabling on construction projects is a combined effort between the DOC CPD Project Manager and the DOC-ITIS.

2.6.1 STATE IT PROCUREMENT POLICY

The Information Services Board (ISB) is the state authority and sets state policy for the acquisition of all information technology (systems, software, services, equipment, and telecommunications) through the Department of Information Services (DIS). The ISB grants DOC a delegated level of acquisition authority based on an IT portfolio style strategic plan submitted to and approved by the ISB and the Washington State Office of Financial Management (OFM) on an ongoing basis. All IT projects with total acquisition and five year operational costs of $200,000 or more require a written IT Acquisition Plan that must have prior approval by DOC IT management. Large IT projects with total acquisition and five-year operational costs exceeding $1,000,000 require prior approval by the ISB.

[3] As of this publication, the web site address is: http://techmall.dis.wa.gov/master_contracts/cabling/cabling.asp

2.6.1.1 DOC Headquarters Information Technology Approval

In order to achieve consistent and competent technical design in compliance with the DOC TDIS and to ensure compliance with DIS procurement requirements, DOC acquisitions and installations of telecommunications infrastructure or substructure must have the prior approval of DOC IT. Requests for approval shall be submitted to the DOC-ITIS per the requirements established by each DOC-RITM. Requests for approval must include a description of the acquisition and installation and identify the following:

- Source of funding
- RCDD for design services
- RCDD for construction observation services
- SYSTIMAX® SCS cable installer

2.6.1.2 Criteria and Methods for Acquisition

A. DOC may acquire information technology (IT) resources by conducting a new competitive solicitation, by using an existing DOC contract or DIS Cabling Master Contract, in limited cases through a sole source method, through strategic partnerships, or by transferring the resource from one agency to another.
   - All acquisition methods for IT resources shall be compliant to the DIS IT acquisition requirements.

B. The most efficient, cost effective, and preferred method for procuring telecommunications infrastructure installation services is through the use of the pre-existing DIS Cabling Master Contracts for Cabling Equipment, Installation and Maintenance. Contact the DOC Office of Administrative Support, Information Technology for details.

C. For additional methods of acquisition, refer to the Department of Information Services Policy for the Acquisition and Disposal of Information Technology Equipment.

D. All DOC Work Orders (not formal bids) to contractors for telecommunications work shall have a document attached titled, "*Installation of Telecommunications Cabling @WSDOC*." This document may be obtained from the DOC-ITIS; a sample is shown in the Appendix, Section 6.7.
   - <u>The SYSTIMAX® VAR must state in their contract documents acknowledgement of this attachment and state they will meet the DOC requirements</u>. DOC projects shall not commence until this document is attached to the Work Order and the SYSTIMAX® VAR has agreed to comply with this requirement.

2.6.1.3 SYSTIMAX® Products and Approved Alternatives

The majority of DOC facilities have an installed base of SYSTIMAX® Structured Cabling System (SCS) products (formerly known as AT&T, or Lucent Technologies, or AVAYA). Some manufacturers offer SCS systems, but each manufacturer's SCS system is engineered to provide optimum performance "only" when matched with the manufacturer's specified components. Standardization on the SYSTIMAX® product line ensures performance compatibility with the installed base when additions are made to the infrastructure, and spare parts and components from one facility can be used at other facilities as needed. Standardization also ensures that DOC technical personnel are familiar with the manufacturer's components and installation requirements at all facilities, and they are prepared to handle moves, adds, and changes to the telecommunications infrastructure.

A. Where additions are made to existing facilities that currently use SYSTIMAX® SCS products (including new buildings on an existing campus) the addition shall exclusively use SYSTIMAX® products.
B. Where additions are made to existing facilities that currently do not have a SYSTIMAX® SCS installation, products from the SYSTIMAX® SCS product line shall be used (where performance will not be compromised) with the eventual goal of standardizing on the SYSTIMAX® SCS products.
C. The telecommunications infrastructure design for all new facilities shall be based upon the SYSTIMAX® SCS product line.

2.6.1.4 Sole Source Procurement

Standardization on the SYSTIMAX® SCS product line does not imply there is a sole source for procurement or installation of the SYSTIMAX® products. Acquisition of SYSTIMAX® SCS products by DOC is based on a single manufacturer, but the products are procured through multiple supply sources, and installation can be procured through multiple SYSTIMAX® SCS certified cable installation contractors using competitive solicitations and existing contracts. Refer to Section 2.6.1.2 *Criteria and Methods for Acquisition*, above.

3 PROJECT PROCEDURES

A. The Project Procedures section contains requirements for architects, engineers and telecommunications distribution designers regarding DOC procedures for projects that include telecommunications distribution systems. This applies both to projects that entail primarily telecommunications distribution work (such as telecommunications infrastructure replacement projects) as well as to architectural projects and other work (such as a new building or campus) that involve telecommunications design.

B. This section is not intended to supersede the requirements in the State of Washington *Conditions of the Agreement* or the *Instructions for Architects and Engineers*, but rather to complement them, providing additional requirements that apply specifically to telecommunications distribution design projects at DOC facilities.

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

3.1 TELECOMMUNICATIONS DISTRIBUTION DESIGNERS

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.

B. **<u>A/E's using RCDD's on DOC projects shall first provide a copy of their requested scope of work to the DOC-CPDPM and DOC-ITIS for review and comment.</u>** DOC shall review the request to ensure all relevant aspects of the telecommunications infrastructure design and construction within the scope of the project are adequately requested by the A/E based on the requirements of the DOC TDIS. A/E firms shall modify the requested scope of work per comments provided by DOC. DOC may require a meeting with the A/E to further refine the scope of work.

C. A/E's shall only select RCDD's from the DOC pre-qualified RCDD Pool.

D. Project procedures and requirements for Designers shall include:
- When assigned to DOC projects, the Designer shall retain BICSI RCDD status through the duration of the project.
- The telecommunications design shall be produced by the RCDD.
- Telecommunications-related communications between DOC and the A/E shall be mainly through 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 DOC.

- Questions on any DOC telecommunications infrastructure issue shall be directed to the DOC IT Infrastructure Specialist; **answers from any other DOC personnel shall not be considered official DOC responses.**

E. Telecommunications distribution designers shall be responsible to apply the guidelines, instructions, and requirements in this document along with the "hidden-text" guidelines contained in the TCGS, and the TIA Standards and BICSI recommended practices in the course of designing a fully compliant telecommunications distribution infrastructure at DOC facilities.

F. 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 REVIEW PROCESS

As noted in Section 3.4.4 *Procedures Related to Project Phases*, the project documents will pass through this design review process at the end of each design phase plus follow-up reviews when necessary. These requirements are in addition to those contained in the *State of Washington Conditions of the Agreement and the Instructions for Architects and Engineers*.

The following steps correspond to the numbered activities shown on the Design Review Process diagram below:

① Each time a review is required, the A/E shall provide copies of the complete project documents set (drawings and specifications for all disciplines involved in the project) submitted to the following people:

- DOC-CPDPM
- DOC Plant Manager (if applicable)
- DOC-ITIS
- DOC-RITM or designee
- RCDD Review Consultant[4] (*two sets*)

ⒶⒷ The RCDD Review Consultant will have 3, 5, or 10 days (depending on the project phase) to review the design documents and provide written RCDD Review Comments to the DOC CPD PM and the DOC-ITIS.

②③④ The DOC CPD PM and the DOC-ITIS will have 5, 8, or 10 days (depending on the project phase) to review the design documents and the RCDD Review Consultant's comments. The DOC-ITIS will create the DOC IT Review Report, and incorporate the RCDD Review Comments into the report. Following their review, they will distribute the

[4] On some projects, DOC may hire an RCDD Review Consultant to act in the capacity of an independent reviewer and consultant to DOC. The RCDD Review Consultant will be responsible to review the overall design, paying particular attention to areas of the design that are related to the current or future operation and maintenance of the telecommunications system including low voltage systems other than voice and data. The RCDD Review Consultant will identify issues that do not appear to be compliant with the requirements in the TDDG and the TCGS.

complete set of comments to the RCDD Review Consultant and hold brief discussions about the comments. If there is no RCDD Review Consultant assigned to the project:

- The A/E and Designer shall meet with DOC-ITIS to initiate the review process.
- The DOC-ITIS will create the DOC IT Review Report without RCDD Review Comments
- The DOC IT Review Report will then be sent to the DOC CPD PM for review

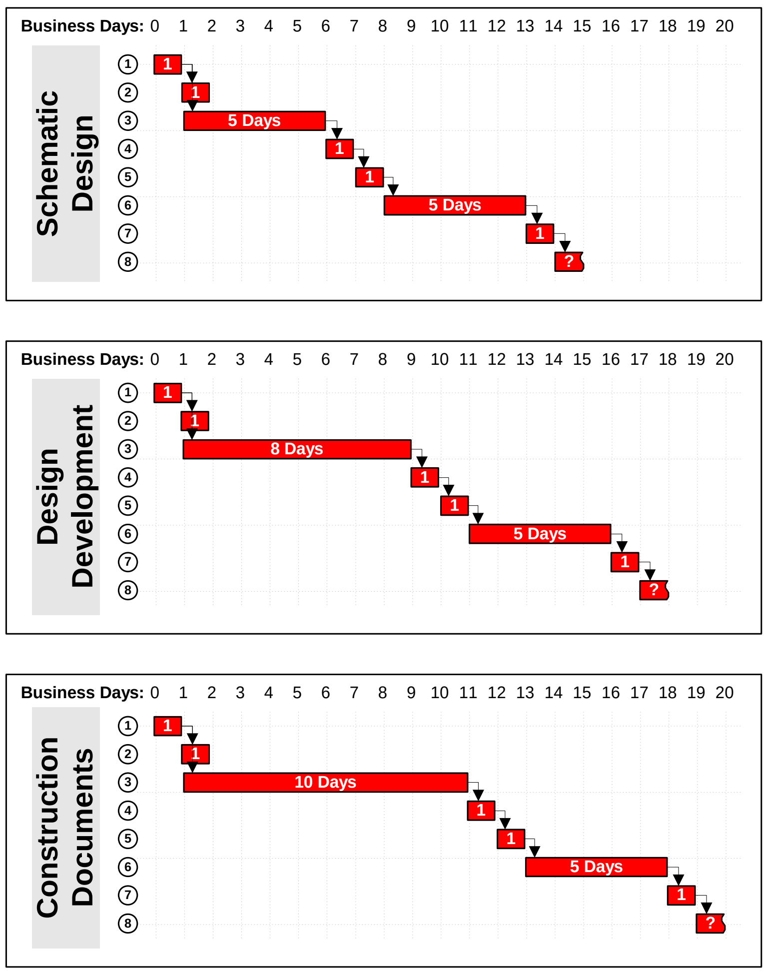
⑤⑥ Following the meeting, the DOC CPD PM will submit the RCDD Review Report to the Designer. The Designer will then be given five days to review the comments and respond to them in writing. Negative responses to any comment shall include a discussion of the reasons for non-compliance.

⑦⑧ Finally, a meeting or teleconference will be held with the DOC CPD PM, the DOC-ITIS, the RCDD Review Consultant 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 the DOC's resolution for each comment.

The following diagram depicts a typical telecommunications design review process when an RCDD Review Consultant is not involved in the review process. The number of days listed for #3 and #6 may need to be adjusted based on the scope or depth of the telecommunications infrastructure on a project.

TABLE 3.1 DESIGN REVIEW PROCESS WITHOUT AN RCDD REVIEW CONSULTANT

Design Review Process Without an RCDD Review Consultant



1. Designer ships Drawings and Specifications to DOC IT Infrastructure Specialist, and DOC Capital Planning and Development Project Manager (DOC CPD PM)

2. DOC CPD PM reviews the drawings and the specifications.

3. Architect and Designer meet with DOC IT Infrastructure Specialist to initiate the review process. DOC IT Infrastructure Specialist then reviews the drawings and specifications and then produces the DOC IT Review Report.

4. DOC CPD PM, and the DOC IT Infrastructure Specialist meet to discuss and finalize the DOC IT Review Report.

5. DOC CPD PM issues the DOC IT Review Report to the Designer for response.

6. The Designer reviews the DOC IT Review Report and provides a written response for each comment to the DOC IT Infrastructure Specialist, and DOC CPD PM.

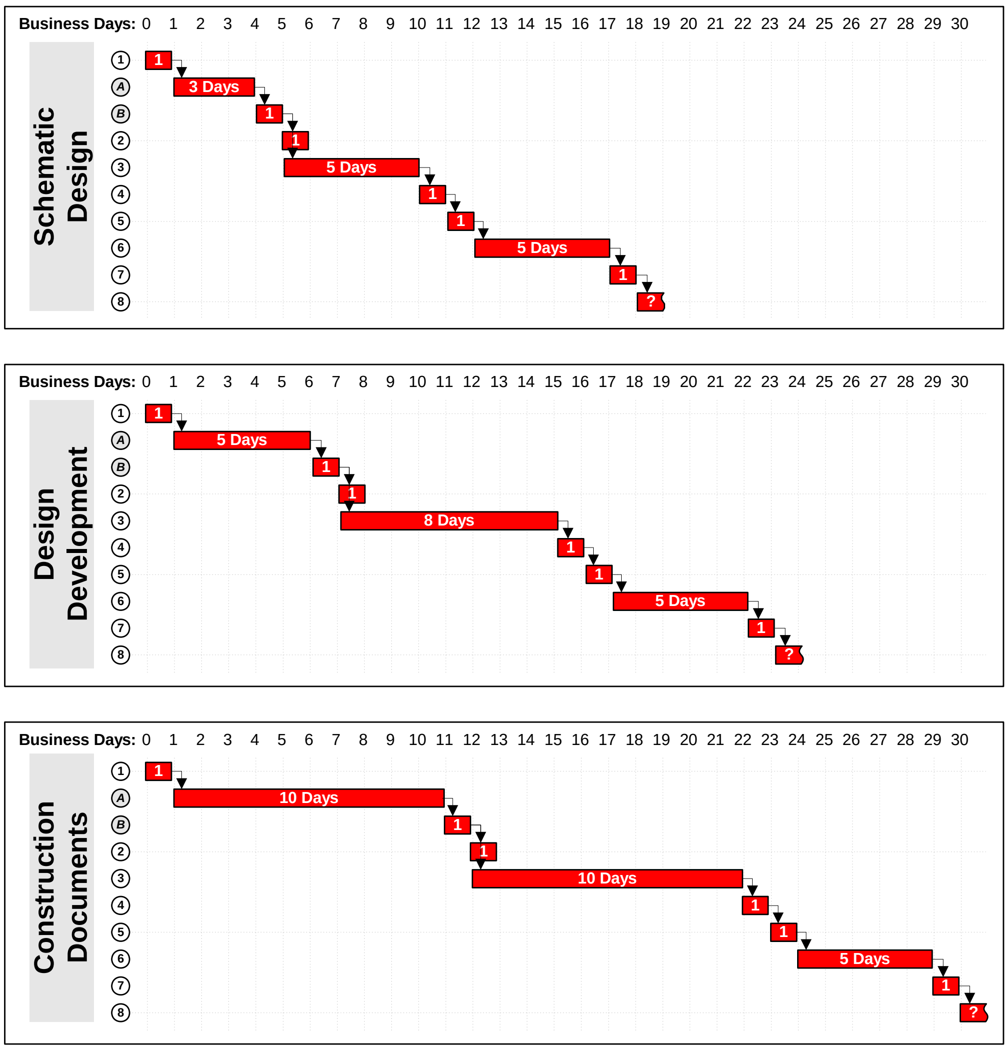
7. DOC CPD PM, DOC IT Infrastructure Specialist, and the Designer meet to discuss the Designer's responses to the DOC IT Review Report and determine a course of action for each item.

8. The Designer shall revise the design per the direction given in Step 7 (above). The Designer shall then submit a second written response to the DOC IT Review Report, indicating how each comment was resolved.

The following diagram depicts a typical telecommunications design review process, including the RCDD Review Consultant's role in the review process. The number of days listed for #3 and #6 may need to be adjusted based on the scope or depth of the telecommunications infrastructure on a project.

TABLE 3.2 DESIGN REVIEW PROCESS WITH AN RCDD REVIEW CONSULTANT

Design Review Process With An RCDD Review Consultant



1. Designer ships Drawings and Specifications to RCDD Review Consultant, DOC IT Infrastructure Specialist, and DOC Capital Planning and Development Project Manager (DOC CPD PM)

A. RCDD Review Consultant reviews the drawings & specifications and produces RCDD Review Comments.

B. RCDD Review Consultant ships the RCDD Review Comments to DOC CPD PM, and DOC IT Infrastructure Specialist.

2. DOC CPD PM reviews the RCDD Review Comments, the drawings and the specifications.

3. DOC IT Infrastructure Specialist reviews the RCDD Review Comments, drawings and specifications and then produces the DOC IT Review Report, incorporating the RCDD Review Comments.

4. DOC CPD PM, the RCDD Review Consultant, and the DOC IT Infrastructure Specialist meet to discuss and finalize the DOC IT Review Report.

5. DOC CPD PM issues the DOC IT Review Report to the RCDD Review Consultant and to the Designer for response.

6. The Designer reviews the DOC IT Review Report and provides a written response for each comment to the RCDD Review Consultant, DOC IT Infrastructure Specialist, and DOC CPD PM.

7. DOC CPD PM, DOC IT Infrastructure Specialist, the RCDD Review Consultant and the Designer meet to discuss the Designer's responses to the DOC IT Review Report and determine a course of action for each item.

8. The Designer shall revise the design per the direction given in Step 7 (above). The Designer shall then submit a second written response to the DOC IT Review Report, indicating how each comment was resolved.

A. The Designer for the Prime Consultant shall also be responsible for performing QC/QA on the telecommunications design prior to releasing documents for each phase for review. The QC/QA shall include, but not be limited to, the components and issues listed in Table 3.3.

B. ***Occasionally, DOC workload becomes backlogged and design reviews might not be completed according to the schedule.***
   - ***The A/E and Designer shall require DOC to review the documents and respond with written review comments to the Designer at each phase of the design.***
   - ***The A/E and Designer shall not proceed with the next phase of telecommunications design without receipt of written comments from the DOC-ITIS and approval to proceed from the DOC-CPDPM***.
   - ***The DOC-CPDPM shall not authorize a project to proceed to bidding until the IT issues are appropriately addressed in the Construction Documents by the Prime Consultant.***

C. The Prime Consultant shall be responsible for ensuring the review process is conducted in accordance with all DOC's requirements including the DOC TDIS, and shall participate in the review process to ensure the review comments are satisfactorily addressed prior to issuing bid documents.

3.2.1 RCDD REVIEW CONSULTANT

For projects where DOC hires an RCDD Review Consultant, the prime consultant (Designer or A/E) shall provide two sets of the drawings and specifications (from all 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:

3.2.1.1 Typical Document Review Scope

- Review telecommunications distribution system design:
  - For compliance with DOC 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
- Review the completed needs analysis report.
- Review the cutover plans.

The RCDD Review Consultant shall review the documents according to DOC's scope of work and then produce a report consistent with the format shown in Appendix 6.1. All design reviews shall include, but not be limited to the components and issues listed in Table 3.3.

TABLE 3.3 MINIMUM SCOPE OF DESIGN REVIEW

	Components to be Reviewed	Issues to be Considered
Pathways	Horizontal Conduit	Sizing, Sweep Radius, Pull Points, EMI Clearance, Grounding & Bonding
	Horizontal Innerduct	Sizing, Type
	Horizontal Cable Tray	Sizing, Sweep Radius, Drop Supports, EMI Clearance, Grounding & Bonding
	Riser Conduit	Sizing, Sweep Radius, Pull Points, EMI Clearance, Grounding & Bonding
	Riser Innerduct	Sizing, Sweep Radius
	Riser Sleeves	Sizing
	Outside Plant Ductbanks	Sizing, Sweep Radius, Depth, Slope, Pull Points, EMI Clearance, Grounding & Bonding, Labeling
	Outside Plant Innerduct	Sizing, Type
	Outside Plant Maintenance Holes and Handholes	Sizing, Location, Elevation Relationships w/Bldgs, Sealing, Grounding & Bonding, Security, Drainage, Racking, Cable Routing, Signage
Spaces	Main Equipment Rooms	Same as TR below, plus Generator Capacity, Raised Floor
	Telecommunications Rooms	Location, Cabling Distance Limitations, Racks, EMI Clearance, Cable Protection and Termination, Grounding & Bonding, Clear Working Space, Labeling, Approved Components, UPS Capacity, Electrical & HVAC, Lighting, Fire Suppression, Water Issues
	Riser Shafts	Grounding and Bonding, EMI Clearance
Cable Plant	Outside Plant	Multi-pair Copper, EMI Clearance, Fiber Optic, CATV/CCTV Coax
	Horizontal	4-PR UTP Copper, EMI Clearance, Fiber Optic, CATV/CCTV Coax
	Riser	4-PR UTP Copper, EMI Clearance Fiber Optic, CATV/CCTV Coax
	Testing & Administration	Copper, Fiber Optic, Labeling Plan

3.2.1.2 Other Services (upon specific DOC request)

A. On some projects, DOC 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 always remains responsible for submittal review, construction observation, punch list management, and other standard services as indicated in the *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services* (published by the Washington State Department of General Administration).

B. In these situations, the RCDD Review Consultant shall provide written comments to DOC and to the Designer. In turn, DOC will decide how to act on the written comments, and then direct the A/E, Designer or Contractor accordingly. The RCDD Review Consultant shall not, under any circumstances, give direction to the A/E, Designer or Contractor.

3.3 ARCHITECT/ENGINEER TEAMS

DOC agrees with BICSI that in order to have a building or campus successfully designed, constructed and provisioned for telecommunications, it is imperative that the telecommunications design be incorporated during the preliminary architectural design phase.

A. In addition to the DOC-CPDPM, the Prime Consultant shall consider the designated project RCDD, RCDD Review Consultant (when used), DOC-ITIS, and DOC-RITM as part of the Design Team and work closely with them from the beginning, starting with the Schematic Design phase of the project through final project closeout.

B. The Prime Consultant shall notify the Design Team members of all scheduled design and construction meetings, with agendas attached, and forward copies of all meeting notes.

3.3.1 CROSS DISCIPLINE COORDINATION

DOC 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:

3.3.1.1 Outside plant telecommunications infrastructure:

- Ductbank routing around obstacles (trees, tunnels, buildings, existing ductbanks, etc.)
- Coordinate the locations of maintenance holes and hand holes to assure they are not located in areas of water concentration. Site requirements, drainage, traffic, joint usage, utility requirements, etc.
- Coordinate the elevations of maintenance holes and ductbanks in relation to finished floor elevations of TR’s and ER’s to assure no ingress of water into buildings
- Proximity of ductbanks to sources of EMI, adhering to setback requirements
- Proximity of ductbanks to steam piping
- Routing of entrance conduits through buildings

- Backbone cabling requirements of other disciplines (fire alarm, HVAC, security, CATV, etc.)
- Specifying the appropriate number of conduits between maintenance holes for main backbone distribution pathways and proper depths

3.3.1.2 Horizontal and Intra-building backbone telecommunications infrastructure:

- Location and size of TR's
- HVAC cooling and humidity requirements for telecommunications rooms (TR)
- HVAC ductwork routing (avoiding TR ceiling spaces)
- Plumbing routing avoiding TR spaces
- Lighting requirements for TR's
- Power requirements for TR's
- 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 pull boxes in congested areas (HVAC ductwork, plumbing, electrical, etc.)
- Floor treatments in TR's
- Backboards in TR's

More information regarding the above requirements is available in Section 4 *Design Criteria* of this document, and the BICSI TDM, CO-OSP, and TCI manuals.

3.4 GENERAL PROCEDURES

3.4.1 PROCUREMENT AND INSTALLATION

A. DOC uses several methods for the procurement and installation of the telecommunications infrastructure. Refer to Section 2.6 *Telecommunications Procurement and Installation* of this document.

B. In larger construction projects, the telecommunications infrastructure installation might be part of the general construction contract or it could be a separate contract. Generally the decision on the procurement and construction of telecommunications infrastructure will be a combined effort between the DOC-CPDPM and the DOC-ITIS.

C. DOC generally uses the Washington State DIS Cabling Master Contract[5] whenever possible to keep costs to a minimum. When the DIS Cabling Master Contract is not used and the cabling is not part of the general construction contract, a competitive bid by at least three SYSTIMAX® VAR's licensed to perform SYSTIMAX® installations in Washington state is required to fulfill

[5] As of this writing, more information about the Washington State DIS Cabling Master Contract is available at http://techmall.dis.wa.gov/master_contracts/cabling/cabling.asp

mandatory state competitive purchasing regulations. There are specific limitations on the maximum cabling project cost for these two methods.

3.4.2 CAD FILES

The Designer shall coordinate with the A/E to assure 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 and those retained by DOC.

3.4.3 ALTERNATIVE DESIGN REQUEST (ADR)

A. This document identifies specific design solutions intended to meet the technical requirements of DOC telecommunications and information technology systems, as well as the unique security requirements necessary at many DOC facilities. Designs not consistent with the requirements in this document shall require prior approval through the DOC Alternative Design Requests (ADR) process. Requests to deviate from industry standards or DOC design solutions will be considered on a case-by-case basis. Any request to deviate from applicable code requirements or deviate from the requirements of the SYSTIMAX® Design and Installation Guidelines will not be accepted.

B. Requests to apply Alternative Design Requests shall be submitted in writing to the DOC-ITIS for consideration. The DOC-ITIS will forward a copy of the request, if endorsed, to the DOC-RITM for review as indicated in the flow chart below. Approval, which will only be granted in writing, shall be authorized by the DOC IT Network Operations Manager (or designee), and (if capital funding is involved) it shall be authorized by the DOC CPD Project Manager.

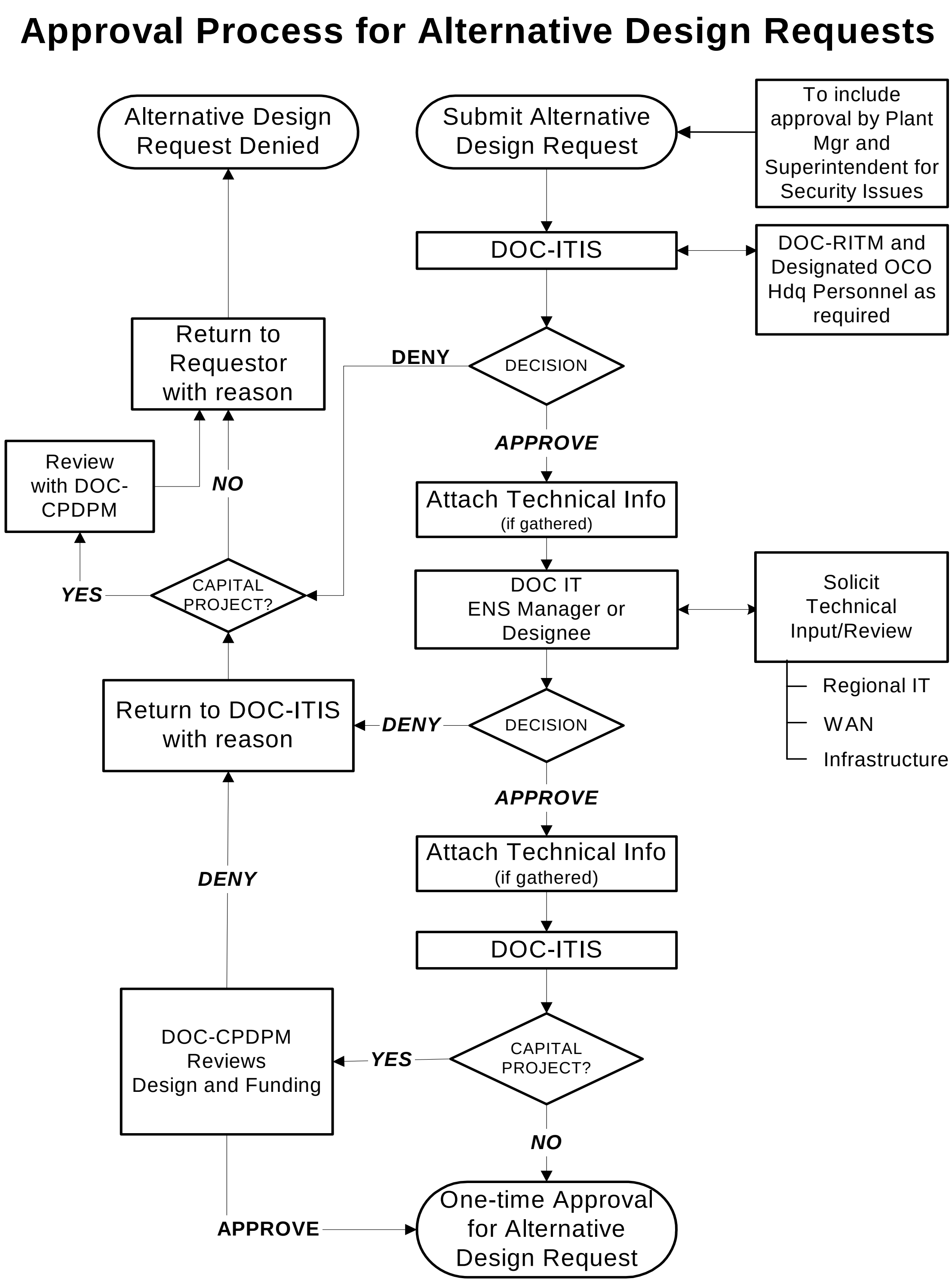
The request shall include a complete description of the proposed alternative design identifying:

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, including technical specifications, drawings, detailed materials list, product cutsheets, etc.;
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 contractor or personnel performing the construction;
8. A statement identifying the impact to the physical security of the DOC facility. The facility Superintendent, or a senior security officer designated by the Superintendent, must endorse this statement.

C. The Designer shall provide written comments proving the proposed alternative design will meet the applicable DOC system performance requirements, and identifying any performance limitations, drawbacks and benefits from using the alternative design.

D. The Designer shall be responsible for properly conducting the ADR process. For projects where the Designer is not the prime consultant, the prime consultant shall be responsible for properly conducting the ADR process, and shall participate in the process (review, acknowledge and address issues) to determine that DOC's requirements are met.

FIGURE 3.1 APPROVAL PROCESS FOR ALTERNATIVE DESIGN REQUESTS



3.4.4 PROCEDURES RELATED TO PROJECT PHASES

Telecommunications projects are typically conducted in phases. In addition to the requirements contained in the State of Washington *Conditions of the Agreement* and the *Instructions for Architects and Engineers*, Designers of telecommunications distribution systems for DOC facilities have the following phase-related responsibilities:

3.4.4.1 Schematic Design and Fieldwork

A. Telecommunications projects on existing DOC campuses shall require preliminary fieldwork to document the existing cabling and infrastructure systems into which the new cabling and infrastructure will integrate. DOC believes this information is vital to a successful project.

B. Prior to visiting the project site for any work at existing or new DOC facilities, the Designer shall meet with the DOC-ITIS and review the status of all existing telecommunications infrastructure and obtain all pertinent information regarding existing or pending projects to determine telecommunications design, construction, and installation limitations. This meeting shall include the DOC-RITM and DOC Plant Manager.

C. 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 Appendix 6.3.

D. 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 TR affected by or affecting the new project work.

E. The Designer shall also conduct a needs analysis to identify and describe the required features and functionality in the new telecommunications infrastructure.

This shall include the DOC-ITIS, DOC-RITM, DOC Plant Manager, and other DOC personnel as required.

F. 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.

G. Schematic Design documents shall show the following information:
- Building and local distribution
- Telecommunications Room sizes and locations
- Major distribution pathways
- Backboard locations

H. Upon completion of the Schematic Design documents, a complete set of documents shall be distributed to the DOC-ITIS and DOC-RITM, and the standard Design Review Process shall be conducted. The Designer and Architect shall resolve any issues raised by DOC-IT prior to progressing to the Design Development phase.

3.4.4.2 Design Development

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

B. During the Design Development phase, the Designer shall obtain the assistance of a SYSTIMAX® product representative to review the project specification (adapted by the Designer from the DOC Telecommunications Construction Guide Specification) to determine that the correct part numbers have been included for each SYSTIMAX® product in the specification. The Designer shall also verify that the part numbers for non-SYSTIMAX® 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, a complete set of documents shall be distributed to the DOC-ITIS and DOC-RITM, and the standard Design Review Process shall be conducted. The Designer and Architect shall resolve any issues raised by DOC-IT prior to progressing to the Construction Document phase.

3.4.4.3 Construction Documents

A. The Architect and Designer shall modify the design documents to address the IT 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, a complete set of documents shall be distributed to the DOC-ITIS and DOC-RITM, and the standard Design Review Process shall be conducted. The Designer and Architect shall resolve any issues raised by DOC-IT prior to progressing to the preparation of the Final Construction Documents.

D. The Architect and Designer shall modify the design documents to address the IT review comments received during the Construction Documents phase. Upon completion of the Final Construction Documents, a complete set of documents shall be distributed to the DOC-ITIS and DOC-RITM, and the standard Design Review Process shall be conducted. The Designer and Architect shall resolve any issues raised by DOC-IT.

E. The Architect and Designer shall modify the Final Construction Documents to address the IT review comments associated with the Final Construction Documents. The Architect and Designer shall provide the DOC-ITIS with revised/corrected Final Bid Documents that have resolved all issues raised by DOC-IT prior to the bidding phase rather than “by addendum.”

3.4.4.4 Bidding

On projects where a pre-bid walkthrough is held, the Designer 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 use of flex-conduit is prohibited.
- The installation of conduit under-slab or in-slab is prohibited.
- The existence of “rat walls”.
- The requirement for sweeps rather than bends and no more than two 90 degree sweeps in any conduit run.
- The fact that telecommunications standards are significantly different and more stringent than electrical installation requirements.
- The requirement to adhere to the detailed telecommunications pathway routing designs in the drawings “as specified”.
- The clearance requirements for OSP and ISP telecommunications conduit, cable, and equipment from sources of EMI.

3.4.4.5 Construction Schedules

A. Input from DOC IT, site operations personnel, and the designated security officer must be incorporated in developing the initial and on-going construction schedules. This input is especially important when an early or phased turn-up of buildings is required, but is also vital for the initial start-up of a new prison. Timing on the construction of the main telecommunications room and building and the backbone cable plant connecting it to key buildings would be a vital consideration in bringing key buildings online at required dates.

3.4.4.6 Construction Observation/Administration

A. Unless noted in writing by the DOC-CPDPM and the DOC-ITIS, the Designer shall perform construction administration through the Architect for DOC or as specifically noted, directly to DOC. The scope of construction administration shall cover all telecommunications and low voltage infrastructure as defined in the DOC TDIS.

B. The Designer shall confer with the DOC-CPDPM and the DOC-ITIS 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 projects and two site visits per week larger projects. The frequencies will likely change during construction as the telecommunications-related activity increases or decreases.
1. The Designer shall develop an agreed site visit schedule with the DOC-CPDPM and DOC-ITIS for each project.
2. The Designer shall review any proposed changes to the site visit schedule with the DOC-CPDPM and DOC-ITIS prior to changing the schedule.

C. The Designer shall hold a pre-construction meeting with the General Contractor (GC) and electrical contractor(s) responsible for installing telecommunications pathways. The Designer shall cover all of the typical problems related to GC and electrical firms not understanding the differences between electrical and telecommunications installations, and the need for coordinating the installation of telecommunications infrastructure with the other trades.

D. The Designer shall review the Contractor’s submittals required by the Construction Documents. When the Contractor’s submittals include materials or methods that deviate from DOC standards, the Designer shall either:
- Reject the specific materials and methods that do not comply, when the Designer believes they constitute undesirable solutions.
- Pursue the ADR process to seek approval for each specific material and method the Designer believes would constitute a better solution.

E. The Designer shall visit the construction site frequently to observe the construction quality and status. During the site visits, the Designer shall review all construction activity for compliance to the Construction Documents on the telecommunications infrastructure. **<u>This review shall include construction activity that appears to adversely affect the telecommunications infrastructure or violate the DOC TDIS</u>**. The Designer shall take digital photographs of existing and new telecommunications pathways, spaces and cabling, both intra-building and outside plant that are related to the project. In particular, the Designer shall photograph infrastructure that will later be concealed during the course of construction.

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

G. 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:

FIGURE 3.2 CORRECTIVE ACTION – OBSERVATION REPORT

Description of the issue:	
Applicable Requirements in the Construction Documents:	
Applicable DOC standards, industry standards and codes:	
Corrective options available to DOC:	
A	
B	
C	
Designer's Recommendation:	

H. The Designer shall submit the construction observation reports via email to the DOC-CPDPM and the DOC-ITIS 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 DOC in identifying potential problems early in the construction process.

I. The Prime Consultant shall ensure all "Request For Information" (RFI) documents related to and/or having a potential impact to the telecommunications infrastructure and the DOC TDIS are forwarded to the Designer for review and response. All RFI responses, as defined above, shall be in accordance with the requirements of this document, and a copy of the RFI with response shall be forwarded to the DOC-CPDPM and DOC-ITIS.

J. The Prime Consultant shall ensure all Change Order Proposals (COP) and Change Orders (CO) related to and/or having a potential impact to the telecommunications infrastructure and the DOC TDIS are forwarded to the Designer, the RCDD Review Consultant (when used), and the DOC-ITIS for review and response before being approved by the DOC-CPDPM.
- Note that all CO's shall only be approved by designated DOC management staff per the construction documents, typically the DOC-CPDPM or the DOC Plant Manager on some projects.
- Authorization for the General Contractor to implement a CO shall not occur prior to CO approval by designated DOC management.

K. 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:

TABLE 3.4 CABLE TEST REPORT – CONDITIONS TO BE ADDRESSED

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 per the DOC-specified requirements.	The report shall indicate that the cable passed the test per the DOC-specified requirements.
The Designer shall verify that the correct tests are conducted using the correct test criteria, and 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 correct tests are conducted using the correct test criteria, and the cable test report indicates the correct Nominal Velocity of Propagation (NVP) indicated on the cut sheet from the cable manufacturer. The headroom dB value shall be as defined in the TCGS documents.

L. Towards completion of the construction process, the Designer shall review the entire telecommunications installation for quality assurance and develop a final closeout punch list of corrections.

3.4.4.7 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.

a. Upon approval of the content in the Operation and Maintenance information, the Designer shall submit the information to DOC-RITM with written documentation to the DOC-RITM and DOC-ITIS indicating the Designer has reviewed the information and it appears to meet the requirements in the Construction Documents.

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

C. The Designer shall ensure the SYSTIMAX® 20-year warranty is delivered to the DOC-RITM with a copy to the DOC-ITIS.

4 DESIGN CRITERIA

A. The DOC TDDG is not intended to be a comprehensive design guide resource for telecommunications design at DOC facilities. The Designer shall look to the BICSI TDMM and CO-OSP for general design guidance which shall be refined by the DOC TDIS. The resulting Construction Documents shall also be consistent with the installation practices described in the BICSI Telecommunications Cabling Installation Manual (TCIM).

B. Where ANSI/TIA/EIA Standards or BICSI manuals offer multiple choices with a preferred method identified, and where the DOC TDDG 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 the current SYSTIMAX® Structured Connectivity Solutions (SCS) product line. The design documents shall require that the workmanship fully comply with the current SYSTIMAX® SCS Design and Installation guidelines and Performance Specifications.

- Telecommunications distribution pathways shall be designed and installed to be fully compliant for IEEE 802.3 Ethernet Gigabit cabling.

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

F. Architects, Engineers, and Designers shall ensure that all telecommunications distribution infrastructure for DOC projects shall fully comply with the current DOC TDIS, the current Washington State Department of Information Services (DIS) “Computing and Telecommunications Architecture Standards – Building Wiring”, the current ANSI/TIA/EIA Commercial Building Telecommunications Standards, and the National Electrical Code (NEC).

G. DOC’s prisons continually require expansion of both housing units and support buildings to meet the need of an increasing offender population. The Architect, Engineers, and Designer shall consider the future growth requirements for the facility when telecommunications infrastructure is designed for a project. Within the DOC campus areas affected by the current project(s), the main backbone telecommunications infrastructure shall be designed and sized to readily accommodate the identifiable future growth. Following are areas where this design criterion is most significant:

- *Backbone Distribution Systems*
- *Equipment Rooms*
- *Telecommunications Entrance Facilities*

To determine the size and design of telecommunications infrastructure to support the future growth, the Designer shall gather and review planning information about the facility from:

- Architect
- DOC CPD Project Manager
- DOC Superintendent
- DOC Plant Manager
- DOC-RITM
- DOC-ITIS
- Facility Master Plan (if one is available)
- DOC Capital 10-year Plan
- 2004 DOC Statewide Master Plan

For the current project(s), the Designer shall provide a telecommunications infrastructure pathway design sized to support the current project(s) with the capacity to economically support future buildings identified from the sources listed above that would obviously utilize the same pathway or portions thereof. The Designer shall review this information with all of the parties identified above and a joint decision by DOC shall be made for the design and size criteria for the telecommunications infrastructure on the current project(s) in areas such as:

1. Quantity of conduits in OSP ductbanks, including entrance facilities, and the size of maintenance holes (MH) to provide pathways for future buildings.
   a. The maximum number of conduits required to support the identifiable future growth should be included in the current project where funding is sufficient. If less than the maximum conduits are installed, the ductbank shall be constructed to allow the maximum number of conduits to be added at a later date with minimal impact, cost, and disruption to the facility.
   b. MH's shall be sized and located to accommodate the current and future conduit requirements up to the last MH needed for the current project(s).
2. Placement of ductbank pathways that avoid foundation footprints of future buildings.
3. Locations for MH's, not just to provide a pull point for the current project, but also located to provide a suitable entrance pathway for future buildings.
4. Size and layout of Equipment Rooms to accommodate all of the future growth identified above.
5. Design and construction methods used for the ER in the current project that allows future expansion with the least amount of expense and disruption to

the facility operations.

H. The DOC facility Superintendent or designee shall review and approve all telecommunications infrastructure designs and construction methods related to facility security. This shall include, but not be limited to the following:

- Bolt-down/lock-down lids for MH/HH's
- Security screws for faceplates
- Exposed ISP raceways styles and mountings

I. The following subsections are arranged to mirror the chapter sequence of the 9th Edition of the BICSI TDMM published in 2000 (the subsection numbers below are in the form of 4.x where x represents the chapter number in the BICSI TDMM). Note: The following subsections do not follow the chapter sequence of the 10th Edition.

- Each TDDG subsection contains commentary and requirements regarding the application of the BICSI TDMM to DOC Projects. In particular, each section contains limitations and prohibitions on specific materials and methods discussed in the BICSI TDMM.
- Where no TDDG subsection is written (addressing comments about or requirements for the corresponding TDMM subchapter) the Designer can assume that the TDMM subchapter applies as written.

4.1 GENERAL INFORMATION

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 DOC facilities, including additional DOC regulations as well as State of Washington RCW's and WAC's.

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 DOC facilities.

Other terms are defined in the Glossary located in Appendix 6.7 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 requirements listed below take precedence over the BICSI TDMM guidelines for telecommunications infrastructure at DOC facilities.

A. Horizontal telecommunications distribution pathways shall be designed and installed to be fully compliant for IEEE 802.3 Ethernet Gigabit cabling.

B. Architect, Engineers, and Designer shall provide Construction Document Drawings showing details of all horizontal telecommunications distribution systems and Building Automation Systems (BAS) where TDIS compliance is required for the BAS cabling pathway. This shall include <u>Main Equipment Rooms, Telecommunication Rooms, LVE and Security Electronics Rooms, Work Areas, **routing details for individual conduits and cable trays including elevations, details on junction boxes (placement locations, sizes, and types)**, telecommunication outlets (locations, sizes, and types), detailed layout of racks/cabinets in M-ER's, TR's, LVE and Security Electronics Rooms, etc.</u>

4.4.1 <u>HORIZONTAL PATHWAY SYSTEMS</u>

The design and installation practices for intra-building telecommunications pathways at DOC have some unique requirements beyond those normally applicable to commercial buildings. The requirements listed below are required to be included in the design documents for installation of intra-building telecommunications conduit in DOC facilities.

- The Designer shall also review the project with the Superintendent or designee to identify any additional security concerns for the horizontal pathways systems.

A. Secured Areas:
Unless specifically addressed below, shall be conduit inside ceilings and walls.

B. Slab on grade construction:
For the main floor in, "slab on grade constructed buildings", conduit will route in walls and ceilings, not in or under the slab.

C. Sources of Electromagnetic Interference (EMI):
All horizontal telecommunications cabling pathways shall comply with the separation distance specified in ANSI/TIA/EIA 568-B and 569-A, and Table 4.4 *ISP Telecommunications Clearances for EMI Reduction* found in Section 4.

D. Exposed Ceilings:
Use conduit or cable trays for construction of new buildings. In offender use areas (such as dayrooms, gyms, Correctional Industries operations, etc.), all exposed cable (including cable trays) shall be installed at a minimum of 16 feet high from the finished floor; else cable shall be installed in conduit.

E. Hard-lid Ceilings:
If sufficient access space and structural support for walking exists for both cable installation and maintenance personnel to achieve complete access, J-hooks or Caddy Bags can be used; else use conduit with pull/junction boxes appropriately placed in the ceiling with direct access from the floor below. Sufficient access is defined as both pre/post-construction to easily facilitate cabling moves, adds, and changes compliant to ANSI/TIA/EIA 568/569 Standards.

F. Suspended Ceilings (Accessible Ceiling Grid):
Use J-hooks, Caddy Bags, or cable trays only where cabling pathways are fully accessible from the floor below and where removable ceiling tiles are placed at a height of no greater than 11 feet above the finished floor.

G. Fiber Optic Cable:
Shall be installed within innerduct; both cable and innerduct shall be installed within conduit where the potential exists for damage by maintenance or other activity.

H. Surface Mounting:
Not allowed within high-risk secure areas. Use only where other options are limited. Where used, preference is plastic wire mold rather than conduit. Surface mounting requires an Alternative Design Request (ADR) with additional approval from the Superintendent or designee of a prison or work release facility.

I. Authorization of Exceptions:
Prepare an ADR as described in Section 3.4.3 and submit to the DOCITIS. If the DOC-ITIS approves, the request will be submitted for review and final decision to the designated OCO Headquarters personnel.

Notes:

1. All design and construction methods identified in the TDIS, ANSI/TIA/EIA Standards, and BICSI recommended practices shall be followed.
2. D-Rings shall "**not"** be used to support cable horizontally and are allowed only for vertical alignment of cables on walls and for cross-connect telephone wiring in M-ER's and TR's.
3. Wide-base J-hooks can be used where less than 40 cables are supported.
4. Caddy Bags shall be required in lieu of J-hooks where more than 40 cables are supported.
5. Designer shall specify radius cable support modules (waterfalls) wherever raceway terminations will result in a cable elevation drop to support the cable downward transition to eliminate stress and deformation of the outside cable sheath.

4.4.1.1 Sizing Considerations for Horizontal Pathways

A. The cable pathway shall be sized to support the initial installation of cable, plus a minimum of 25% growth.

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

4.4.1.2 Design Considerations for Conduit Distribution

A. Conduit runs shall not be designed using "multi-drop" or "daisy-chain" configurations.

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

C. 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.

D. Surface metal raceways and surface non-metallic raceways (e.g. Panduit, Wiremold) shall not be used in new construction or within high-risk offender areas.

E. DOC does not permit the use of any non-metallic conduit for horizontal pathways.

4.4.1.3 Conduit Capacity (Cable Fill)

A. Conduits shall not be filled with multiple cables beyond 40%. The Designer shall refer to the BICSI TDMM for general information regarding conduit capacity and fill. The Designer shall verify the outer diameter of all cable approved for use by DOC 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. The following table shows the quantity of cables that can be placed in a single EMT conduit, based on the current dimensions of Category 3 and Category 6 horizontal cables from SYSTIMAX®:

TABLE 4.1 EMT CONDUIT CAPACITY (CABLE FILL)

		CAT 3		CAT 5e		CAT6				OSP
		1010	**2010**	**1061**	**2061**	**1071E**	**2071E**	**1081**	**2081**	**1571**
Trade		**0.170**	**0.180**	**0.215**	**0.196**	**0.232**	**0.226**	**0.250**	**0.233**	**0.250**
Size	I.D. (in.)	**Max # of Cables per Conduit (@40% fill)**								
3/4"	0.824	9	8	5	7	5	5	4	5	4
1"	1.049	15	13	9	11	8	8	7	8	7
1 1/4"	1.380	26	23	16	19	14	14	12	14	12
1 1/2"	1.610	35	32	22	26	19	20	16	19	16
2"	2.067	59	52	36	44	31	33	27	31	27
2 1/2"	2.731	103	92	64	77	55	58	47	54	47
3"	3.356	155	139	97	117	83	88	72	82	72
3 1/2"	3.834	203	181	127	153	109	115	94	108	94
4"	4.334	259	231	162	195	139	147	120	138	120

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 DOC when existing conditions prevent the use of one-inch trade size conduit as a minimum conduit size.

4.4.1.4 Multidrop Conduit Systems

DOC does not permit the use of the Multidrop Conduit System as identified in the BICSI TDMM.

4.4.1.5 Pull Boxes (PB) for Conduits

A. Pull boxes shall be sized not less than the *Pull Box Table* in TCGS 16131 *Raceway and Boxes for Communication Circuits*. Note that this DOC table is down-sized from the TIA Standards and BICSI manuals for selection of standard Type I Wiring Troughs and has been approved by the SYSTIMAX® Regional Account Manager. The Designer shall review the DOC table sizes to ensure adequate bend radius for the cables anticipated for the current project and potential future needs.
   a. For horizontal cable, pull boxes shall be sized to accommodate future fiber to the desktop, typically using 2 – 4 strands.
   b. For OSP copper cable entering through the building, the largest pair size is typically 200 pair ANMW, and bend radius is ten (10) times the cable sheath O.D.

B. Outlet boxes shall not be used as pull boxes regardless of conduit size. Outlet boxes do not adequately accommodate the newer, larger diameter CAT-6 cables and are far too undersized to accommodate fiber to the desktop.

C. Pull boxes shall be designed for access doors to open from the area where the cable installer will normally work. For ceiling installations, this is typically from the bottom (floor) side of the box.

D. Ceiling access to the pull box shall be designed to allow full access to the pull box cover/door and adequate working room for both the installation personnel and proper looping of the cable during installation. In hard-lid ceilings, the access cover (or pull box door if exposed) shall be lockable when installed in a secured area.

4.4.1.6 Access Floors

DOC's design criterion requires placement of telecommunications cables above equipment racks on cable runways and placement of electrical cables in the access floor space. An ADR is required if it is desired to place both at the same level. DOC requires electrical power circuits to be placed in rigid steel conduit and maintain adequate separation (according to Section 4.18 *Electromagnetic Compatibility* of this document) to reduce EMI.

4.4.1.7 Ceiling Distribution Systems

A. When considering the possibility of designing a non-conduit ceiling distribution system in DOC 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 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.

4.4.1.8 Cable Tray Design for Ceiling Systems

The Designer shall obtain written authorization from the DOC-ITIS to consider use of cable trays. Lay-in Type I wiring troughs shall typically not be used for ceiling distribution pathways, except for pull boxes in conduit distribution systems. Cable trays shall not be shared with power cables and shall maintain the minimum separation distances required by DOC. Each cable tray section shall be bonded. The Designer shall ensure a minimum of 12 inch headroom access is maintained above cable trays.

4.4.1.9 Distribution from Ceiling Systems – Utility Columns

DOC requires that utility columns used for both telecommunications and power distribution be metallic and be equipped with a solid metallic barrier for a complete separation of the electrical and telecommunications cables and outlets.

4.4.1.10 Poke-Thru

Poke-thru distribution is not recommended by SYSTIMAX® and is not acceptable in DOC-owned facilities.

4.4.1.11 Modular Furniture

Where telecommunications cables will be routed through modular furniture, the Designer shall ensure the telecommunications cable has a separate pathway from electrical cable. The two pathways shall be separated by a metallic barrier and the metallic barrier shall be bonded to ground. The separation distance between telecommunications and electrical cables shall be maintained as indicated in the table titled *"ISP Telecommunications Clearances for EMI Reduction."*

4.4.1.12 Wet Locations

A. Wet locations include areas such as slab-on-grade construction, where pathways are installed under slab 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 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.
   - Alternative Design Requests to route pathways through wet areas will not be accepted.

4.4.1.13 Correctional Industries

A. The telecommunications substructure supporting Correctional Industries (CI) locations shall be designed and installed to provide maximum flexibility to meet the various needs of CI and of the private companies who operate in CI locations as tenants.

B. The horizontal telecommunications pathway supporting Correctional Industries (CI) locations shall be designed and installed to provide maximum flexibility. CI locations are usually inside the secured area, are frequently “warehouse” style buildings with some having multiple independent bays for separate, individual private companies. The Designer shall apply the following guidelines when planning the horizontal telecommunications pathways for CI locations:

1. DOC Policy 280.925 "Offender Access to Electronic Data" governs the use of Information Technology by offenders at DOC locations. The Designer shall review all telecommunications infrastructure designs for Correctional Industries with the DOC-ITIS to insure full compliance with the requirements of the DOC policy and IT guideline. The final design shall be approved by the local Superintendent or designee.
2. The Designer shall include horizontal pathway to and within CI locations in the design documents. The Designer shall request direction from DOC regarding the requirements for telecommunications infrastructure serving CI locations on a case-by-case basis.
3. All low voltage infrastructures installed for CI and their vendors shall be in full compliance with the DOC TDDG.
4. Telecommunications infrastructure in CI locations shall be sized to allow a minimum of 25% growth. Where industry buildings house separate manufacturing bays, the calculation for the growth shall be a minimum of 25% growth per bay. The potential also exists for CI to establish a Call Center at any of their locations. The Designer shall take this into consideration when sizing the horizontal telecommunications pathways.
5. All telecommunications distribution equipment shall be in a lockable telecommunications room or lockable steel telecommunications cabinet.
6. TR’s serving CI locations shall be provided with additional vacant egress pathways (such as sleeves) to accommodate future changes to the telecommunications cabling due to the higher rates of tenant turnover expected in these locations.

4.4.2 <u>HORIZONTAL CABLING SYSTEMS</u>

4.4.2.1 General

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

- DOC has standardized on the SYSTIMAX® Structured Cabling System product line for telecommunications infrastructure. Therefore, telecommunications infrastructure designs and specifications shall be based upon the SYSTIMAX® Structured Cabling System.

B. For the purposes of this document, references to Category 6 cable in this document shall be interpreted as SYSTIMAX® GigaSPEED cable. The Designer shall check with the DOC-ITIS to determine the specific SYSTIMAX® cable products that shall be used for the project.

C. The basic configuration for providing telecommunications infrastructure to work areas is to provide three 4-pair cables. A work area shall be defined as an area large enough to place a desk or cubical for a staff person, measured as an 8 ft by 10 ft area (80 square feet). Offices that can accommodate more than one staff shall be configured accordingly, even though the "current" plan may be for only one desk. There are many situations that require more or less cables than the basic configuration, for example:
- A wall mounted telephone location might need only one cable.
- A particular work area might require five cables to support two computers, telephone, printer, and fax machine.
- Additional cables shall be provided to accommodate LAN-attached printers, fax machines, and other devices.
- Some Correctional Industries staff require two PC's, one for accessing the DOC Administrative LAN and a second for access to the physically separate CI LAN (considered to be an Inmate LAN).

D. Providing spare outlets in work areas and spare outlets in most rooms are encouraged within the limitations of the project budget to meet projected future needs – cabling installed during projects or multiple drops installed at the same time are less expensive than one drop at a time at a later date.

E. At the time of publication of this document, DOC IT security staff have no projections as to when or if wireless LAN (WLAN) technology will be sufficiently secure to allow use for DOC Administrative LANs. Unless specifically directed by the DOC-ITIS, wireless access points will not be engineered and installed as part of the horizontal cabling system.

F. Generally, the eight-position pin/pair assignment for new cabling in new construction shall be the <u>T568-B configuration</u>. The T568-A configuration shall only be used in the following two cases (but only after receiving written approval from the DOC-ITIS):
1. For new cabling in a new building on an existing site, where the T568-A configuration is used everywhere else throughout the entire campus.
2. For new cabling added to an existing building, where all of the existing cabling is T568-A which is to remain in operation and where the T568-B configuration does not exist anywhere in that building.

G. Outdoor-rated waterproof cable will not be allowed in horizontal cabling applications without an approved ADR.

H. Designer shall review areas where higher room temperatures will occur and adjust the permanent link distance accordingly.

- ANSI/TIA/EIA 568-B.2-1 Annex G: "Temperatures above 20° C/68° F need to have permanent link length of 90 M de-rated."

4.4.2.2 Horizontal Cable to Support Data Applications

A. At DOC 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.

B. Horizontal distribution cable to support data applications (and all other low voltage systems that are capable of operating with 22-24 AWG copper cabling) shall be SYSTIMAX® GigaSPEED 4-pair Category 6 cable in new installations.
   1. Refer to Figure 4.2 for additional information.
   2. Horizontal Category 6 GigaSPEED cables shall be terminated at the work area (WA) end with SYSTIMAX® GigaSPEED information outlets. The outlets shall be colored yellow unless the facility has a different pre-established color code for Category 6 outlets.
      a. In all cases, Category 6 outlets shall be of a color that is different from existing outlets with other cable categories such as CAT 3, 5, or 5e.
      b. For new construction, there shall be no distinction made for voice or data at the WA regarding cable type or color, outlet type or color, or labeling.
   3. Horizontal Category 6 GigaSPEED cables shall be terminated at the telecommunications room (TR) end onto rack-mounted SYSTIMAX® Category 6 PATCHMAX GigaSPEED patch panels designated for reference as "Work Area Patch Panel" **(WA-PP)**.
      a. The HC between the WA-PP and LAN equipment shall be made with a CAT 6 patch cord.
      b. Designer shall confer with the DOC-RITM or designee to determine the color of patch cords, which may be the same or different color from that used for HC voice cords. Green patch cords shall only be used for inmate LAN connections.
      c. The WA-PP shall be separate from, but adjacent to the Administrative Voice horizontal cross-connect patch panel (**Adm-HC-PP**) – refer to the Section 4.4.2.3 for additional information.

C. In existing buildings, where additions are made to an existing Category 5 or 5e installation, the additions shall be made using SYSTIMAX® Category 6 cable and matching components unless directed otherwise by the DOC-ITIS. The Category 6 cable sheath shall be of a color that is different from other existing cable that is less than Category 6.
   1. <u>Category 5</u> cable and components shall not be purchased or installed.
   2. Existing DOC 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.
   3. Category 6 cables shall be terminated at the work area end with a SYSTIMAX® GigaSPEED information outlet. The outlet shall be colored yellow 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.
   4. Where only two or three new cables are required, Category 6 GigaSPEED

cables may be terminated at the TR end on existing Category 5/5e patch panels or existing model 1100PSCAT5e Modular Patch Panels if those patch panels have existing ports available for the new cabling.

5. Where more than three new cables are required or where there is insufficient existing port availability on existing Category 5/5e patch panels, the DOC-ITIS shall be contacted for specific direction on a case-by-case basis.
6. All newly purchased patch panels shall be Category 6 SYSTIMAX® GigaSPEED PATCHMAX.

D. **Under no circumstances will the splitting of cable pairs be allowed** on either side of the information outlet or either side of the outlet panel or patch panel.

1. External line splitting devices shall not be used for cables connecting data devices.
2. Where existing split cable pairs are encountered, they shall not be used and the local IT staff, DOC-RITM, and DOC-ITIS shall be notified immediately. Any data device connected to split cable pairs shall be moved to cables that are not split.
   a. If sufficient cable service slack is available, the split portion of the cable shall be cut back to the cable sheath and re-terminated.
   b. If insufficient cable service slack is available, new cable shall be ordered immediately to replace the existing damaged cable. The damaged cable shall be completely removed for compliance to the NEC requirement on "abandoned cable."

4.4.2.3 Horizontal Cable to Support Administrative Voice Applications

A. Horizontal distribution cable intended to support voice services at prisons for new installations or major renovations shall follow the exact same requirements in the previous Section titled: *Horizontal Cable to Support Data Applications.*

B. A second, separate rack-mounted modular patch panel designated for reference as "Administrative Voice Horizontal Cross-connect Patch Panel" **(Adm-HC-PP)** shall be included for routing voice connections from the WA-PP.

1. Refer to Figure 4.2 for additional information.
2. The Adm-HC-PP should be a CAT 5 or 5e grade patch panel for cost savings, although a CAT 6 panel could be used.
3. The Adm-HC-PP shall be separate from, but adjacent to the WA-PP.
4. The Adm-HC-PP shall be labeled: "Adm-HC-PP."
5. The Designer shall confer with the local DOC staff supporting the facility telephones to determine if the connections on the rear of the panel should be the modular 25-pair female 525 connector style or IDC punch down style.
   a. Where no preference is given, use the 25-pair female 525 connector style.
6. The connection between the WA-PP and Adm-HC-PP shall be made with a CAT 6 patch cord.
   a. The Designer shall confer with the DOC-RITM or designee to determine the color of the patch cords, which may be the same or different color from that used for data connections. Green patch cords shall only be used for inmate LAN connections.
7. Refer to Section 4.5.4.2.1 *Administrative Voice Backbone Cabling* for

additional connection information.

C. Minor quantities of additional horizontal distribution cable to support voice services in existing prison buildings where the majority of existing voice cable is Category 3 shall be SYSTIMAX® 4-pair Category 3 cable. Most DOC leased facilities can also use SYSTIMAX® 4-pair Category 3 cable for voice applications, but the DOC-RITM shall make this determination.

1. Category 3 horizontal distribution voice cables shall be terminated at the backboard in the Telecommunications Room on SYSTIMAX® 110 Wiring Blocks using 110C-4 Connecting Blocks. Rack-mounted 110 Wiring Blocks can be used for small buildings and for wall-mounted cabinets.
2. Category 3 horizontal distribution voice cables shall be terminated at the work area end into ivory colored SYSTIMAX® type M1BH/1 Modular 8-position, eight 8-conductor information outlets.

D. **Under no circumstances will splitting of horizontal cable pairs be allowed** on the horizontal cabling side between the information outlet and the 110 block or patch panels. Splitting of cable pairs degrades the performance of all pairs in the cable and voids the SYSTIMAX® warranty.

1. To support an additional telephone at a work area on existing cable, plug an external line-splitting device into the information outlet on the faceplate side at the work area and connect additional cross-connect wires to the appropriate pins on the 110 connecting blocks in the TR and/or ER.

4.4.2.4 Horizontal Cable to Support Inmate Voice Applications

Horizontal distribution cable to support inmate telephones shall be SYSTIMAX® 4-pair Category 3 cable. Higher pair count cables may be used to serve banks of telephones, as appropriate. Inmate telephone services do not run through a DOC PBX. In new installations, and wherever possible at existing facilities, all cables (both ISP and OSP) supporting inmate telephone service shall be separate cables (separate sheaths) from cables supporting other telephone or data services in the facility.

A. Category 3 horizontal distribution cables for inmate telephone service shall be terminated at the TR on 110 Wiring Blocks that are physically separated from the 110-blocks used for prison administration telephone wiring. The Designer shall confer with local DOC Intelligence & Investigations (I&I) personnel to determine whether the circumstances in the local Inmate Telephone Equipment Room (ITER) will require that the 110 blocks and BEPs be enclosed in lockable cabinets.

B. Typically, the work area (telephone) end of inmate telephone cables will not be terminated by the cable installer. The inmate telephone service provider typically terminates these cables directly into the telephone sets. The Designer shall verify this information with the local DOC person responsible for the inmate telephones.

C. If any modular information outlets are used for Inmate Telephone terminations, they shall be colored green.

D. The Designer shall coordinate with the DOC facility security representative to identify locations for inmate telephones and mounting structures for each location.

4.4.2.5 Patch Cords

A. Patch cords shall be SYSTIMAX® factory manufactured patch cords. Patch cords shall be certified by the manufacturer to match the cable type used in the horizontal distribution with backward compatibility.

B. <u>The Designer/Installer shall ensure the combined length of all copper patch cords within each channel shall not exceed 33 feet unless the “maximum” horizontal link length is reduced accordingly.</u>

C. Category 3 horizontal cables shall use a Category 3 or better patch cord.

D. Category 6 GigaSPEED patch cords shall be used with all other horizontal cabling, regardless of the “category” of the horizontal cabling.

E. Field terminated patch cords are not acceptable and shall not be used. Any existing field-assembled patch cord used in areas affected by a project shall be replaced under the project with factory assembled Category 6 patch cords.

F. Patch cords shall not be used in lieu of installing horizontal cable and outlets. Patch cords shall not be installed or routed into ceiling or plenum spaces or over walls.

G. Where the SYSTIMAX® Visi-PATCH system is approved via the ADR process and installed, only SYSTIMAX® factory-manufactured 110 Visi-PATCH patch cords shall be used. Visi-PATCH cords with less than 4-pairs of wire are available from SYSTIMAX®.

4.4.2.6 Horizontal Cabling to Support Correctional Industries

The telecommunications infrastructure supporting Correctional Industries (CI) locations shall be designed and installed to provide maximum flexibility. The following requirements shall be followed when planning the telecommunications cabling for CI locations:

A. The Designer shall include voice and data cabling to and within CI locations in the design documents. The Designer shall request direction from DOC and CI management regarding the requirements for telecommunications infrastructure serving CI locations on a case-by-case basis.

B. The Designer shall ensure that designated CI management (identified by the DOC-ITIS) shall approve the final telecommunications design for all CI areas.

4.4.2.7 Horizontal Cable to Support Low Voltage and Building Automation Systems

A. During planning for intra-building telecommunications cabling installations, the A/E's shall work with the Designer to support power limited (low voltage) and building automation systems (BAS) with the common structured cabling system as directed in Section 4.21 *Building Automation Systems* of this document.

B. Low voltage systems that are capable of using a common structured cabling system (either backbone or horizontal cabling) shall be designed to use the SYSTIMAX® Structured Cabling System cable and termination hardware.

C. The Designer shall request from the A/E's a list of systems that will require telecommunications outlets for operations. The Designer shall then include outlets in the design as necessary to meet the listed requirements.

4.4.2.8 Horizontal Cable - Service Slack

The Designer shall ensure cables are installed and terminated properly, including proper cable service slack at both ends, per ANSI/TIA/EIA Standards, BICSI practices, and the requirements specified in TCGS *Section 16740 - Inside Plant Communications Circuits.*

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-OSP, and the *Installing Backbone Pathways* section of the BICSI TCIM for general information regarding the design of backbone distribution pathway and cabling.

The backbone distribution system shall be designed to fully comply with both the NEC and NESC.

Within the DOC-owned campus areas affected by the current project(s), the Designer shall design and size the DOC telecommunications backbone distribution system to readily accommodate the future growth requirements for the facility as determined per Section 4.G of this document.

The requirements listed below take precedence over the BICSI TDMM, the BICSI CO-OSP, and the BICSI TCIM guidelines for telecommunications infrastructure at DOC facilities.

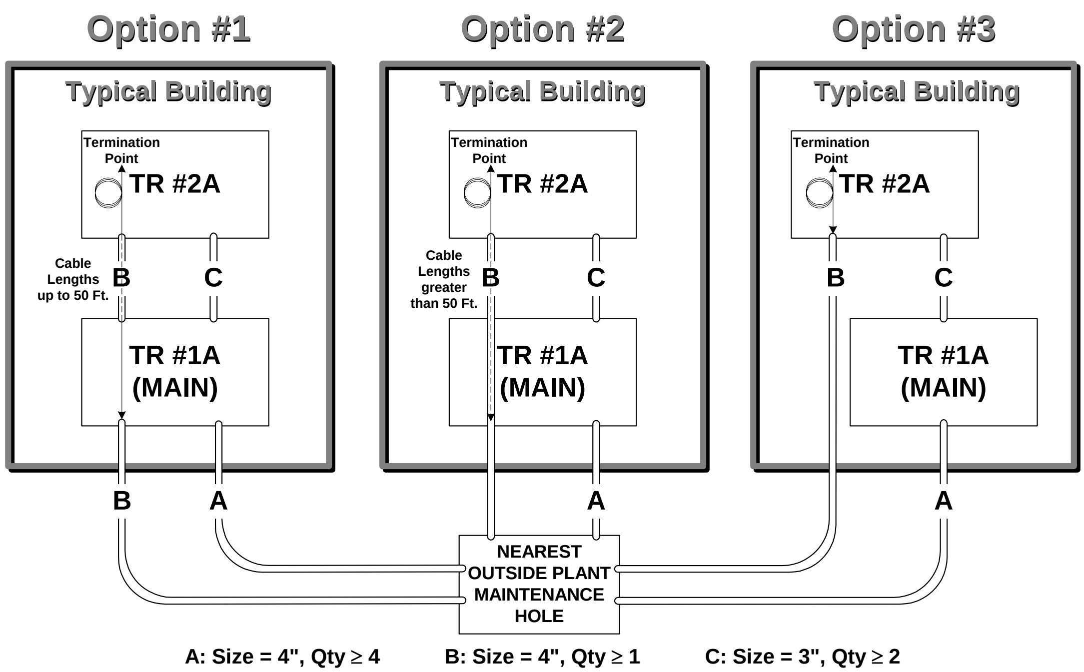
A. Backbone telecommunications distribution pathways shall be designed and installed to be fully compliant for IEEE 802.3 Ethernet Gigabit cabling.
B. Sweeps in backbone telecommunications pathways shall meet or exceed TIA radius requirements.
C. All backbone cables shall be designed for installation with a minimum 25 foot service slack loop near each end of the cable within the room where the cable terminations are made.
D. All fiber optic backbone cables, in addition to *"C."* above, shall be designed for

installation with a minimum 10 foot service slack within the fiber termination cabinet/shelf.

4.5.1 BUILDING ENTRANCE & 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.

FIGURE 4.1 ENTRANCE AND INTRA-BUILDING BACKBONE 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 secondary TR) is to pass through the main TR to reach a secondary TR.
- When the cable length (including 25 ft. service slack 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 Main TR without terminating or being spliced. While it is permitted for the cable in the Main TR to exit the conduit on one wall and re-enter conduit on another wall, the only termination for the cable is in TR #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 secondary TR) is to pass through the main TR to reach a secondary TR.
- 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 slack loops).

Please note that the cable remains inside conduit “B” while it passes through the Main TR without terminating or being spliced. The cable then terminates in TR #2A.

Option #3 applies when the most desirable route (between the nearest outside plant telecommunications maintenance hole and a secondary TR) does **not** pass through the main TR to reach a secondary TR.

The following requirements apply to the above three options:

A. DOC requires a minimum quantity of four trade size 4” entrance conduits connecting the main TR in each building with the OSP conduit system (typically with the nearest OSP telecommunications maintenance hole.) (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.)

1. All conduits used for cabling shall be fitted with innerducts except where one cable results in maximizing the 40% fill limit (note that a 53% fill is allowed when conduit contains only one cable). Conduits not initially identified for installation of cable do not require innerduct.
2. Typically, at least one of the four conduits shall be fitted with a full set of fiber optic innerducts. DOC’s default standard for innerducts is three 3-inch 3-cell MaxCell® packs (totals 9 innerduct paths) or an alternative four 1 ¼” HDPE innerducts. The actual size and quantity of innerducts shall be determined by the Designer based on the quantity and size of cables that will be installed to the building.
3. All conduits and innerducts shall be equipped with pull ropes.
4. In all cases, the design shall provide for sufficient quantities of trade size 4” conduit to accommodate all low voltage services and BAS planned for installation plus a minimum of either 25% growth capacity or one spare trade size 4” conduit (whichever is larger), but not less than four trade size 4” entrance conduits.
5. The Designer can recommend (via the Alternative Design Request process) a smaller quantity of entrance conduits for very small buildings where four conduits might not be economically justifiable. A minimum quantity for very small buildings approved through the ADR process shall typically never be less than two trade size 4” entrance conduits.

B. Any secondary TR’s in a building shall be provided with a minimum of one trade size 4” conduit that runs from the OSP conduit system (typically from the nearest OSP telecommunications maintenance hole). (See the conduits labeled “B” in the diagram above, each representing one or more conduits routed between a secondary Telecommunication Room in the building and the nearest outside plant telecommunications maintenance hole.)

1. Above items A.1 through A.3 apply.

C. Any secondary TR's in a building shall also be provided with at least two trade size 3" conduits from the main TR. (See the conduits labeled "C" in the diagram above, each representing two or more conduits routed between the Main Telecommunication Room in the building and another TR in the same building.)

4.5.2 INTRA-BUILDING BACKBONE CABLING

A. DOC requires each TR in each building be provided with non-spliced fiber optic backbone cabling that is directly connected to the Main Equipment Room at the site via the outside plant pathway infrastructure.
   1. In some designs an ADR can be submitted for review/approval to allow secondary TR's in a building to connect back only to the main TR in the building. This alternative design still does not allow splicing of the backbone fiber optic cable, but does allow riser fiber optic cable to be installed between the main and secondary TR's, connected to fiber optic patch panels.
      a. However, this requires an additional assessment and approval by the DOC-RITM to determine if the LAN switch design can accommodate one or more secondary TR's in the building.

B. Generally, the OSP copper backbone cables from the Main Equipment Room at the site will terminate in the main TR of a building. Copper backbone cabling for voice applications should then be routed from the main TR in a given building to secondary TR's 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, low voltage, and BAS cabling systems at DOC facilities as identified in Section 4.21 *Building Automation* Systems of this document.

B. The telecommunications distribution pathway system shall be designed so that conduits, maintenance holes, handholes, or tunnels are not shared with the electrical power distribution system or steam distribution system.

C. The Designer shall not assume that existing, open pathways are necessarily available for use by the current project. The Designer shall inquire about the potential for future buildings, building expansions or other projects that may depend on using existing pathways as described in Sections 4.G and 4.5 of this document. Existing pathways to buildings shall not be used for the current project unless sufficient space is left for growth as indicated above plus an additional 25%.

D. In addition to the requirements of the current project, where new pathways are required, the Designer shall inquire about the potential for future buildings, building expansions or other projects as described in Sections 4.G and 4.5 of this document. Where future building areas would utilize the telecommunications pathways called out for the current project, the Designer shall accommodate those telecommunications pathway requirements within the design of the current project by increasing the current project's pathway sizes accordingly.

E. DOC requires a common telecommunications ground to be established in telecommunications ductbanks by installing a copper ground cable adjacent to the outside of the conduit in all telecommunications ductbanks.
   1. The telecommunications ground cable shall bond to the grounding system of all maintenance holes and handholes that are part of the ductbank, and grounding collars of all metallic conduits in the ductbank.
   2. Where conduit feeds into buildings, the ground cable shall be bonded to the electrical service ground of each building or other methods as appropriate per code.
      a. <u>The Designer shall review Section 4.17 *Grounding Bonding and Electrical Protection* of this manual to determine possible exceptions for the connections of the ground cable.</u>

F. For main distribution pathways, the maximum number of conduits required to accommodate the future growth requirements for the facility as determined per Section 4.G of this document shall be installed between maintenance holes, plus a minimum of 25%.
   1. Main distribution pathways shall be defined as all telecommunications ductbanks starting from the Main Equipment Room (M-ER) to the nearest maintenance hole(s), and between every maintenance hole serving multiple buildings (current and future), but not necessarily including the pathway to individual buildings.
   2. Buildings designated as Secondary Equipment Rooms (S-ER) shall be considered the same as the M-ER above for main distribution pathway design.

G. DOC requires 4" trade-size Schedule 40 PVC for all outside plant pathway, with the exception of transitions to RGC or PSC where specifically stated or where required to reduce EMI problems as defined in Table 4.2.
   1. Multiple-cell conduit shall not be used.
   2. DOC "prefers" to limit the number of 90 degree sweeps between pull points to one (1), and the maximum number of pull points shall not exceed two (2).
   3. Designer shall ensure construction documents identify all conduit pathway elevations to reflect <u>an installed slope of at least 4 inches per one hundred (100) feet in general and ¼ inch per foot where possible</u>.

i. Slope of conduit shall be downwards away from all building entrances/upwards towards buildings from MH/HH per 2002 NEC 800.12(C).
ii. Slope conduit toward lower MH/HH or from high points toward MH/HH at both ends.
iii. Conduit shall not have a section lower than the elevation of the lowest conduit opening (no concave sections).

4. The Designer shall ensure that while the outside plant pathway is exposed, the Designer and a DOC field representative (designated by the DOC-ITIS) shall observe the OSP conduit to ensure all installation requirements have been addressed.
   a. Upon identifying any problems, the Designer shall take immediate steps through the proper construction procedures to stop the ductbank fill activity until the problems are corrected.

H. The top conduits of campus distribution ductbanks shall be placed a minimum of 30 inches below finished grade. Where this minimum depth cannot be achieved due to physical constraints, approval for burial at an alternative depth may be requested through the ADR process.
1. The Designer shall specify that conduit first be installed in the lowest available MH/HH duct entrances, working up as additional conduits are required.
2. Where less than the maximum number of conduits are installed in main distribution pathways, conduits shall be installed at an elevation sufficiently low enough to allow the maximum number of additional conduits (up to the number of MH duct knockouts or the maximum number of conduits required to accommodate the future growth requirements, whichever is greater) to be installed above them at a later date and still maintain 30 inches below finished grade.
   a. The Designer shall ensure the depth of MH's are sufficient to accommodate the required depth of the conduits below finished grade.

I. Conduits shall be placed into pre-defined ducts in the wall sections of a MH/HH and shall not be placed into the designated top or bottom sections of a MH/HH. Where pre-defined ducts are available in the wall sections of a MH/HH and yet core drilling is determined to be the best entrance into a MH/HH, an ADR shall be required for approval of core drilling.

J. The Designer shall determine where construction equipment and vehicular traffic may occur in relation to both new and existing telecommunications ductbanks for projects, and specify appropriate action to protect the ductbanks from damage during construction and after construction.
1. This determination shall include communications with the architectural design team, including the DOC Plant Manager and the DOC-CPDPM.
2. Given that telecommunications ductbanks are often constructed prior to other building and utility construction activities, careful consideration shall be given as to their placement and design, including existing ductbanks, to properly address any negative, destructive effects from live loads of construction equipment and vehicular traffic both during and after construction activities throughout the life of the ductbank.

3. The Designer shall determine if barriers are required to keep construction equipment and vehicular traffic away from ductbanks until after the construction period when designated roadways are available, and if additional protection such as steel plates are required to reduce live load impact.
4. The Designer shall readdress these issues with the DOC Plant Manager and DOC-CPDPM at the close of the construction project regarding the use of heavy equipment in the proximity of the ductbanks for maintenance activities and future construction projects.

K. Where conduit is placed beneath any form of vehicular traffic (i.e., drives, roadways, parking, construction or maintenance equipment accesses, etc.) or where a sweep is placed in the conduit system, OSP conduit shall be encased in concrete. The Designer shall determine the required thickness of concrete encasement based on the depth of the conduit and anticipated live loads. The concrete encasement shall be no less than a minimum of 3 inches on all four sides and with a minimum compressive strength of 2500 psi.
1. The Designer shall ensure the Contractor is made aware that prior to the concrete encasement pour, the Designer and a DOC field representative (designated by the DOC-ITIS) shall observe the OSP conduit installation to ensure all installation requirements have been addressed.
   a. Upon identifying any problems, the Designer shall take immediate steps through the proper construction procedures to stop the concrete pour until the problems are corrected.

L. Conduit designated for routing telecommunications service provider entrance cables shall be installed per the service providers' requirements, generally 36 to 48 inches below finished grade from the property line into the building to the demarcation point. The Designer shall consult with all DOC-identified service providers and incorporate their requirements into the ductbank design for the Entrance Facility.

M. OSP conduit shall transition from PVC to PSC (PVC-coated, rigid steel) conduit when it enters a 10-foot zone of circumference around a building foundation and shall route from that point to the building Entrance Facility. 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.

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

O. The telecommunications distribution pathway shall maintain the minimum separation clearance distance from the electrical power distribution system as required by the table below:

TABLE 4.2 OSP CONDUIT CLEARANCES FOR EMI REDUCTION

Outside Plant (OSP) Conduit Clearances for Electromagnetic Interference (EMI) Reduction		
Ref #	**Electrical & Telecommunication Conduits *Crossing Perpendicular* - Regardless of Voltage/Current**	**Min. Separation**
1	Electrical and Telecom conduits both RNC. See Notes 1, 2, 3, and 6.	48" (4 ft)
2	Electrical or Telecom conduit RGC/PSC (**one must be metallic**). Extend RGC/PSC conduit a min. of 5 ft. on both sides of intersect. See Notes 1-6.	12" (1 ft)
Ref #	**Electrical & Telecommunication Conduits *Running Parallel* - Regardless of Voltage/Current**	**Min. Separation**
3	Electrical and Telecom conduits both RNC. See Notes 1, 2, 3, and 6.	60" (5 ft)
4	Electrical or Telecom conduit RGC/PSC (**one must be metallic**). See Notes 1-6.	12" (1 ft)
5	Electrical and Telecom conduits both RGC/PSC (**both in metallic)**. See Notes 1-6.	12" (1 ft)
Ref #	**Telecommunication Conduits *Running Adjacent to Electrical Transformer* - Regardless of Voltage/Current**	**Min. Separation**
6	Telecom conduit RNC. See Notes 1, 2, 3, and 6.	84" (7 ft)
7	Telecom conduit RGC/PSC (**must be metallic**). Extend RGC/PSC conduit a minimum of 10 ft. beyond footprint of transformer. See Notes 1-6.	36" (3 ft)

Notes:	
1)	NESC 2002 Corrected Ed., Section 097.F, 20 ft setback supersedes above distances.
2)	Conduits surrounded & separated by well-tamped earth/sand per DOC TDIS 16108.
3)	#2 bare copper ground wire in entire length of telecom duct bank per DOC TDIS 16108.
4)	Grounding collars required on metallic telecom conduit & bonded per DOC TDIS 16108.
5)	Metallic conduit properly grounded per NEC and NESC.
6)	Where conduit encased in concrete, add concrete thickness to separation distance.

4.5.3.2 Maintenance Holes and Handholes

A. In addition to the requirements of the current project, where new maintenance holes and handholes (MH/HH) are required, the Designer shall inquire about the potential for future buildings, building expansions or other projects as described in Sections 4.G and 4.5 of this document. Where future building areas would utilize telecommunications pathways and MH/HH's called for in the current project, the Designer shall accommodate those telecommunications pathway requirements within the design of the current project by sizing the MH/HH accordingly and specifying locations appropriately to accommodate the future buildings.

B. DOC's design criteria does not allow for splices in backbone fiber and allows splices in backbone copper only through an approved Alternative Design Request. However, when sizing OSP telecommunications maintenance holes and handholes, the Designer shall size MH's with sufficient space for potential future splice cases (for example, as a temporary, emergency repair for cable damage).

C. Telecommunications MH/HH's shall be placed in outside plant conduit runs at a preferable interval of every 450 feet, but no greater than every 600 feet, and preferably with only one 90 degree bend in between. The following rules apply to maintenance hole/handhole design:
1. A conduit exiting a MH/HH shall be aligned opposite the wall and at the same elevation where it entered the maintenance hole or handhole.
2. Conduit shall be installed in the lowest available ducts in the maintenance holes or handholes working up as additional conduits are required.
3. Conduits shall be placed into pre-defined ducts in the wall sections of a MH/HH and shall not be placed into the designated top or bottom sections of a MH/HH.
4. Designers shall use conduit sweeps outside of MH's for 90 degree bends of cable direction rather than inside of MH's wherever possible, especially during new construction. This practice leaves more room inside MH's for future, additional cabling requirements.

D. The Designer shall establish the elevations of MH/HH's and ductbank slope **<u>in relation to finished floor elevations of TR's and ER's</u>** to assure no ingress of water to buildings. The Designer shall ensure all telecommunications duct banks have the appropriate **<u>downward slope of 4" per 100 ' away from the buildings towards the MH/HH</u>**, and the **<u>MH/HH elevation is set where the highest possible water level inside the MH/HH (at the MH/HH lid level) shall not allow ingress of water to the TR or ER</u>**; this shall include analysis of hydraulic pressure by the Designer.
1. Sump pumps in a MH/HH and/or water-tight duct plugs shall not eliminate the requirements stated above and <u>shall not be the sole means of preventing water ingress to a building in lieu of proper conduit elevation and slope</u>.
2. Where drains are installed in a MH/HH, appropriately-sized screening shall be fitted to prevent total obstruction of water egress.

E. All maintenance holes or handholes at DOC facilities shall have lockable or bolt down covers to prevent unauthorized access. The Designer shall obtain approval on the type and style cover from the facility Superintendent or designee.

F. Designer shall ensure handholds:
1. Are not used in a main conduit system.
2. Are not used as a cable splice point.
3. Are not used for a ductbank containing more than 3 conduits.
4. Have conduits entering aligned on opposite walls at the same elevation.

4.5.3.3 Proximity to Steam Lines and Steam Utilidor

The maximum fluid temperature of steam in the main line is approximately 335° F and 212° F in the condensate line. A breach in a steam line often causes the line pressure to reduce, but under some circumstances this does not always occur. At 125 psi, steam can blow out 4 feet or more, cutting through and destroying many objects, including concrete. Where telecommunications infrastructure is in close proximity to a steam line, a breach would have an extremely damaging effect to telecommunications conduits and cabling, both copper and fiber. Additionally, as ambient temperature increases, both copper and fiber optic cabling incurs increased attenuation.

- Per ANSI/TIA/EIA 568-B.2-1 Annex G: Temperatures above 68° F/20° C shall have permanent link length of 90 M de-rated.

The design and installation requirements listed within this section are based on an engineered design developed for the 2004-05 steam line replacement project at the Washington Corrections Center. The design criterion was developed to achieve the following maximum temperatures at the outside of telecommunications conduits:

- <u>Normal Operation</u>: a maximum temperature equal to or less than 72° F/22° C.
- <u>Extreme Operation (Major Steam Leak):</u> a maximum temperature equal to or less than 90° F/32° C.

The Designer shall ensure the installation of telecommunications conduits and steam lines are constructed based on the design criteria listed in this section. Any changes shall require an engineering design that guarantees meeting the maximum temperatures listed above.

Additionally:

- Installation of a steam line or utilidor within ten (10) feet proximity to an existing telecommunications conduit or where the steam installation is below an existing telecommunications conduit shall require approval through the Alternative Design Request (ADR) process. The ADR shall include a detailed design for each proximity encounter and/or crossing. The design shall include details on how existing telecommunications conduit will safely be supported during construction and the methods of protection and insulation.
- Telecommunications conduits shall not be run inside a steam tunnel or a steam utilidor.
- For above ground steam lines, telecommunications conduits shall maintain a minimum separation distance of ten (10) feet and shall not be positioned above steam lines.
- Design and installation shall also be compliant to the NESC.

A. Telecommunications conduits **<u>crossing</u> direct-buried OSP steam lines** shall meet the minimum requirements listed below:
   1. Telecommunications conduits shall “<u>only” route under direct-buried steam lines</u> and shall <u>cross perpendicular</u>.
   2. The telecommunications conduit crossing point shall be positioned a minimum of five (5) feet away from all steam and condensate pipe welds and connections.

3. The telecommunications conduits and steam lines shall be separated by all of the following:
   a. Telecommunications conduit shall be fully encased with a minimum of four (4) inches of concrete. Concrete shall extend a minimum of three (3) feet beyond both sides of the telecommunications conduit and three (3) feet beyond both sides of the steam lines of the crossing axis.
   b. Six (6) inches of insulation shall be installed covering the entire concrete extension described above:
      i. One (1) inch of Unifrax Duaboard HD.
      ii. Five (5) inches of Insulfoam 40.
   c. A minimum of twelve (12) inches of controlled density fill (CDF) concrete shall be placed on top of the insulation.
   d. An outside sleeve of galvanized steel or class 3 ductile iron casing with a bitumastic coating shall fully encase the steam line and a second sleeve fully encasing the condensate line at the crossing. Both sleeves shall extend five (5) feet beyond both sides of the telecommunications conduit. The maximum amount of insulation shall be installed around both the steam and condensate lines (inside the two sleeves).
      i. Both ends of the two sleeves shall be vented above finished grade to allow steam to escape from a potential line rupture.
         1. Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.

B. Telecommunications conduits **<u>run parallel</u> to direct-buried OSP steam lines** shall meet the minimum requirements listed below:
   1. Telecommunications conduits shall have a minimum separation distance from steam lines of five (5) feet of well-compacted soil.
   2. Telecommunications conduit shall be fully encased with a minimum of four (4) inches of concrete.

C. Telecommunications conduits **<u>crossing</u> an OSP steam utilidor** shall meet the minimum requirements listed below:
   1. It is preferable for telecommunications conduits to <u>route under</u> a steam utilidor whenever possible.
   2. Telecommunications conduits shall <u>cross perpendicular</u> to the steam utilidor.
   3. The telecommunications conduit crossing point shall be positioned a minimum of five (5) feet away from all steam and condensate pipe welds and connections and in the middle of a utilidor section (not above a joining of two utilidor sections).
   4. At the point of crossing, the <u>steam utilidor shall be constructed</u> as follows:
      a. An outside sleeve of galvanized steel or class 3 ductile iron casing with a bitumastic coating shall fully encase the steam line and a second sleeve fully encasing the condensate line at the crossing. Both sleeves shall extend five (5) feet beyond both sides of the telecommunications conduit. The maximum amount of insulation shall be installed around both the steam and condensate lines (inside the two sleeves).
         i. At both ends of the sleeves, vents shall be installed through the

utilidor lid to above finished grade to allow steam to escape from a potential line rupture.

1) Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.

5. Where telecommunications conduit **crosses under** a steam utilidor:
    a. Telecommunications conduit shall be fully encased in a minimum of four (4) inches of concrete.
    b. The base below the telecommunications conduit shall be well-compacted to structurally support the weight of the steam utilidor with no settling damage to the telecommunications conduit.
    c. The steam utilidor base shall be a minimum thickness of four (4) inches of concrete.
    d. Six (6) inches of insulation shall be installed on the floor inside the utilidor under the steam lines, extending a minimum of three (3) feet beyond both sides of the telecommunications conduit crossing:
        i. One (1) inch of Unifrax Duobond HD.
        ii. Five (5) inches of Insulfoam 40.
6. Where telecommunications conduit **crosses over** a steam utilidor:
    a. The steam utilidor lid shall be a minimum thickness of seven (7) inches of concrete. Along the entire length of the utilidor lid where it meets the top of the utilidor walls, a water-tight sealant shall be applied that maintains sealing integrity under extreme operation (major steam leak).
    b. Insulation shall be installed on top of the utilidor lid, extending a minimum of three (3) feet beyond both sides of the telecommunications conduit crossing and three (3) feet beyond the sides of the utilidor wall:
        i. One (1) inch of Unifrax Duabond HD.
        ii. Five (5) inches of Insulfoam 40.
    c. A minimum of twelve (12) inches of controlled density fill (CDF) concrete shall be placed on top of the entire area covered by the insulation.
    d. The telecommunications conduit shall be fully encased in a minimum of three (3) inches of concrete.
    e. The top of the telecommunications ductbank shall be placed a minimum of thirty (30) inches below finished grade.

D. Telecommunications conduits **run parallel to an OSP steam utilidor** shall meet the minimum requirements listed below:
    1. The steam utilidor walls shall be a minimum of four (4) inch thick concrete.
    2. Vents shall be installed through the steam utilidor lids to above finished grade every one hundred (100) feet along the parallel run to allow steam to escape from a potential line rupture.
        a. Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.
    3. All steam utilidor section joints shall be sealed with a water-tight sealant that maintains integrity under extreme operation (major steam leak).
    4. Telecommunications conduits shall be fully encased in a minimum of four (4) inches of concrete and shall maintain a minimum of two (2) feet separation from the outside utilidor wall.

5. The top of the telecommunications ductbank shall be placed a minimum of thirty (30) inches below finished grade.

4.5.3.4 Proximity to Water, Gas or Oil Conduits

Outside plant telecommunications conduits shall have a minimum separation from conduits/pipes that can be identified as not containing electrical power distribution conductors as indicated below:

- For gas or oil lines: a minimum separation of 18 inches.
- For water lines: a minimum separation of 36 inches. Telecommunications conduits shall not be installed above water lines.

4.5.3.5 Aerial Distribution

Aerial distribution of telecommunications cabling at DOC facilities is not authorized unless specific approval is granted through the "Alternative Design Request" process. In cases where aerial distribution is approved for use, the facility Superintendent or designee shall 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, inspected, and approved by the DOC-ITIS and DOC Plant Manager.

4.5.3.6 Bridge and Waterway Crossings

The Designer shall review the construction of bridge and waterway crossing distribution systems for compliance with the design. Each phase of the design and installation shall also be reviewed, inspected, and approved by the DOC-ITIS and DOC Plant Manager.

4.5.4 INTER-BUILDING (CAMPUS) BACKBONE CABLING

4.5.4.1 General

A. As discussed in the *Preface* section of this document, telecommunications distribution systems designed for DOC facilities shall support and integrate all low voltage, power limited signal systems, and Building Automation Systems that convey information within and between buildings as described in Section 4.21 of this document.

   - During planning of backbone cable installation sizing, the opportunity for these systems to use the common structured cabling system shall be evaluated by the Designer and discussed with DOC. The backbone cabling design shall reflect the needs and requirements identified during these discussions.

B. The Designer shall specifically identify the conduits that shall be used by the cabling installation contractor. The Designer shall ensure the conduits specified are not reserved for other projects as discussed earlier in Section 4.5.3.1, and the cable to be installed in each shall not exceed the maximum 40% fill. OSP cable shall be installed in the lowest available conduit in a duct bank, working up after the maximum 40% fill has been reached in the lower conduits as additional cables are installed.

C. **<u>The use of direct buried cabling is prohibited</u>**.

D. The Designer shall observe the installation of cabling to ensure all requirements have been adhered to. The Designer shall prepare a Punch List of outstanding issues requiring corrections and provide to the DOC CPD Project Manager and DOC-ITIS prior to recommending payment to the cabling contractor.

4.5.4.2 Copper Backbone Cabling

A. DOC requires copper backbone cabling be designed and installed in a non-spliced, home run configuration.
   1. Designs shall conform to Section 5.5.1 of TIA Standard 568-B.1 for **<u>maximum backbone cable length of 2,624 ft.</u>**
      a. An Alternative Design request (ADR) shall be submitted to request lengths beyond the ANSI/TIA/EIA Standard.
      b. AVAYA 6000 series digital telephones have a maximum wire distance of 3,500 feet.

B. Outside plant copper backbone cabling for voice applications shall be Category 3 twisted pair cabling.
   1. Indoor rated cabling shall not be used.
   2. Inter-building data backbone applications (LAN connections) shall not be made to this cable.

C. All modem connections:
   1. Shall be consistent with Department *IT and Security Policies.*
   2. Shall be authorized by the appropriate DOC Operations Management and forwarded to the DOC-RITM.
   3. Shall be reviewed and approved by the DOC-RITM.

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

4.5.4.2.1 <u>Administrative Voice Backbone Cabling</u>

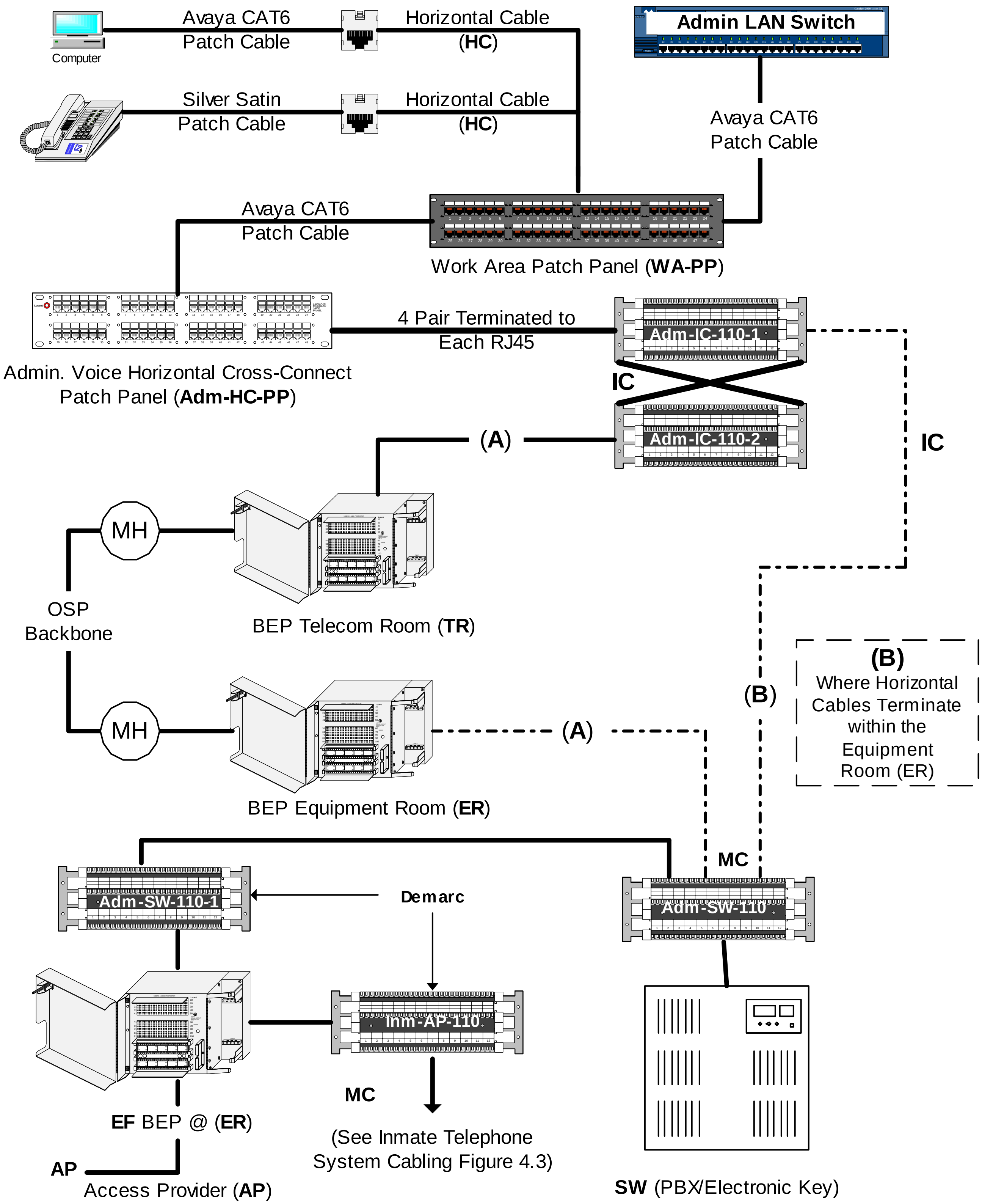
Administrative voice backbone cables (all voice backbone cabling that is not intended for inmate voice applications) shall meet the following requirements:

1. Voice backbone cables are generally sized to support two pair per work area outlet, plus 25% growth. When calculating size, work areas shall also include fax machines, dial-up modems, and ancillary systems such as alarms. The Designer shall confer with the DOC facility telephone support staff and DOC-ITIS to determine the pair count for each voice backbone cable.
   a. The Designer shall also confer with the DOC facility telephone support staff to identify the number of older telephones for each building that require two or three pair per outlet and increase the backbone pair counts accordingly.
2. All inter-building OSP copper voice backbone cables shall be terminated with a primary protector panel at each cable end. The protector panels shall be equipped with Protector Units that provide sneak-current protection.

   a. All cable pairs shall be terminated - unprotected copper backbone cables shall not be allowed inside buildings.
   b. The metallic cable sheath shall be grounded.
3. For ancillary systems routed to the ER and TR's of remote buildings:
   a. Ancillary systems are defined as alarms, etc.
   b. A small quantity of voice backbone cables shall be cross-connected via tie cable from the primary protector to backboard mounted SYSTIMAX® 110 Wiring Blocks designated for ancillary systems, using 110C-5 Connecting Blocks.
4. An Intermediate Cross-connect (IC) shall be constructed in all Telecommunication Rooms:
   a. <u>For TR's of remote buildings</u>:
      i. Two SYSTIMAX® 110 Wiring Blocks shall be mounted to backboards in each TR and designated for reference as "Administrative Voice Intermediate Cross-connect 110 blocks" (**Adm-IC-110-1** and **Adm-IC-110-2**).
      ii. The 110 blocks shall be labeled as referenced.
      iii. The **Adm-IC-110-2** shall be punch down style 110 blocks; the modular 50-pin 525 connector style blocks shall not be used.
      iv. Tie cables shall be connected from the primary protector (**BEP**) to **Adm-IC-110-2**.
      v. Cross-connect wire shall be connected from the **Adm-IC-110-2** to **Adm-IC-110-1**.
   b. <u>For TR's in the same building with the ER</u>:
      i. The 110 blocks referenced as **Adm-IC-110-1** will be mounted on the backboard in the TR; the 110 blocks designated as **Adm-IC-110-2** shall not be used.
      ii. Riser-rated tie cables shall be connected from the telephone switch 110 blocks designated as **Adm-SW-110** to the **Adm-IC-110-1**.
   c. <u>Where horizontal cabling from WA's are terminated directly onto patch panels in the ER</u>:
      i. The 110 blocks referenced as **Adm-IC-110-1** will be mounted on the backboard in the ER; the 110 blocks designated as **Adm-IC-110-2** shall not be used.
      ii. Tie cables or cross-connect wire shall be connected from the telephone switch 110 blocks designated as **Adm-SW-110** to **Adm-IC-110-1**.
   d. The number of cross-connect wires connected between the 110 blocks shall be based on the number of pairs required at each WA outlet for telephones. The Designer shall confer with the DOC IT Design Team to determine how many pairs shall be used.
      i. New single line telephones at DOC require only one pair while console telephones require two pair.
      ii. Some older telephones require up to three pair.
      iii. Some DOC telephone support staff prefers two pair be wired for every telephone, but project costs have to be considered for this type of design criteria.
   e. Four pair cable shall be connected from the **Adm-IC-110-1** to each **RJ45** module connector on the **Adm-HC-PP** as described in Section 4.4.2.3.

i. If the Adm-HC-PP style with 525 connectors was chosen, then 25-pair (Male to Unterminated) Cord shall be used; else specify CAT 3 MultiPair cable.

Figure 4.2 Administrative Telephone System Cabling


Computer
Avaya CAT6
Patch Cable
Horizontal Cable
(HC)
Admin LAN Switch
Silver Satin
Patch Cable
Horizontal Cable
(HC)
Avaya CAT6
Patch Cable
Avaya CAT6
Patch Cable
Work Area Patch Panel (WA-PP)
4 Pair Terminated to
Each RJ45
Adm-IC-110-1
Admin. Voice Horizontal Cross-Connect
Patch Panel (Adm-HC-PP)
IC
Adm-IC-110-2
(A)
IC
MH
OSP
Backbone
BEP Telecom Room (TR)
MH
(B)
(B)
Where Horizontal
Cables Terminate
within the
Equipment
Room (ER)
(A)
BEP Equipment Room (ER)
MC
Adm-SW-110-1
Demarc
Adm-SW-110
Inm-AP-110
MC
EF BEP @ (ER)
(See Inmate Telephone
System Cabling Figure 4.3)
AP
Access Provider (AP)
SW (PBX/Electronic Key)

4.5.4.2.2 <u>Inmate Voice Backbone Cabling</u>

Backbone cabling to support inmate telephone service shall meet all of the same requirements for administration voice backbone cables above, plus the following additional requirements:

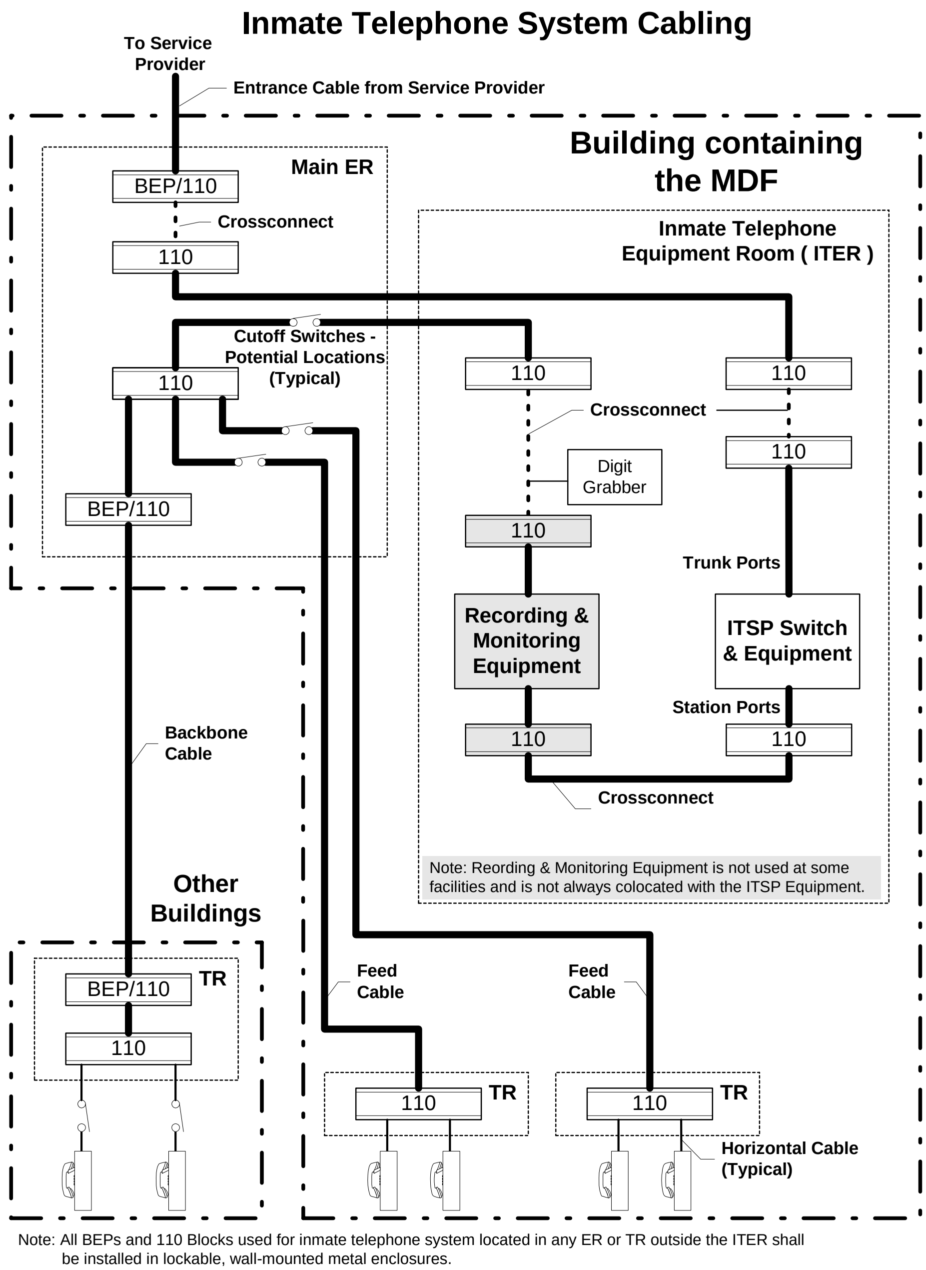
1. The Designer shall obtain site-specific design requirements from DOC IT regarding the configuration of cabling to support the inmate telephone system.
2. Inmate telephone inter-building backbone and intra-building feed cables shall be separate cables (separate sheath) from all other voice and data services. While it is preferred the inmate telephone service cable enter the facility on a separate sheath service entrance cable (separate from the cable carrying administrative telephone services), DOC will accept both administrative and inmate telephone services provided over a single service entrance cable.
3. Inmate telephone inter-building backbone and intra-building feed cables shall be terminated on primary protectors and termination blocks that are separate from all other services.
4. <u>All termination blocks for inmate cables in the Main ER and each building TR shall be located inside lockable cabinets.</u> These measures are necessary to prevent inadvertent cross-connection between inmate telephone and administrative DOC circuits, unauthorized monitoring of inmate circuits, or unauthorized monitoring of administrative circuits by inmates.
5. From the service entrance cable termination (directly from the separate primary protectors) in the Main ER, the inmate telephone cables shall cross-connect to separate, dedicated termination blocks located inside a lockable cabinet.
6. Inmate telephone backbone or feed cables shall route from the Main ER to a termination in a physically separate inmate telephone equipment room (ITER) as directly as possible.
7. The ITER may be located in a different building from the location of the Main ER.
8. The local DOC Intelligence & Investigations (I&I) personnel will determine whether the termination blocks for inmate backbone and feed cables are enclosed in lockable cabinets within the ITER.
9. The ITER houses the *Inmate Telephone System Provider's (ITSP)* switching equipment for the inmate telephones at all DOC prison facilities, both camps and major institutions. The ITSP switch is the interface between the inmate telephones and outside telephone connectivity. The ITSP switch provides unique call restrictions on an individual basis for each inmate.
10. Cabling from all inmate telephones must be connected to the ITSP switch (except for legal/attorney phones).
11. The inter-building OSP backbone cable for the inmate telephone system will originate from either the Main ER or the ITER. If the inter-building backbone cable originates from the Main ER, two separate sheathed intra-building feed cables (one for the telephone station pairs and one for the service trunk pairs) will be required from the Main ER to the ITER.
12. The ITER at the major prisons also includes recording and monitoring (R&M) equipment attached to the inmate telephone system. The R&M equipment may be included with the ITSP's switching equipment, or may be separate and from a different provider or manufacturer. The R&M equipment is connected between the

cabling from the inmate telephones and the ITSP switch.

13. A digit grabber unit may also be used in conjunction with the R&M equipment. If used, it would be connected between the cabling from the inmate phones and the R&M equipment.

The following diagram depicts a typical cabling configuration of an inmate telephone system used at a DOC facility. Please note, the diagram shows the systems typically present at many facilities, however the physical location of each component varies from site to site (ITSP switch, R&M equipment, cutoff switches, etc.).

FIGURE 4.3 INMATE TELEPHONE SYSTEM CABLING



4.5.4.3 Fiber Optic Backbone Cabling

A. DOC's general strategy for the common fiber optic backbone cabling is to provide sufficient strand quantities to support all low voltage, power limited signal systems and Building Automated Systems. The assumptions for the potential **minimum** fiber optic cable strand usage is as follows:

1. **Single Mode Fiber (SMF):**
   a. 2 strands = Administrative LAN (cable distance > 275 M)
   b. 2 strands = Correctional Industries LAN (cable distance > 275 M)
   c. 2 strands = Video surveillance cameras - full stream video
   2-6 strands = subtotal

2. **Multi-Mode Fiber (MMF):**
   a. 2 strands = Administrative LAN (cable distance < 276 M)
   b. 2 strands = Correctional Industries LAN (cable distance < 276 M)
   c. 4 strands = Fire alarm system
   d. 2 strands = HVAC control system
   e. 2 strands = Lighting control system
   f. 2 strands = Security system
   g. 2 strands = CCTV system
   h. 2 strands = taut wire fence protection system
   i. 2 strands = Education LAN
   j. 2 strands = Other outside entities LAN
   18-22 strands subtotal

B. Typically, the minimum quantity and sizing for the common fiber optic backbone cabling will be to install 12 strands of Zero-Water-Peak singlemode fiber optic cable and 24 strands of 50/125 micron graded index multimode fiber (MMF) optic cable to each building, originating from the main Equipment Room (ER).
   1. The Designer shall check with the DOC-ITIS to determine the exact type of SMF and MMF cable to use for all projects.
   2. The fiber strand count shall be increased as required to meet the current and future needs of specific buildings or additional applications beyond those identified above.
   3. Fiber optic backbone cables shall be designed with a minimum of 20% spare strands beyond those identified above.

C. Where an alternative design has been approved to install fiber optic cable with a lower quantity of strands to small buildings such as utility buildings:
   1. The Designer shall have reviewed all Building Automation Systems with the Plant Manager to determine cabling needs to the building. The ADR shall have the Plant Managers signature per this review.
   2. The conduit shall have innerduct installed with sufficient capacity to install additional copper and fiber cable in the future per DOC Standards.
   3. No less than 6-strands of singlemode and 12-strands of multimode fiber shall be installed, however:
      a. Fiber backbone cable runs exceeding 275 meters from the M-ER shall have at least 12 strands of singlemode fiber included.

D. Where an alternative design has been approved to install multimode-only fiber cable to small buildings, the conduit shall 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.

E. Prior to designing outside plant fiber optic cabling systems, the Designer shall seek direction from the DOC-ITIS 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 62.5 um multimode, and teal for 50.0 um 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).

F. Fiber optic cable with metallic armoring should only be used where the armor may be required for protection against rodents. The design of fiber optic cabling with metallic armoring requires alternative design approval.

G. 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.

1. <u>Design or installation of fiber optic cabling without the use of innerduct shall require approval through the "Alternative Design Request" process.</u>

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

I. <u>DOC does not permit the design of any fiber optic cabling solution that is dependent on splices.</u>

J. The Designer shall consult with the DOC-ITIS prior to developing the fiber optic design to determine the performance requirements for the network electronics.

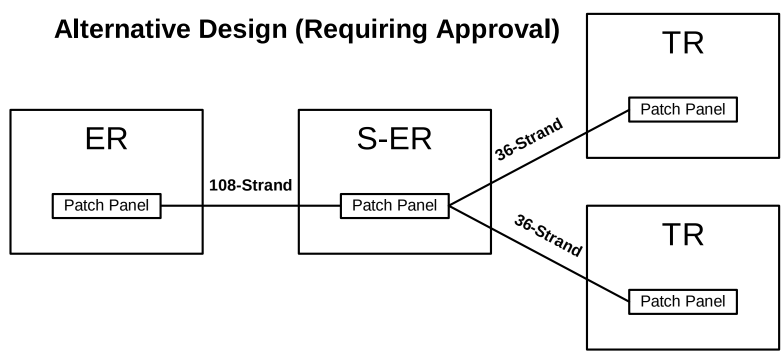
1. The Designer shall provide to DOC IT the estimated cable length between the fiber patch panels of each TR and the main ER fiber patch panel in the design phase. DOC IT will base its design of the LAN switches on the estimated lengths of the backbone cable runs between each telecommunications room and the Main ER.
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 DOC-ITIS immediately.

K. Fiber optic cable and components shall be rated and installed to comply with the IEEE 802.3z 1000Base-X Ethernet Gigabit Standard. DOC networks depend on Gigabit and higher backbone speeds. Due to the distance limitations of 62.5 nm multimode fiber (300m for SX, 550m for LX), singlemode fiber optic cable shall be required to support Gigabit and higher applications where cable distances exceed 275m.

L. Fiber optic backbone cables shall home-run through conduit from each individual TR 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.

- The figure below represents a Secondary Equipment Room (S-ER), which requires an approved LAN switch design by the DOC-RITM, and the fiber strand counts approved by the DOC-ITIS. 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 may be greater than the sum of all branch backbone cables, or at least greater than the DOC minimum standard quantity. For example:

FIGURE 4.4 ALTERNATE DESIGN EXAMPLE OF FIBER BACKBONE



M. Fiber optic cabling shall be terminated in a Fiber Optic Interconnection Unit patch panel. SYSTIMAX® offers rack-mounted units that will mount directly into a standard EIA 19-inch equipment rack, and wall-mounted interconnection units that may be mounted on a plywood backboard.

1. Where equipment racks are installed, the rack-mountable Fiber Optic Interconnection Units shall be used.
2. The standard fiber optic connector for DOC is the type 568SC Duplex or LC units. The Designer shall check with the DOC-ITIS to determine which type shall be specified. When fiber additions are made to existing facilities where type 568ST connectors are in use, new 568SC Duplex or LC connectors and new Duplex SC or LC patch panels shall be used for new fiber.
    a. Installation of ST connectors shall not be acceptable.
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 or LC 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 anywhere at DOC facilities.

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

4.5.4.4 Fiber Optic Patch Cords

A. Fiber optic patch cables shall be factory manufactured SYSTIMAX® 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 SYSTIMAX® 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 TR patch panel and the LAN switch.

4.5.5 WIRELESS AND RADIO SYSTEM DISTRIBUTION

A. DOC facilities frequently use wireless or radio systems for communications with mobile units and personnel, 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 signal.

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 DOC facilities:

A. Undercarpet telecommunications cabling (UTC) solutions shall not be used at DOC 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 DOC IT personnel 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 be orange in color.

C. Telecommunications outlet faceplates used throughout a facility (in both secured and non-secured areas) shall be mounted with tamper-proof screws. Recommended screw heads are the "Torx Tamper-Resistant Head" and the "Pin-in-Socket Hex Head." Both of these screw head types have a pin in the center of the screw head that prevents the insertion of home made tools. The Designer shall obtain approval from the facility superintendent or designated senior security officer for the type of tamper-proof screw to be used.

D. Either plastic or stainless steel outlet faceplates may be used throughout a facility at the discretion of each facility. DOC personnel shall consider the security implications when selecting the faceplate type. Plastic faceplates can be more easily broken. Stainless steel faceplates are more difficult to remove. Either type can be fashioned into a weapon.
   1. The Designer shall have the prison or work release facility Superintendent or designee determine the type of faceplates and security screws that shall be used. Plastic faceplates can be used for all Community Corrections offices.

E. Media converters shall not be used in DOC installations.

4.6.1 NON-SECURED AREAS

A. Horizontal telecommunications pathway in non-secured areas, defined earlier in Section 1.2, shall be designed consistent with industry codes, standards, the guidelines in the BICSI TDMM, and DOC's TDIS.

B. Any SYSTIMAX® approved faceplate, frame, or surface mounted box may be used to mount Modular Information Outlets, as applicable to the particular installation, with the following restrictions:
   - Faceplates with angled connectors are not permitted.

4.6.2 SECURED AREAS

A. Horizontal telecommunications pathway in secured areas, defined earlier in

Section 1.2, shall be designed consistent with industry codes, standards, the guidelines in the BICSI TDMM, and DOC's TDIS.

B. Any SYSTIMAX® approved faceplate, or frame may be used to mount Modular Information Outlets, as applicable to the particular installation, with the following restrictions:
1. Telecommunications outlets shall be located to minimize the length of patch cord required to connect the computer or telephone to the outlet. Patch cords can easily be disconnected and used as a weapon.
2. Multi-User Telecommunications Outlet Assembly (MUTOA) shall not be used inside secured areas except for designated classrooms and multipurpose rooms.
3. The Designer shall have the facility Superintendent or designee review and approve/deny all surface-mounting of telecommunications equipment to ensure it presents no significant risk to physical security of the facility or safety risk to staff.

4.7 TELECOMMUNICATIONS ROOMS (TR)

Please refer to the *Telecommunications Rooms* section of the BICSI TDMM for general information regarding the design of telecommunications rooms. Note that a Telecommunications Room (TR) is not an Equipment Room (ER), see Section 4.8 for ER. The Designer shall review the usage requirements for the TR with the DOC-RITM and DOC-ITIS. Depending on the size and usage requirements of a TR, it may also need some or all of the design and construction requirements of an ER.

The following requirements take precedence over the BICSI TDMM guidelines for telecommunications infrastructure at DOC facilities:

A. The Telecommunications Room (TR) shall be dedicated to telecommunications functions and is the location(s) in a building where the telecommunications cabling is terminated. In DOC facilities, the TR(s) in a building shall be dedicated to voice and data systems equipment with inter-connected pathways for cabling to the BAS/LVE equipment room, typically containing electronic equipment intended to serve the building or a portion of the building, and the Security Electronics (SE) Room. Check with the facility Superintendent or designee to determine where the Security Electronics should be located. The BAS/LVE and SE Room (if separate) should be located directly adjacent to the TR to take advantage of minimizing the OSP backbone cable lengths inside the building if they require direct termination in the BAS/LVE or SE Room. The fire alarm system should be located in the BAS/LVE Room. Refer to Table 4.3, *TR "Base Size",* for TR sizing based on a dedicated room.
1. Where equipment other than voice and data are proposed to be collocated in the TR, the Designer shall use the ADR process for approval. If approved, the Designer shall increase the TR size to accommodate the additional equipment and required working space. The Designer shall ensure the clearances for equipment footprints and clear working space requirements are incorporated as defined in subsequent sections.
2. The TR shall not be shared with electrical installations other than those

necessary for direct support of the telecommunication systems.

B. The Designer shall obtain detailed information from the A/E, DOC-RITM, DOC-ITIS, DOC Plant Manager, and other DOC personnel as necessary regarding the equipment that will be located in the TR to perform room/rack/cabinet design and calculate HVAC and electrical requirements. This information shall include specific types of racks/cabinets, size (RU's if rack/cabinet mounted), weight, placement location requirements, voltage and Ampere requirements including specific electrical receptacles to match equipment plugs, single or dual power supplies, heat generated-BTU's, UPS requirements, etc.
   1. Designers - Note that file servers can not be installed in the Universal 2-post racks and require specific 4-post frames with square mounting holes for cage nuts.
   2. Designing the TR/ER to provide adequate clear working space for two people to install the file servers into the 4-post frames DOC now uses is critical. Each person must stand on each side of the 4-post frame. **<u>DO NOT LOCATE 4-post frames ADJACENT TO WALLS.</u>**

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

D. The Designer shall be responsible to determine that the <u>architectural, environmental, mechanical, and electrical power requirements for the telecommunications spaces are met as described in this document.</u> For projects where an architect is involved, the Designer shall coordinate directly with the Architect, Mechanical Engineer, and Electrical Engineer to verify that their design documentation meets the DOC requirements and is fully conveyed in the Construction Documents. For projects without the involvement of an architect and mechanical or electrical engineer, the Designer shall alert DOC where additional architectural, environmental, mechanical, and electrical elements are needed to meet DOC's requirements.
   1. The Designer shall verify that all TR requirements are specified in the appropriate divisions of the Construction Document (CD) Specifications and Drawings, <u>including CD divisions outside of the DOC TCGS sections.</u> The information listed below includes some, but not necessarily all of the requirements the Designer shall convey to the A/E:
      a. Division 6 *Wood and Plastics*: plywood size, grade, and mounting requirements for backboards.
      b. Division 8 *Doors and Windows*: door size, swing direction, and locks.
      c. Division 9 *Finishes*: type and number of coats of primer and fire-retardant paint for backboards, room color, and the floor, wall, and ceiling requirements.
      d. Division 15 *Mechanical*: sprinkler issues, floor drains, and HVAC requirements.
      e. Division 16 *Electrical*: the type, size, rating, color, and location of outlets and circuits for the room, and racks/cabinets, lighting, etc.

4.7.1 TELECOMMUNICATIONS ROOM LOCATION

A. Telecommunications Rooms shall not be collocated with or located directly adjacent to any type of electrical room/closet, mechanical room/closet, or any room or area where the potential exists for generation of RFI or EMI. The TR location shall maintain the separation distances identified in Table 4.4 of this document.

B. When planning the size and location of TR's in existing buildings, the Designer shall make every reasonable effort to meet the requirements for telecommunications rooms. Where the design requirements can not be met, the Designer shall prepare an Alternative Design Request per procedures in Section 3.4.3.

C. TR's and telecommunications cabinets have very critical setback clearance distance requirements from all electrical sources for EMI reduction. Designer shall refer to Table 4.4 of this document to ensure clearance requirements are maintained.

D. Where telecommunications cabinets are used in lieu of a dedicated TR, the criteria listed above shall be followed.

4.7.2 TELECOMMUNICATIONS ROOM SIZING

A. ANSI/TIA/EIA-569-A provides Standards for sizing a TR for normal office buildings. The sizing is based on the "usable floor space," which is the space on a floor that is typically 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 100 square feet of floor space for each person, or "work area."

B. Many DOC 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. Designer Note:

- DOC is now designing for deployment of Ethernet/IP connections to inmate cells.
- Inmate housing shall be included in sizing TR space.
- The horizontal cabling for inmate cell systems "may" originate in either the Security Electronics Room or the TR, or a combination of both, depending on where the various head-end equipment serving the inmate cells is located.
- All telecommunications infrastructure Standards within this document shall be adhered to for the Security Electronics Room. As such, the Security Electronics room shall be designed in similar fashion to a TR, and may need to be enlarged to accommodate clear working space requirements.

When calculating the base size required for a TR in a DOC 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 TR.
2. Determine all other locations in the area to be served by the TR, where voice

and/or data service will be provided. Other locations will include, but are not limited to Corrections Officers duty stations, inmate phone locations, inmate cells, and possibly BAS/LV system connection areas. Count each location as 100 square feet of usable floor space. Check with the DOC-ITIS and DOC-RITM to determine the number of square feet to use for inmate cells.

3. Add together the total office space and total "other" usable floor space resulting in the total area to be served by the TR.
4. Determine the "base size" of the TR per the table listed below, including requirements for clear working space around equipment racks/cabinets (also refer to Figure 4.5).

TABLE 4.3 TELECOMMUNICATIONS ROOM "BASE SIZE"

Total Usable Floor Space	Telecommunications Room "Base Size"	# Square Feet
5,000 SQUARE FEET OR LESS	8 FT. X 11 FT.	88
5,001 - 8,000 SQUARE FEET	11 FT. X 11 FT.	121
8,001-10,000 SQUARE FEET	13 FT. X 11 FT.	143

C. The Designer shall determine the **Final TR Size** "after" developing the TR design layout that accounts for all "equipment footprints" and incorporates all of the defined "clear working spaces".

1. Using the TR Base Size from the above calculation, refer to Figure 4.5 *TR Layout* and the following subsections, and design the configuration of all equipment footprints, racks, cabinets, wall fields, additional BAS/Low Voltage systems, etc., including the required clear working spaces for all systems designated for the TR.
2. If for any reason the TR door must swing inward rather than outward, do not use the wall space behind the door swing for mounting panels, equipment, or placing wall fields.
3. If additional space is required to achieve a compliant layout, adjust the length or width of the TR, and if necessary, expand the number of square feet accordingly.
4. The Designer shall not eliminate or reduce the defined clear working space requirements. TR layouts with inadequate clear working space for equipment are not acceptable.

D. There shall be a minimum of one TR per floor per building. Additional TR's shall be added when the area to be served exceeds 10,000 square feet or where the cable lengths have the potential to exceed 295 feet between the patch panel and the telecommunications outlet in the work area, including the service slack requirements at both ends of the cable as identified in other sections of this document.

E. The TR shall have a minimum height from floor to ceiling of eight feet without obstructions. A minimum headroom access of 12 inches shall be maintained above cable runways.

4.7.3 TR ARCHITECTURAL PROVISIONING

A. The Designer shall be responsible for informing the Architect of the architectural provisioning requirements for Telecommunications Rooms and do this in the Schematic Design phase of the project.

B. The walls in telecommunications rooms shall be covered with ¾" A-C grade plywood backboards. The plywood shall be painted on both sides with primer and two coats of white, fire retardant paint, and mounted with the A grade exposed. The plywood shall ***not*** be fire retardant (paint tends to flake off of fire retardant plywood).

C. In most cases it is preferable to have the plywood extend from the floor to a height of eight feet above the finished floor. In TR's 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.

D. In new construction, power and telecommunications outlets, light switches, and all electrical and mechanical control devices in the TR shall be flush mounted, not surface mounted on the plywood backboard. 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 with device box extensions installed as appropriate.

E. Doors shall be hinged to open out from telecommunications spaces wherever possible, else slide side-to-side. Doors shall be located in hallways or other common areas. In no case shall the door be located in another building occupants' designated space.
   1. Doors shall be solid wood core or metal, no glazing, minimum size of 36" x 80".
   2. Doors may have venting depending on the air handling design.
   3. Doors shall be fitted with a lock. The Designer shall coordinate key requirements with the DOC-RITM and DOC Plant Manager.

F. In addition to the requirements in the BICSI TDMM, telecommunications rooms shall be provisioned as follows:
   1. The walls and ceiling shall be treated and sealed to eliminate dust. False ceilings are not allowed in TR's. 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. For raised floors, all floor-standing equipment and equipment racks and cabinets shall be securely anchored to the sub floor. For concrete subfloors, concrete floor anchors shall be used.

G. Lighting shall be a minimum equivalent of 500 lux (50 footcandles) measured 1 m (3 ft) above the finished floor.
   1. Light fixtures shall be a minimum of 8.5 ft above finished floor. Placement

shall be coordinated with racks/cabinets to provide the best lighting exposure while maintaining adequate clearance from telecommunications cable and cross-connect locations as defined in *Table 4.4* of this document.
2. Emergency lighting is required.
3. Power for lighting should not come from the power panel inside the TR. At least one light shall be on emergency power, if available, else a light with battery backup shall be installed.

4.7.4 TR ENVIRONMENTAL PROVISIONING

A. The Designer shall be responsible to inform the Architect and 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 provisioned as follows:
1. TR's shall be designed to support active electronic equipment (hubs, routers, switches, file servers, etc.) even if the current design does not immediately call for such devices. TR's shall be provisioned with an HVAC system capable of operating on a 24 hours-per-day, 365 days-per-year to maintain a sustained operating temperature between 64-75F degrees with a relative humidity between 30-55%. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the TR.
2. Where fire suppression sprinklers are installed, they shall be equipped with wire cages under 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.

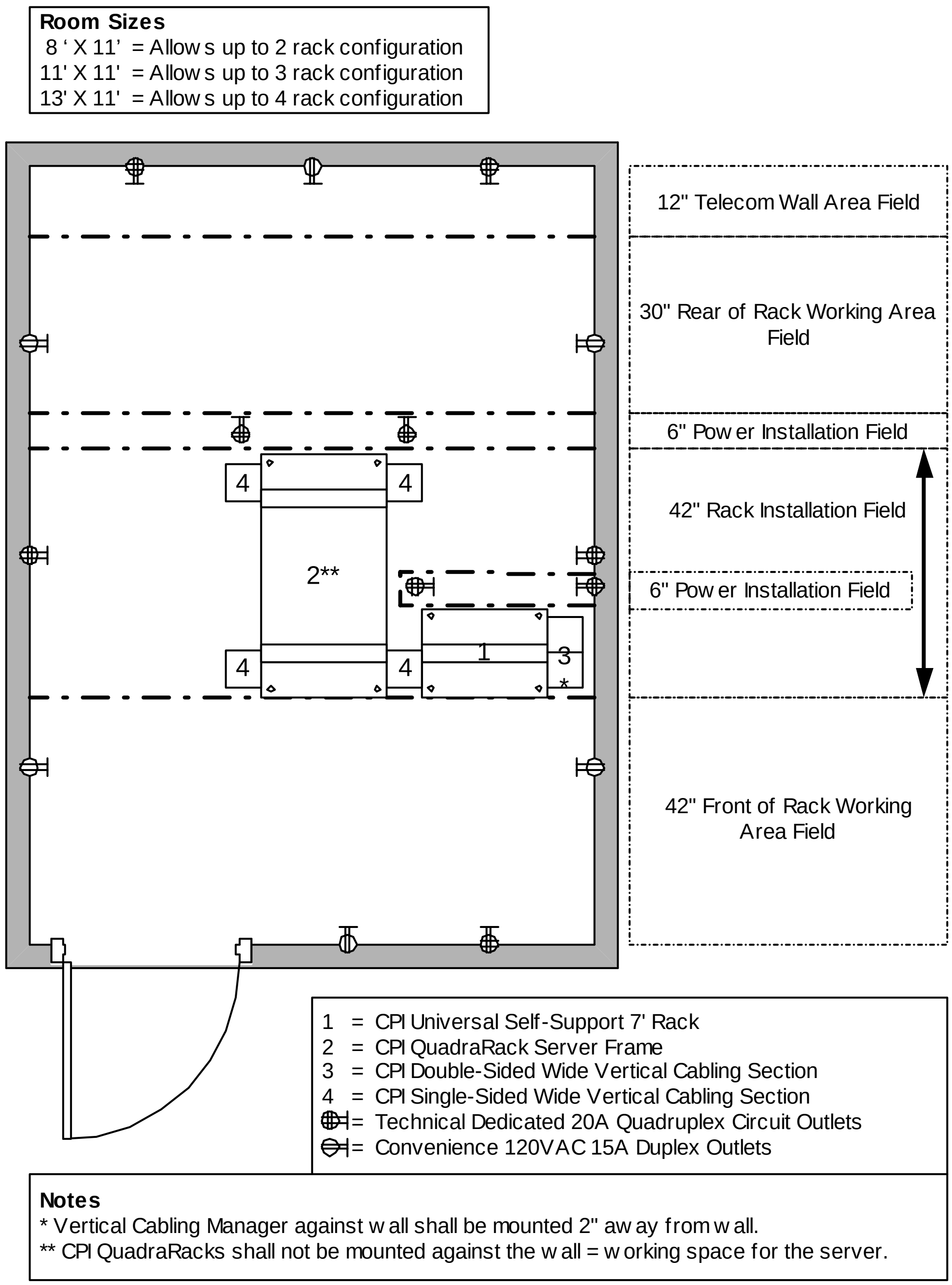
4.7.5 TR LAYOUT AND EQUIPMENT RACKS AND CABINETS

A. When designing the layout for Telecommunications Rooms, the Designer shall allow adequate space for both "Equipment Footprints" and "Clear Working Space."

The following diagram illustrates DOC's mandatory TR layout of one to four racks/cabinets and the minimum requirements for Equipment Footprints and Clear Working Space. Note that the diagram spacing is based on the size of a specific CPI open-frame and rack.

FIGURE 4.5 TELECOMMUNICATIONS ROOM (TR) LAYOUT

DOC Telecommunications Room
Scale 3/8" = 1'



1. <u>Clear Working Spaces</u> 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.

a. The Designer shall coordinate with the DOC-RITM to determine if file servers will be located in the TR, and design the rack/cabinet layouts accordingly to ensure clear working space. The current file servers require space for two people, one on each side of the rack/cabinet, to lift the unit for installation due to the weight. This precludes placing the rack/cabinet against a wall or other object where a server will be installed.

2. <u>Equipment Footprints</u> 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 <u>off wall</u> 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 <u>plus</u> 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.

B. In addition to the requirements of the BICSI TDMM, the Designer shall specify continuous cable runways from all cable ingress and egress points within the TR, above all telecommunications racks/cabinets, and to/from any additional cabling locations within the TR as required.
   1. Designer shall specify on the Contract Documents, “alternate space cable runways” above racks/cabinets which are specifically designed for use over 19” wide racks (spaced to simplify horizontal to vertical alignment of Cross Member Radius Drops).
   2. Designer shall ensure that cable runways shall not be secured directly to racks/cabinets due to the potential for seismic event damage.
   3. A minimum headroom access of 12 inches shall be maintained above cable runways.

4.7.5.1 Floor-standing Equipment Racks/Cabinets

A. EIA standard, 19-inch, open-frame equipment racks or enclosed cabinets shall be provided in the TR. The Designer shall confer with the DOC-RITM and DOC-ITIS to determine where cabinets or 4-post racks are needed in lieu of 2-post racks. Floor standing racks/cabinets shall be securely bolted to the floor. Racks/cabinets **shall not** be braced to the wall and **shall** not be secured directly to cable runway due to the potential for seismic event damage.

1. For raised floors, all floor-standing equipment and equipment racks and cabinets shall be securely anchored to the sub floor. For concrete sub floors, concrete floor anchors shall be used.

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

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 strain relief is maintained for “all” cables.

D. Some IT equipment requires both front and rear mounting rails. The Designer shall discuss with DOC the network electronics that will be hosted in each TR 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).

1. Note that file servers can not be installed in the Universal 2-post racks and require specific 4-post frames with square mounting holes for cage nuts.

E. Cabinets containing telecommunications equipment shall have cooling fans installed except where AC is provided under a raised floor with ventilated floor panels positioned under the cabinets. Fans and their electrical connections shall be located to provide the least amount of EMI to both cabling and cable connections. Consideration shall be given to fans located in the bottom of the cabinet. The Designer shall coordinate with DOC and/or the electrical engineer to provide power for the fans.

4.7.5.2 Wall-mount Telecommunications Racks/Cabinets

A. In new construction, wall-mounted telecommunications racks/cabinets shall only be permitted in guard towers, sally-ports, gatehouses, and very small buildings housing only several staff. All wall-mounted telecommunications racks/cabinets require approval through the ADR process. The Designer shall develop a complete rack/cabinet design, including conduit and cable routing to the cabinet, and submit with the ADR. All other new buildings shall be designed with TR’s and floor-mounted racks/cabinets.

B. In remodel construction, very small buildings with only several staff may not justify a separate telecommunications room. In some existing buildings, sufficient space may not be readily available for a telecommunications room.

1. In these instances, a wall-mounted or floor-mounted telecommunications cabinet may be recommended through the ADR process.
    a. Inadequate clearance and working space, EMI potential, or other circumstances may require a separate TR. This will require the facility to give up some existing space or construct an additional room onto the existing building.

C. The location of telecommunications racks/cabinets shall adhere to:

1. All requirements identified under the *Telecommunications Room Location* subsection of this document.
2. Both the Equipment Footprints and Clear Working Space requirements of this document.
3. 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.

D. The size of the rack/cabinet and conduits serving cabinets shall include space for future growth of cables and computer network equipment.

E. Wall-mount telecommunications racks/cabinets shall meet the following requirements:

- Have a minimum of 24” from the front rail to the wall.
- Shall be double-hinged, providing access to both the front and rear of the equipment.
- Where a telecommunications backboard on the adjacent wall is not acceptable, a plywood backboard shall be mounted in the rack/cabinet for mounting telecommunications hardware typically mounted on TR backboards. Plywood shall meet all requirements for TR/ER backboards for type of wood and paint.
- Shall provide a means of mounting electronics equipment, including one or more LAN switches and UPS. Acceptable means are rails for rack mounting.

F. Cabinets containing telecommunications equipment shall have cooling fans installed meeting all of the requirements identified in Section 4.7.5.1 above.

4.7.5.3 Telecommunications Cabinets in Secured Areas

In addition to the above requirements:

A. The telecommunications cabinet design shall provide physical security to protect the contents and prevent unauthorized access.

- The cabinet 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.
- Any removable panels shall have tamper-proof screws.
- Cabinets shall not have Plexiglas or glass panels.

- Shall contain a plywood backboard inside for mounting telecommunications hardware typically mounted on TR backboards. Plywood shall meet all requirements for TR/ER backboards for type of wood and paint.

B. All power and telecommunications cables routed to or from the cabinet shall be contained in conduit or concealed within the adjacent wall. No exposed cables are allowed.
   1. A telecommunications main grounding Busbar (TMGB) shall be installed inside the cabinet in accordance with the grounding requirements of the BICSI TDMM and this document.

C. Power and telecommunications cables for equipment housed within the cabinet are to be contained within the cabinet.

D. The design and completed installation of telecommunications cabinets in secured areas shall be reviewed, inspected, and approved by the Superintendent or designee to ensure they present no significant risk to the physical security of the facility or safety risk to staff.

4.7.5.4 Equipment Rack & Cabinet Design

A. The Designer shall obtain detailed equipment information from the A/E's, DOC-RITM, and other DOC personnel as necessary to develop a detailed design layout for each equipment rack and cabinet. The design shall identify the exact placement of all cabling panels, each unit of equipment identified by the A/E's and DOC personnel, locations of electrical outlets, etc.
   1. Designer shall determine the type, quantity, and length of patch cords for all backbone and horizontal cable connections, and equipment identified for each rack and cabinet. Designer shall ensure the lengths of patch cords reach the intended connections without excessive length.
      a. <u>The combined length of all copper patch cords within each channel shall not exceed 32 feet unless the horizontal link length is reduced accordingly.</u>

4.7.6 <u>TR POWER REQUIREMENTS</u>

A. Most, if not all DOC telecommunications equipment requires single phase electrical service. Most buildings at DOC prisons have 3-phase electrical service.

B. The Designer shall perform a detailed review of the electrical service panel wiring design (for new/remodel - provided by the Electrical Engineer, or the existing panel) to ensure compliance to the telecommunications electrical requirements for the TR walls, all racks and cabinets, and all stand-alone equipment.

C. All electrical plans for new or altered electrical installations in DOC facilities must be reviewed by the Washington State Department of Labor and Industries and approved prior to construction, per WAC 296-46A-130 and WAC 296-46A-140.

D. The Designer shall ensure that the routing of electrical conduit and cable from the electrical panel to all technical power and convenience electrical outlets shall adhere to the *ISP Telecommunications Clearances for EMI Reduction* as specified in this document. The Designer shall ensure the appropriate Sections of Division 16 of the Contract Documents and Drawings clearly identify how to route the electrical conduit accordingly.
   a. Electrical conduit should be routed in the sub-floor or in the concrete floor with stub-ups at the appropriate locations to coincide with the equipment rack base wherever possible.

E. Each technical power and convenience electrical outlet shall be labeled with its electrical panel and circuit number identified on the faceplate.

4.7.6.1 TR Technical Electrical Power Panels

A. The technical power circuits shall originate from a technical power panel dedicated to serving the TR. 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 TR or in close proximity to the TR.
   - Some small buildings (such as guard towers) might not justify a dedicated technical power panel. In these cases, an available general-purpose power panel may be used.
     - Designer shall ensure the electrical panel is properly grounded.
   - If standby generator power is available to the facility, the TR technical power panel shall be served by the generator. Whenever possible, the Designer shall coordinate this with DOC on a case-by-case basis.

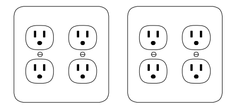
B. Where telecommunications cabinets are used in lieu of a TR, an available general-purpose power panel may be used to support the telecommunications cabinet power outlet via dedicated circuits. However, the Designer shall ensure that the power panel is not used to supply power to sources of electromagnetic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

4.7.6.2 TR 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 identify the electrical panel and circuit number. The 20 Ampere technical power outlets shall be equipped for "straight-blade plugs" (NEMA 5-20R), rather than twist-lock style receptacles.

B. The Designer shall tabulate the connection/load requirements from each piece of equipment identified for the TR and provide the information for review and confirmation by DOC.

4.7.6.2.1 <u>Technical Power Outlets for Equipment Racks/Cabinets</u>

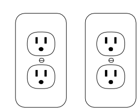


A. Each equipment rack/cabinet shall be equipped with a minimum of two quad power outlets (120VAC, 20 Ampere), each quad power outlet shall be on a separate dedicated 20A circuit.

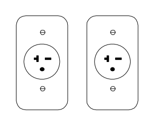
B. Outlets shall be located at the base of the rack/cabinet such that they will not interfere with the placement of equipment (UPS, network electronics, etc.) in the bottom elevation spaces. It is particularly important to coordinate the location of outlets with “double-railed” equipment racks/cabinets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

4.7.6.2.2 <u>Technical Power Outlets for Large, Rack/Cabinet-mounted Equipment</u>

A. At DOC facilities, some IT equipment is fitted with dual power supplies (such as routers, large “core” LAN switches, and most file servers). The Designer shall develop the electrical outlet design for the racks/cabinets accordingly. The design shall indicate where such equipment is intended to reside, and those racks/cabinets shall have separate power outlets to service the large equipment as indicated below. The outlets for the large equipment shall be “<u>in addition to</u>” the two quad outlets for technical power discussed above. Each outlet shall be equipped with a dedicated minimum size #12 AWG, insulated, solid copper, equipment-grounding conductor.



1. Where the equipment requires 120 VAC power, the design shall provide for two duplex power outlets (120 VAC, 20 Ampere) per piece of equipment having dual power supplies, each outlet shall be on a separate dedicated 20A circuit.



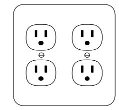
2. Where the equipment requires 208 VAC single phase power, the design shall provide for two simplex power outlets (208VAC, single phase, at the specified Amperes) per piece of equipment having dual power supplies, each outlet shall be on a separate dedicated circuit.

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

C. The outlets described in this section shall be in addition to the two quad Technical Power Outlets described in the previous section for each rack/cabinet.

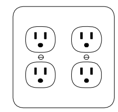
4.7.6.2.3 <u>Technical Power Outlets for Wall-mounted Racks/Cabinets</u>

Each small wall-mount telecommunications cabinet shall be equipped with a minimum of one quad power outlets (120VAC, 20 Ampere), medium to large cabinets shall have two installed inside the cabinet. Each quad power outlet shall be on a dedicated 20A circuit. The outlets shall be colored orange and labeled as “Technical Power” with the electrical panel and circuit numbers identified.

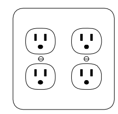
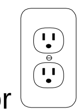


4.7.6.2.4 <u>Wall-mounted Technical Power Outlets</u>

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



B. The design shall also provide for circuits to the other equipment in the TR as required, including:
- Service provider electronics
- PBX or electronic key system
- Inmate telephone equipment
- Voice mail servers


or


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

4.7.6.3 TR Convenience Power Outlets

A. In addition to the technical power outlets described above, the design shall provide for general purpose, convenience duplex convenience outlets (120VAC, 15 Ampere) that are available for use with power tools, testing equipment, etc. These outlets <u>shall not</u> be used to power telecommunications equipment. The convenience power outlets shall be <u>placed at 6-foot intervals along the walls</u> 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).

B. Where wall-mount telecommunications cabinets are used in lieu of a TR, there shall be at least one general-purpose convenience power outlet (120VAC, 15 Ampere) located within six 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.

4.7.7 <u>TR GROUNDING, BONDING, AND ELECTRICAL PROTECTION</u>

All metallic cable shields, metallic conduits, equipment racks and exposed non-current carrying metal parts of telecommunications infrastructure and information technology equipment in the TR and/or wall-mount cabinets shall be bonded to an appropriately designed and constructed TMGB/TGB located within the TR. 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.

4.7.8 TR FOR INMATE TELEPHONE SERVICE

Telecommunications rooms serving inmate telephone locations shall have sufficient backboard space for cables and cable terminations, and floor space for equipment and racks/cabinets to support inmate telephones that is physically separate from administrative telephone cables and cable terminations.

4.7.9 TR FOR CORRECTIONAL INDUSTRIES

Telecommunications rooms serving Correctional Industries (CI) locations shall provide maximum flexibility.

1. The potential exists for CI to establish a Call Center at any of their locations. The Designer shall take this into consideration when sizing the TR's.
2. Telecommunications Rooms serving CI locations shall be sized to allow a minimum of 25% growth. Where industry buildings house separate manufacturing bays, the calculation for the TR growth shall be a minimum of 25% growth per bay.
3. All telecommunications distribution equipment shall be in a locked telecommunications room or locked steel telecommunications cabinet.

4.8 EQUIPMENT ROOMS (ER)

Please refer to the *Equipment Rooms* section of the BICSI TDMM for general information regarding the design of equipment rooms. Note that Equipment Rooms are not Telecommunications Rooms (see Section 4.7), they are distinct from TR's because of the nature or complexity of equipment they contain. The following requirements take precedence over the BICSI TDMM guidelines for telecommunications infrastructure at DOC facilities:

A. Telecommunications Equipment Rooms shall be dedicated to telecommunications functions. At DOC facilities, the main ER (M-ER) is the central location on a campus where the major core telecommunications equipment is located and where the main campus backbone cables terminate. The M-ER typically contains the telephone switching system (PBX), the data center with LAN file servers and server farms, the core LAN switch, and wide area network (WAN) communications equipment. The M-ER is the central hub of a Hierarchical Star topology for an Ethernet LAN design. The Hierarchical Star topology is also the recommended topology for structured cabling backbone systems in buildings and in campus environments.

   1. Secondary Equipment Rooms (S-ER) are consolidation or concentration points for routing telecommunications backbone cables to various buildings in a selected geographical area of a campus, in lieu of homerun routing the cables from the M-ER.
      a. A secondary LAN core switch or a fiber concentrator LAN switch is typically located in an S-ER and up-linked to the core LAN switch in

the M-ER with a high speed fiber optic cable.

b. There may be multiple S-ER at a prison, such as the four at Monroe, one each at MSU, SOU, TRY, and WSRU.
c. An EPN from the PBX may also be placed in an S-ER like the one at Olympic Corrections Center on the Clearwater side of the campus.

B. ER's shall not be shared with electrical installations other than those necessary for telecommunications. The ER may also serve as a BAS/LVE equipment room, but typically does not contain security electronics.

1. Where BAS/LVE equipment is collocated with the ER, the Designer shall increase the ER size to accommodate the additional equipment and required additional working space. The Designer shall ensure the clearances for equipment footprints and clear working space requirements as defined in subsequent sections are incorporated.
2. The ER shall not be shared with electrical installations other than those necessary for direct support of the telecommunication systems.

C. The Designer shall obtain detailed information from the A/E, DOC-RITM, DOC-ITIS, DOC Plant Manager, and other DOC personnel as necessary regarding the equipment that will be located in the ER to perform room/rack/cabinet design and calculate HVAC and electrical requirements. This information shall include size (RU's if rack/cabinet mounted), weight, placement location requirements, voltage and Ampere, single or dual power supplies, heat generated-BTU's, UPS requirements, etc.

1. Note that file servers can not be installed in the Universal 2-post racks and require specific 4-post frames with square mounting holes for cage nuts.

D. 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.

E. The Designer shall be responsible to determine that the architectural, environmental, mechanical, and electrical power 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, Mechanical Engineer, and Electrical Engineer to verify that their design documentation meets the DOC requirements and is fully conveyed in the Construction Documents. For projects without the involvement of an architect and mechanical or electrical engineer, the Designer shall alert DOC where additional architectural, environmental, mechanical, and electrical elements are needed to meet the requirements.

1. The Designer shall verify that all Equipment Room requirements are specified in the appropriate Divisions of the Construction Document (CD) Specifications and Drawings, including CD divisions outside of the DOC TCGS. The information listed below includes some, but not necessarily all of the requirements the Designer shall convey to the A/E:
   a. Division 6 *Wood and Plastics:* plywood size, grade and mounting requirements for backboards.
   b. Division 8 *Doors and Windows*: door size, swing direction, and locks.
   c. Division 9 *Finishes*: type and number of coats of primer and fire-retardant

paint for backboards, room color, and the floor, wall, and ceiling requirements.

d. Division 13 *Special Construction*: raised floor.
e. Division 15 *Mechanical*: FM200-style fire suppression system, sprinkler issues, floor drains, and HVAC requirements.
f. Division 16 *Electrical*: type, size, rating, color, location of outlets and circuits for the room, racks, and cabinets; lighting, security, outside notification lights, etc.

4.8.1 EQUIPMENT ROOM SIZING

A. The first step in determining the size required for the ER is to identify the systems that will be installed in the ER. In this process, first identify the size of the area that will be served from the ER. The area might be an office suite at a Community Corrections office, a single building, or an entire campus at a corrections institution. 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.

B. The Designer shall confer with the DOC-ITIS and DOC-RITM to determine any sizing requirements for the ER on a project-by-project basis. The ER sizes for several DOC sites are listed below, and it is important to note they <u>were not adequately sized or designed for expansion</u> to accommodate future growth requirements for the facility as determined per Section 4.G of this document.

1. ER @ MCC: 30.0 ft x 21.0 ft (630 sq. ft.)
2. ER @ WCCW: 22.5 ft x 22.5 ft (506 sq. ft.)
3. ER @ Hdq-Olympia: (1,058 sq. ft.)

C. The Designer shall, in a functionally efficient arrangement, lay out the equipment for the room with clear working spaces as identified in following sections. 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.
   1. The DOC-ITIS and DOC-RITM (or designee) shall both be involved in this process, and shall approve the final space requirements and design layout for the equipment and racks.

D. When laying out the arrangement of the ER, 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. 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 inmate 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 DOC-owned systems in other areas of the equipment room.
   3. Provide a separate wall space area for demarcation of inmate telephone

cable pairs, inter-building backbone cables, and intra-building feed cables (see Section 4.5.4.2.2 *Inmate Voice Backbone Cabling* of this document). The Designer shall request additional information about cabling for inmate telephone systems (including schematic diagrams) from DOC IT.

4. 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.

E. The Architect/Engineers and Designer shall design and size the ER to readily accommodate the future growth requirements of the DOC-owned campus as determined per Section 4.G of this document. The ER design shall readily accept increases to all telecommunications infrastructure for the facility, such as (service provider pathways for entrance facilities, OSP maintenance holes and entrance pathways for conduits, internal expansion of cables, wall fields, racks/cabinets, etc.), and also provide the necessary architectural, mechanical, and electrical provisioning capacity to support the future growth.

1. Where a relatively large ER expansion could occur in the future, beyond what can be constructed initially, the ER shall be designed and constructed in such a manner that the future building expansion can be constructed with the least amount of expense and disruption to the (24 x 7 x 365 operation) of the ER and the prison.
2. Placement and sizing of the future telecommunications infrastructure shall be incorporated into the current ER design.

F. Once an acceptable equipment layout is developed based on the criteria listed above, the size of the equipment room can be calculated.

4.8.2 EQUIPMENT ROOM LOCATION

A. Once the size has been determined, including the design criteria identified above to accommodate future expansions based on the maximum build-out potential of a prison campus or DOC-owned facility, the location of the equipment room can be selected. To minimize both conduit and cable lengths, the ER shall be located as centralized as possible to the buildings on a DOC campus.

B. In new construction, the ER 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 ER, the DOC-ITIS shall be consulted to design appropriately sized fiber optic cables to route from the ER to the data center. All interconnections between the data center backbone and the campus distribution fiber optic backbone shall be located in the ER.

D. The ER shall be located outside the secured area of a prison to simplify access by service provider technicians and to provide additional security to critical telecommunications equipment in the event of an inmate disturbance inside the secured area. The building housing the main ER and the ER itself shall be designed such that it will be monitored as a part of the overall site security system.

E. Other major factors that affect the location of the ER are:
1. Access for delivery and installation of large equipment into the ER.
2. Access by DOC 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.

F. The ER shall ***not*** be located in any of the locations listed below:
1. Inside the Secured 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 ER.
3. Areas exposed to excessive heat.
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. Refer to Table 4.4 of this document for clearance requirements.

4.8.3 ER ARCHITECTURAL PROVISIONING

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.
1. Refer to NFPA 75.
2. Refer to 2002 NEC Article 645.

B. Special security consideration shall be given to:
1. The material used for exterior walls
2. The size and style of windows
3. The use of heavier doors with heavy-duty locks
4. The vents and roof-mounted HVAC units

C. The design shall reflect the following important characteristics of the ER:
1. The ER 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 ER shall be solid wood core or metal, no glazing, a minimum 36 inches wide and 80 inches high, hinged to open out from the ER space, and not vented. Doors shall be located in hallways or other common areas. In no case shall the door be located in another building occupants' designated space.
    - If the ER door is not directly to the outside of the building, all doors in the most direct route to the outside of the building from the ER door

shall be the same size, or larger. This sizing is necessary to accommodate delivery and installation of large equipment.

3. Minimum clearance height in the ER shall be eight feet without obstructions.
4. A minimum headroom access of twelve (12) inches shall be maintained above cable runways
5. The walls and ceiling shall be treated and sealed to reduce dust. False ceilings are not allowed in ERs. Finishes shall be light in color to enhance room lighting.
6. Floors shall be sealed to reduce dust, light colored, fire retardant, and slip resistant. Carpet is not acceptable for telecommunications spaces.
7. Most Equipment Rooms shall require a raised access computer floor. The raised floor shall have a minimum of 8 inches clearance to the base floor, and shall not be used as an air plenum.
   - The Designer shall request determination of when a raised floor is required from the DOC-ITIS at the onset of design.
   - For raised floors, all floor-standing equipment and equipment racks and cabinets shall be securely anchored to the sub floor. For concrete subfloors, concrete floor anchors shall be used.
8. The room shall be free of plumbing and electrical utilities not directly required to support the telecommunications functions.
9. The ER at a prison shall have a security system installed to detect and alarm the following three conditions at the facility's major control:
   - violations of intrusion
   - high temperature
   - loss of electrical power
10. If the ER 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 for the three conditions identified above.

D. The walls in equipment rooms shall be covered with plywood backboards. The plywood shall be ¾" A-C grade and painted on both sides with primer and two coats of white, fire retardant paint. The plywood shall be mounted with the A grade side exposed. The plywood shall ***not*** be fire retardant (paint tends to flake off of fire retardant plywood).

E. In most cases it is preferable to have the plywood shall extend from the floor to a height of eight feet above the finished floor. In ERs 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.

F. In new construction, power and telecommunications outlets, and light switches in the ER 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.

G. Lighting shall be a minimum equivalent of 500 lux (50 footcandles) measured 1 m

(3 ft) above the finished floor.

1. Light fixtures shall be a minimum of 8.5 ft above finished floor and placement shall be coordinated with racks/cabinets to provide the best lighting exposure.
2. Emergency lighting is required.
3. Power for lighting should not come from the power panel inside the ER. At least 50% of the lighting shall be on emergency power, if available.

4.8.4 ER ENVIRONMENTAL PROVISIONING

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

B. In addition to the requirements in the BICSI TDMM, equipment rooms shall be environmentally provisioned as follows:

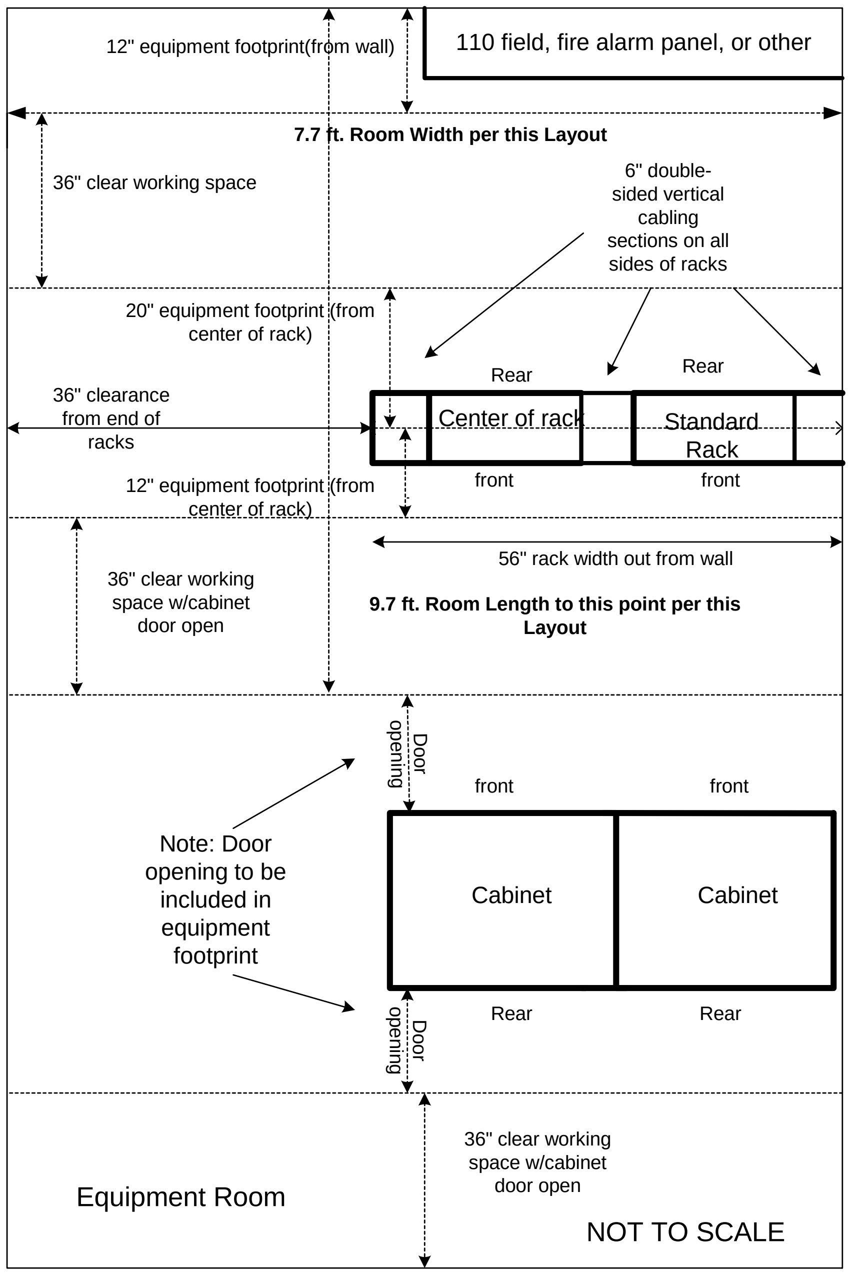
1. ERs shall require an HVAC system capable of operating on a 24 hours-per-day, 365 days-per-year basis, capable of maintaining the temperature between 64-75F degrees with a relative humidity between 30-55%.
    a. Electrical power provisions shall be made to allow the HVAC system to operate on emergency power when commercial power is disrupted.
    b. If the building HVAC system cannot assure continuous operation, a stand-alone (backup) HVAC unit shall be provided for the ER and connected to emergency generator power.
    c. Where humidity levels exceed the limits specified, provide dehumidification equipment.
    d. A high temperature alarm shall be provided and shall be connected to an annunciator located at the Master Control position.
2. A clean agent fire suppression system is required in the ER of medium to large prisons, such as the FM 200 system, and strongly recommended for small prison sites.
    a. All sprinkler heads within the TR shall be removed.
    b. No equipment shall be located directly below or within four feet of any pipes containing water or liquid material.
3. If the Local Authority also requires fire suppression sprinklers to be installed in the ER, the following shall be designed and installed:
    a. Sprinkler heads shall be high-temp, shunt, and dry-head type.
    b. A cut-off valve shall be installed and located outside the equipment room to keep the sprinkler heads dry and charged only in the event additional fire suppression is required after expression of the clean agent.
    c. Sprinklers shall be equipped with wire cages under the sprinkler heads to prevent accidental discharge.
    d. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.
    e. When sprinklers or other water handling equipment are located in the ER, or where the potential for ingress of water exists, a free-flowing floor drain shall be installed.

4.8.5 ER LAYOUT AND EQUIPMENT RACKS & CABINETS

A. When designing the layout for Equipment Rooms, the Designer shall allow adequate space for both “Equipment Footprints” and “Clear Working Space.”

The following diagram illustrates DOC’s minimum requirements for Equipment Footprints and Clear Working Space requirements for Equipment Rooms:

Figure 4.6 Equipment Room (ER)



Layout

1. 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.

a. The Designer shall coordinate with the DOC-RITM to determine if file servers will be located in the ER, and design the rack/cabinet layouts accordingly to ensure clear working space. The current file servers require space for two people, one on each side of the rack/cabinet, to lift the unit for installation due to the weight. This precludes placing the rack/cabinet against a wall or other object where a server will be installed.

2. 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 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.
   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.

4.8.5.1 Floor-standing Equipment Racks/Cabinets

A. All requirements for Floor-standing Equipment Racks/Cabinets stated in the *Telecommunications Rooms* Section 4.7.5.1 of this document also apply to ERs.

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

4.8.5.2 Equipment Rack & Cabinet Design

A. All requirements for Equipment Rack & Cabinet Design stated in the *Telecommunications Rooms* Section 4.7.5.4 of this document also apply to ERs.

4.8.6 ER POWER REQUIREMENTS

A. All *TR Power Requirements* stated in Section 4.7.6 of this document also apply to ERs with the exceptions listed below.

4.8.6.1 ER Technical Electrical Power Panels

A. The ER shall be equipped with a power disconnect switch located near the main door of the ER. The switch shall disconnect power to all electronic equipment in the ER, and is to be used in the event of electrocution or fire in the ER. There shall also be a similar means to disconnect the power to dedicated HVAC equipment serving the ER 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 ER. This electrical panel shall be designated as “ER Technical Power.” The ER 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. The technical power circuits shall originate from a technical power panel, dedicated to serving the ER. 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.

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

E. At medium and large facilities, a centralized uninterruptible power supply (UPS) is required to support the electronics equipment in the ER. 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 DOC. The Designer shall verify the status of a “medium/large” facility with the DOC-RITM or DOC-ITIS.

1. A centralized UPS shall be compliant with the NEC and shall be located in a room that is equipped to vent battery gasses. A centralized UPS shall not be located within the ER that it serves. It shall provide a minimum of two hours run time for the supported low voltage systems hardware identified by the DOC-RITM. The Designer shall request direction from the DOC-RITM regarding any specific needs for an increased UPS run time.
2. Upon installation, a qualified electrician shall test new centralized UPS units for correct voltage prior to connecting DOC equipment. Rooms housing centralized UPS systems shall have the same environmental provisioning as the ER.
3. The Designer 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.
   a. The Designer shall evaluate such claims for applicability on each project.
   b. Designs for a large UPS where the room is not equipped to vent battery gasses shall require a review and approval by the Local Authority prior to design approval, and additional inspection after installation.

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

4.8.6.2 ER Convenience Power Outlets

A. <u>The circuits for the ER convenience outlets shall not originate from the separate ER technical electrical power panel.</u>

4.8.7 <u>GROUNDING, BONDING, AND ELECTRICAL PROTECTION</u>

A. All requirements for Grounding, Bonding, and Electrical Protection stated in the *Telecommunications Rooms* Section 4.7.7 of this document also apply to ERs.

4.8.8 <u>INMATE TELEPHONES – SUPPORT/EQUIPMENT ROOM</u>

The telecommunications pathways and spaces needed for supporting inmate telephone services shall be planned into the overall architectural design of the facility. Inmate 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 DOC to plan, install, own, and maintain the telecommunications infrastructure supporting inmate telephone services. All telecommunications distribution infrastructure required by inmate telephone service contractors shall comply with the DOC TDIS, and shall be installed by DOC-selected SYSTIMAX® VARs. The Designer shall consider the following requirements when planning the telecommunications infrastructure and substructure to support inmate telephones:

A. The inmate telephone equipment room shall be located outside of the Secured Area if possible. It should also be located adjacent to or as close as possible to the Intelligence and Investigations (I&I) offices, and shall contain the inmate phone monitoring and recording equipment.
   1. Some applications with limited space might require a segregation solution to fence off or partition an area of the ER for inmate telecommunications equipment.
   2. Other applications might require the inmate telephone demarcation point to be located near the demarcation point for administrative telephone services and then extended from that point to the inmate telephone equipment room.

B. The inmate 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 inmate telephones.

C. Inmate telephone equipment rooms serving inmate telephone locations shall have sufficient backboard space for separate cables and cable terminations to support inmate 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 DOC facilities:

4.9.1 ENTRANCE FACILITY LOCATION

A. DOC requires the telecommunications entrance facility (EF) be co-located with the Main Telecommunications Equipment Room (ER) for the facility.

B. The service providers' technicians will need access to the EF. Such access is simplified if the facility Entrance Facility and Equipment Room are located outside of the Secured Area.

C. DOC IT requires the wide area network (WAN) equipment be located in the main ER, which is also the typical location of the LAN server farms. DOC IT requires that installation services be obtained directly from the serving Telco (Local Exchange Carrier) provider (such as Qwest, Verizon, Century Tel) when the Telco demarcation point for the WAN telecommunications circuit requires an extension to the location of the WAN equipment. Extension of the Telco demarcation point by a cabling contractor other than the serving Telco provider shall not be accepted.

D. The Designer shall coordinate with the various 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.

E. At DOC facilities, the Designer shall design cable pathways (using 4" conduit) from the property line to the EF.
   1. The cable pathways shall be underground conduit, with telecommunications maintenance holes or handholes as necessary, and shall comply with DOC's TDIS and those of the service providers.
   2. Close coordination with each of the service providers is critical to determine that their requirements for entrance pathways are met. Where the service provider's requirements are in conflict with DOC's TDIS, the Designer shall bring the issues to the attention of the DOC-ITIS for direction.
   3. Some service providers will not share conduit or maintenance holes with

other service providers.

4. The design shall include spare pathways sized to accommodate the future maximum build-out potential of the DOC-owned campus as defined previously in Section 4.G of this document, or at least a 25% increase, whichever is greater.

F. The use of aerial distribution for entrance facilities at DOC prisons or DOC-owned facilities is not allowed.

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 and those specified in the DOC TCGS take precedence over the BICSI TDMM guidelines for field-testing at DOC facilities:

A. The Designer shall note that DOC requires a more stringent test on horizontal copper cable as specified in TCGS 16740 *Inside Plant Communications Circuits.*

B. 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.

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

4.11 RESIDENTIAL CABLING

Please refer to the *Residential Cabling* section of the BICSI TDMM for information regarding the design of telecommunications infrastructure to support residential facilities within DOC facilities.

While this type of facility will be uncommon at DOC facilities, the Designer shall inquire of the DOC-ITIS whether a “residential cabling” solution is required for a particular project. Please note that the “residential cabling” solution will not be provided for inmate residences.

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 Americans with Disabilities Act (ADA) requirements at DOC facilities.

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

1. Coin-operated telephones are typically not provided for use by the inmate population.

2. Where coin-operated telephones are provided in DOC facilities, the “shelfette” style shall be used rather than a booth.

B. The Designer shall request guidance from DOC regarding the requirements for inmate telephones within DOC facilities.
1. Inmate telephones are generally not located centrally. The Designer shall coordinate the locations of inmate telephones with the designated security representative at the facility.
2. Inmate telephones shall not be designed to be located within separate booths.
3. Inmate telephone calls are monitored and recorded.
4. In some cases it might be necessary to provide TTY-type (text-based) inmate telephones for use by deaf inmates.
5. Cabling to support inmate telephones shall be connected to a set of 110 blocks in the TR that is physically separated from the terminations for administrative telephone and data cabling.
6. Cabling serving inmate 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.
7. Typically, the manufacturer of the inmate telephone system will install the inmate telephones at the locations indicated on the drawings and will connect the Contractor-provided unterminated, UTP cable to the telephone.

C. The Designer shall request guidance from DOC regarding the particular spaces within DOC facilities intended to include Americans with Disabilities Act (ADA) features. The design shall comply with the requirements of the ADA, in part to accommodate non-inmate employees and visitors.

D. Automatic Teller Machines (ATM) are typically not provided at DOC facilities.

4.13 TELECOMMUNICATIONS ADMINISTRATION

The ANSI/TIA/EIA-606-A Standard shall be used to determine all identifiers and formats for documenting and labeling DOC telecommunications infrastructure elements within a building or campus, excluding equipment. The classes of administration that shall be used for DOC facilities are Class 1, 2, or 3 as described later in this section.

- An approved Alternative Design Request shall be required to use any other identifiers or labeling scheme.

Please refer to the *Telecommunications Administration* section of the BICSI TDMM for basic, general information regarding the documentation and labeling of telecommunications infrastructure. However, for a thorough understanding of the identifier formats, please refer to the ANSI/TIA/EIA-606-A Standard.

The following requirements take precedence over the BICSI TDMM guidelines and ANSI/TIA/EIA-606-A Standard for telecommunications administration at DOC facilities.

4.13.1 IDENTIFICATION STRATEGY

A. An "identifier" is an item of information that links a specific element of the telecommunications infrastructure with its corresponding record in a structured format. Identifiers for telecommunications infrastructure shall follow the definitions and format per the ANSI/TIA/EIA-606-A Standard, unless specified differently within this document or through an approved ADR. The "606-A" classes of administration used at DOC facilities for identifiers, records, and labeling shall be:

1. Class 1: DOC sites consisting of a single building and a single telecommunications room.
2. Class 2: DOC sites consisting of a single building with more than one telecommunications room.
3. Class 3: DOC prisons and multi-building sites.

B. The Designer shall assign identifiers to the telecommunications infrastructure elements as described in this Section and clearly show the identifier assignments and formats on the Construction Documents with clear instructions for the Contractor to apply labels and signage. The Construction Documents shall include a tabulated report using MS-Excel or approved alternative, of the identifiers in the "Record Format" 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, Headroom, etc.) that are obtained during the construction and testing processes.

C. 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 in the correct format, and correctly applied to all labels and signage by the contractors during construction.

D. 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-#" for voice and "D-#" for data outlet labeling is inconsistent with the industry standard-based philosophy of designing cabling systems that are independent of the application, and are therefore not permitted.

E. The TCGS may contain additional identification requirements, including some items that may not be addressed below. The items listed below shall be shown on the Construction Documents, whereas the TCGS may include some identification and labeling requirements that typically do not appear on the Construction Documents.

F. The Designer shall evaluate any existing telecommunications Administrative Identification Strategy at a facility, considering the pros and cons with the strategy listed in this Section.

- Where an existing strategy differs from the one in this Section, the Designer shall meet with both the DOC-ITIS and DOC Plant Manager to determine how to proceed.

- If the Administrative strategy chosen differs from this Section, the Designer shall prepare documentation on how it is deployed if documentation does not exist (within the scope of the project) and modify the TCGS sections appropriately. All requirements for preparation of relevant documentation and application of labeling and signage within this Section shall still apply, but using the chosen Administrative Identification Strategy.

4.13.1.1 New Telecommunications Distribution Systems

For a new facility, the Designer shall assign the identifiers to the telecommunications components based on the identification strategy listed below.

A. <u>Building Identifier:</u>
For Class 3 Administration, each building shall have a unique identifier.

1. Record Format: (*b*)
   a. Shall be 3-4 alpha-numeric characters.
2. Label Format: Same as Record Format.
   a. Shall be identified on the Construction Documents prints for labels requiring reference to building identifier.
3. The Designer shall meet with the DOC DOC-ITIS, DOC-RITM, and DOC Plant Manager to determine the identifier scheme for the campus building(s).

B. <u>Telecommunications Space (TS) Identifier:</u>
For Class 1-3 Administration, each TS shall have an identifier. Please note that a TS may or may not be a designated telecommunications room – it might just be a floor or wall-mounted telecommunications cabinet, and the room number is not the TS Identifier.

1. Record Format: (*fs*) for Class 1 and 2; *(b-fs)* for Class 3
   a. Where “b” is the building as described above.
   b. Where “*f*” is the floor number on which the telecommunications space resides. In lieu of a numeric floor number:
      i. The letter “B” will be used for basement.
      ii. The letter “M” will be used for mezzanine.
   c. Where “*s*” represents a sequentially assigned alpha character uniquely identifying the telecommunications space on floor “*f”* in which the space is located.
      - Example: A building with two telecommunications spaces on the third floor would have the space labeled “3A” and “3B”.
2. Label Format: Same as Record Format.
   a. The TS Identifier(s) shall be identified on the Construction Document prints.
   b. Although the space may have a “Room Number” on the Construction Documents, the TS Space Identifier shall also be defined.
3. The Telecommunications Space is typically a Telecommunications Room (TR) or Equipment Room (ER), but could also be a floor or wall-mounted telecommunications cabinet in an area that is not a typical TR or ER, such as the middle of a warehouse.

4. Inside <u>secured areas</u>, the telecommunications space shall be assigned an identifier and most likely a room number. However:
   a. The TS Identifier shall be identified by a sign located <u>“inside”</u> the space.
   b. Any physical sign placed on the outside of the room shall only refer to a room number or the very cryptic TS Identifier as defined above. Labels or signage indicating the space or room name, function, or its purpose relating to telecommunications shall <u>not be located outside of the space or room</u>.

C. <u>Maintenance Hole & Handhole (MH/HH) Identifier</u>:
Maintenance holes and handholes shall be identified based on an alphanumeric grid overlay of the entire facility site.

1. Record Format: *(PMH-VHHX)*
   a. *PMH*: TIA-606-A optional identifier for “Pathway Maintenance Hole.”
   b. *VHHX*:
      i. “V” represents the letter of the alphabet associated with the vertical axis or row of the grid square.
      ii. “HH” represents a two-digit number (leading “0” if necessary) associated with the horizontal axis or column of the grid square.
      iii. “X” represents a sequentially assigned letter, starting with “A”, to distinguish between multiple maintenance holes or handholes located within the same grid square.
2. Label Format: Same as Record Format.
   a. Shall be identified on the Construction Document prints for all MH/HHs.
   b. See TCGS Section 16108 for additional label information.
3. The alphanumeric grid system shall be superimposed over the facility site plan with gridlines shown at 100-foot intervals. Designer shall specify the MH/HH identifier in the construction documents and ensure the MH/HH identifier is placed on the MH/HH lid, and a sign is attached to the North wall inside the MH/HH indicating “North Wall” and the MH/HH identifier.
   a. The origin of the grid shall be in the lower left corner of the site plan (typically the south-west corner of the site).
   b. The vertical axis of the grid shall be labeled alphabetically starting at the bottom left with “A”, and the horizontal axis shall be labeled numerically starting at the top left with “01”.
   c. Maintenance holes or handholes that lie within a grid square shall be labeled with an identifier based on the letter and number of that grid square as indicated above.
      - 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 grid square shall be labeled “K08B”, and so forth.

D. <u>MH/HH Duct Identifier</u>:
Each conduit attached to a MH/HH shall be assigned a **<u>permanent</u>** duct identifier. The MH/HH Duct Identifier shall be part of the *OSP Conduit Identifier* format where conduit routes to a MH/HH. The goal of assigning permanent duct identifiers is to establish an identification scheme to eliminate confusion where

different identifiers have been assigned to the same conduit in the same MH/HH on different projects. This will reduce repeated physical inspections of MH/HH's to develop project documentation and eliminate confusing as-built documentation.

1. Record Format: (d)
   a. For wall sections, shall be 1-2 numeric characters.
   b. For top or base sections, shall be 2-3 alpha-numeric characters.
2. Label Format: Physical labels shall not be attached to the inside of the MH/HH for the duct identifiers.
   a. MH/HH Duct Identifiers shall be specified on the MH/HH Butterfly documents and as part of other labels as specified within this document.
3. Within the scope of a project, the Designer shall identify "all" existing and new conduits with an identifier for each MH/HH on a Butterfly Diagram, not just specific conduits used for cabling.
4. The Designer shall obtain current as-builts on all existing MH/HH's affected by the current project. If the Administrative Identification Strategy in this Section is used but is different from that on the as-builts, the Designer shall update the as-builts per this Section and provide to DOC as part of the current project.
5. Where existing infrastructure procedures allowed a cable, that was not installed within conduit, to directly enter a MH/HH wall, it shall also have a duct identifier number assigned to it.
6. For MH/HH <u>wall sections</u>:
   a. Viewed from the inside of a MH/HH, the origin of the duct identifier for a given wall shall be the lower left corner of the left side of each wall. For <u>each separate wall</u> (N, E, S, W), the identifier shall start with a number "1" and be sequentially assigned.
   b. Most MH/HHs have a defined center area on a wall separating where conduit enters the left side verses the right side of the same wall. Where this occurs, conduits on the left side of each wall shall be assigned duct identifiers before the conduits on the right side of the same wall.
      i. Where the MH/HH wall has no identifiable center area separation to designate a left side/right side conduit entrance section, assign the duct identifiers uniformly left to right across the entire wall.
   c. The duct identifier number assignment shall increment sequentially working from left to right across the bottom row of conduits on the left side of the wall, then up to the next row left to right, etc., until the last conduit on the left side of the wall is assigned a duct identifier number.
   d. Using the next sequential number for this wall, move to the right side of the same wall, start at the left conduit entrance of the bottom row, and continue assigning duct identifier numbers working left to right across the bottom row of conduits on the right side of the wall, then up to the next row, left to right as described above.
   e. When moving to the next wall, such as from the North wall to the East wall, start with "1" for the duct identifier number assignment.
   f. Where conduits are added to a MH/HH at a later date after the initial assignment of duct identifiers, based on the conduit entrance location the new duct identifier may be out of sequence, per the scheme described above. Where this occurs, the Designer shall check with both the DOC-

ITIS and DOC Plant Manager to determine how to proceed with assigning a number.

i. The new conduits may be assigned the next sequential duct identifier number for that specific wall, even though the numbers will appear out of sequence on Butterfly Drawings, or the entire wall may be re-numbered to maintain a uniform sequential duct identifier assignment.
    - If the existing duct identifiers are re-numbered, the Designer shall ensure that all as-built documentation using the MH/HH Duct Identifiers are changed accordingly.

7. For MH/HHs with a separate base and/or top section:
Where a MH/HH has a separate base or top section, conduit entering either shall be assigned alpha-numeric Duct Identifiers with the number assignment separate from the wall sections.

NOTE: DOC requires an approved ADR before allowing conduits to be placed into a top or base section of a MH/HH.

a. For the top section, the origin of the duct identifiers shall be at the lower left corner of the top section. For each wall side, the identifier shall start with the alpha-numeric number "T1" and increase sequentially (such as T1, T2). The assignment scheme shall be the same as described above for walls.
b. For the base section, the origin of the duct identifiers shall be at the lower left corner of the base section. For each wall side, the identifier shall start with the alpha-numeric number "B1" and increase sequentially (such as (B1, B2). The assignment scheme shall be the same as described above for walls.

E. OSP Conduit Identifiers – General:
Each individual conduit within an OSP ductbank section shall be assigned a unique identifier. An OSP ductbank section shall be defined as "that section of conduit with two open ends - or - between two pull points." The OSP ductbank sections shall be:
- Building to building (conduit does not enter a MH/HH)
- Building to maintenance hole
- Maintenance hole to maintenance hole

F. OSP Conduit (Building to Building) Identifier:
Where OSP conduit section runs directly between two buildings with no intersecting MH/HH. All OSP conduits shall be labeled at each building end identifying the location of the opposite open end as defined below.

1. Record Format: *[b1-fs1]/[b2-fs2]-PCN.n(s".l')*
a. *"b1-fs1"* = building identifier and TS identifier in which one end of the conduit is terminated.
b. *"b2-fs2"* = building identifier and TS identifier in which the opposite end of the conduit is terminated.
c. *"PCN"* = TIA-606-A optional identifier for "Pathway Conduit."
d. *"n"* = 1-2 numeric characters uniquely identifying a single conduit with one end terminated in the TS space designated *b1-fs1* and the other end

terminated in the TS designated as *b2-fs2*. The *"n"* assignment shall be the same number for both ends of the conduit and increment sequentially for multiple conduits between the same buildings and TS.

e. *"s""* = the trade size of the conduit expressed in inches of diameter.
f. *"l'"* = the end-to-end length of the conduit expressed in lineal feet between the two buildings.

2. Label Format: *To: b1-fs1-PCN.n* and *To: b2-fs2-PCN.n*
   a. See *Record Format* above for identifier definitions.
3. Example: Where conduit starts at the IT building – floor 1, telecom space (TS) A, ends at the Administration building – floor 2, TS A,, conduit numbered "1", is a 4 inch conduit, with a total length of 172.3 feet.
   o Record Format: *[IT-1A]/[Adm-2A]-PCN.1(4".172.3')*
   o Label on conduit at IT Building: *To: Adm-2A-PCN.1*
   o Label on conduit at Adm Building: *To: IT-1A-PCN.1*

G. OSP Conduit (Building to MH/HH) Identifier:
Where OSP conduit section runs from a building to a MH/HH. All OSP conduits shall be labeled at the building end identifying the location of the opposite open end as defined below.

1. Record Format: *[b-fs]/[PMH-UUU.n.d]-PCN.n(s".l')*
   a. *"b-fs"* = building identifier and TS identifier in which one end of the conduit is terminated.
   b. *"PMH"* = TIA-606-A optional identifier for "Pathway Maintenance Hole."
   c. *"UUU"* = MH/HH Identifier "VHHX" as defined earlier.
   d. *"n"* = one letter alpha character (N, E, S, W) identifying the MH/HH wall where the conduit enters.
   e. *"d"* = MH/HH Duct Identifier as defined earlier.
   f. *"PCN"* = TIA-606-A optional identifier for "Pathway Conduit."
   g. *"n"* = 1-2 numeric characters uniquely identifying a single conduit with one end terminated in the TS space designated *b-fs* and the other end terminated at the MH/HH designated as *UUU*. The *"n"* assignment shall increment sequentially for multiple conduits between the same building and MH/HH.
   h. *"s""* = the trade size of the conduit expressed in inches of diameter.
   i. *"l'"* = the end-to-end length of the conduit expressed in lineal feet between the building and MH/HH.
2. Label Format @ Building: *To: PMH-UUU.n-PCN.n*
   a. See *Record Format* above for identifier definitions.
3. Label Format @ MH/HH: Refer to the *Conduit Information* section of the *MH/HH Butterfly Diagram*.
   a. Labels are not used within MH/HH to identify conduit. Conduit shall be identified on the MH/HH Butterfly Diagrams.
4. Example: Where conduit starts at the IT building – floor 1, telecom space (TS) A, conduit numbered "2", is a 4 inch conduit, with a total length of 235.5 feet, entering MH G06A, North wall, duct identifier #6.
   o Record Format: *[IT-1A]/[PMH-G06A.N.6]-PCN.2(4".235.5)*
   o Label on conduit at IT Building: *To: PMH-G06A.N*

H. OSP Conduit (MH/HH to MH/HH) Identifier:

Where OSP conduit section runs from a MH/HH to a MH/HH.

1. Record Format: *[PMH1-UUU.n.d]/[PMH2-UUU.n.d]-PCN.n(s".l')*
   a. *"PMH1"* = "Pathway Maintenance Hole" identifier in which one end of the conduit is terminated.
   b. *"UUU.n.d"* = See *OSP Conduit (Building to MH/HH)* above for identifier definitions.
   c. *"PMH2"* = "Pathway Maintenance Hole" identifier in which the opposite end of the conduit is terminated.
   d. *"UUU.n.d"* = See *OSP Conduit (Building to MH/HH)* above for identifier definitions.
   e. *"PCN.n(s"l'"* = See *OSP Conduit (Building to MH/HH)* above for identifier definitions.
2. Label Format: Refer to the *Conduit* Information section of the *MH/HH Butterfly Diagram*.
   a. Labels are not used within MH/HH to identify conduit. Conduit shall be identified on the MH/HH Butterfly Diagrams.

I. <u>Campus Backbone Cable Identifiers – General:</u>
Each individual OSP backbone cable shall be assigned a cable identifier that is unique for that specific cable and different from all other cables throughout the entire facility. Where backbone cables are spliced (regardless of the splice type – straight, branch, or butt), creating multiple cable segments (legs) extending from the original backbone cable, each cable segment shall be assigned a suffix to the main cable identifier to create a unique cable identifier for each segment.

J. <u>Campus Backbone Cable Non-spliced Identifier:</u>

1. Record Format: *[b1-fs1]/[b2-fs2]-PCN.n-UUU.n(l,q)*
2. Label Format:
   i. *To: b2-fs2-UUU.n*
   ii. *To: b1-fs1-UUU.n*

Shall have identifiers in the form of *"[b1-fs1]/[b2-fs2]-UUU.n(l,q)*. The campus backbone cable identifier shall be marked on each end of the backbone cable within 24 inches of the end of the cable jacket and at each entry/exit end inside every MH/HH.
   a. *"b1-fs1"* = building identifier and TS identifier in which one end of the backbone cable is terminated.
   b. *"b2-fs2"* = building identifier and TS identifier in which the opposite end of the backbone cable is terminated.
   c. *"PCN.n"* = TIA-606-A optional identifier for "Pathway Conduit."
   d. *"UUU"* = identifier from TIA-606-A Table 3 for cable type.
      a. *Examples:*
         1. *"ACA"* for Administrative Voice Copper Cable
         2. *"ICA"* for Inmate Voice Copper Cable
         3. *"BCA"* for Building Automation Systems (BAS) Copper Control Cable
         4. *"FCA"* for Fiber Cable
         5. *"XLG"* for Coaxial Cable Leg

e. *"n"* = one or more numeric characters uniquely identifying a single cable with one end terminated in the TS space designated *b1-fs1* and the other end terminated in the TS designated as *b2-fs2*. The Designer shall ensure that the *"n"* assignment is unique for each cable between two TS's for both existing cables and cables added within the project.
f. *"l"* = Qualifying information on the cut length of the cable between the two end terminations expressed in lineal feet with one decimal.
g. *"q"* = Qualifying information on the quantity of copper pairs or fiber strands.
    i. For copper, state the number of pairs.
    ii. For SM or MM fiber, state as "nn-mode-core size".
        1. Where "nn" is the number of strands.
        2. Where "mode" is "SM" or "MM".
        3. Where "core size" is expressed as:
            a. 8.0
            b. 50.0
            c. 62.5
    iii. For composite fiber, state as: *"nnCM,nn-SM-core size,nn-MM-core size".*
        1. Where "nnCM" is the total number of strands for the composite mode fiber cable.
        2. Where "nnSM" and "nnMM" identify the number of SM and MM strands respectfully.
        3. See "core size" above.

- For example: There are six existing OSP backbone cables run between the Main Equipment Room and the first of two Education buildings: one Administrative copper voice backbone cable, one Inmate copper voice backbone cable, one BAS shielded twisted pair copper cable, one MMF cable, one SMF cable, and one coaxial cable. The existing cables should be labeled as follows:
    - [MER-1A]/[EDU1-1A]-ACA.01(225.3',100)
    - [MER-1A]/[EDU1-1A]-ICA.01(225.9',50)
    - [MER-1A]/[EDU1-1A]-BCA.01(225.7',2)
    - [MER-1A]/[EDU1-1A]-FCA.01(230.1',24-MM-62.5)
    - [MER-1A]/[EDU1-1A]-FCA.02(230.6',12-SM-8.0)
    - [MER-1A]/[EDU1-1A]-XLG.01(226.0',1)
- The new project will add the following additional cables: one Administrative copper voice backbone cable, two BAS shielded twisted pair copper cables, one composite fiber cable, and three coaxial cables. The new cables should be labeled as follows:
    - [MER-1A]/[EDU1-1A]-ACA.02(225.5',100)
    - [MER-1A]/[EDU1-1A]-BCA.02(224.3',2)
    - [MER-1A]/[EDU1-1A]-BCA.03(224.3',2)
    - [MER-1A]/[EDU1-1A]-FCA.03(232.2',36CM,24-SM-8.0,12-MM-50.0)
    - [MER-1A]/[EDU1-1A]-XLG.02(226.0',1)
    - [MER-1A]/[EDU1-1A]-XLG.03(226.5',1)
    - [MER-1A]/[EDU1-1A]-XLG.04(228.0',1)

K. <u>Campus Backbone Cable Spliced Identifier:</u>
Shall have identifiers in the form of *"[b1-fs1]-UUU.n(l,q,pr-pr)/[MH.n-CSn]/[b2-fs2]-UUU.n(l.g)"*. The campus backbone cable identifier shall be marked within 24 inches of each end where the cable enters a TR/ER and at each end entering and exiting a splice case, and at each entry/exit end inside every MH/HH. **<u>Note</u>**: where cables are spliced more than once between buildings, the Designer shall work with the DOC-ITIS to develop the correct identifier methodology based on this scheme.

1. *"[b1-fs1]-UUU.n(l,q)"* = As identified above in *Campus Backbone Cables Non-Spliced*, for the originating end of the cable that is spliced. This cable normally has a higher pair or strand count than the "b2-fs2" cable.
2. *"(…pr-pr)"* = Shall be the specific copper pair or fiber strand numbers of the *"b1-fs1"* cable spliced onto the "*b2-fs2"* cable. Such as pairs "01-50" of a 100 pair cable, with pairs "51-100" going to a different building or dead-end inside the splice case.
3. *"MH.n"* = *"MH"* shall be used to identify "Maintenance Hole" or "Hand Hole". Where "n" shall be the four character MH/HH grid identifier as described earlier, specifying the specific maintenance hole or handhole where the splice case is located.
4. *"[b2-fs2]-UUU.n(l,q)"* = As specified above in *Campus Backbone Cables Non-Spliced*, for the cable originating from the splice case. This cable normally has a lower pair or strand count than the "b1-fs1" cable.

- For example: The 24th Administrative copper cable (OSP CAT 3 200 pair voice backbone) runs from the Main ER 423.5 ft and terminates into a splice case labeled "CS1" in maintenance hole K08A. Two cables exit splice case CS1 in MH.K08A with one 50-pair copper cable running 253.8 ft to the new IMU building (1st copper cable in the IMU) using pairs 01-50 of the cable from the MER. A second 50-pair copper cable running 622.0 ft to the new TR on the 2nd floor of the Administration building (3rd copper cable) using pairs 51-100 of the cable from the MER. Pairs 101-200 of the cable from the MER are dead end in the splice case. The cable runs would be labeled as follows:
  - [MER-1A]-ACA.24(423.5',200,01-50)/[MH.K08A-CS1]/[IMU-1A]-ACA.01(253.8',50)
  - [MER-1A]-ACA.24(423.5',200,51-100)/[MH.K08A-CS1]/[Adm-2A]-ACA.03(622.0',50)

  For record keeping, the following is a definition of the 100 dead end pairs in the splice case:
  - [MER-1A]-ACA.24(423.5',200,101-200)/[MH.K08A-CS1]

L. <u>Campus Backbone Pair or Strand Identifier:</u>
Shall have identifiers as *"[b1-fs1]/b2-fs2]-n.d"*. This identifier shall be marked on the front of the patch panel or the IDC connector (punch-down block) labeling strip in a way to clearly identify the intended pair or optical fiber.

1. *"[b1-fs1]/b2-fs2]-n"* = specified above. Label the patch panel.
2. *"d"* = two to four numeric characters identifying a single copper pair or a single optical fiber strand. Label each patch panel port or IDC connector section.

M. <u>ISP Conduit/Cable Tray Identifier:</u>

Each Inside Plant (ISP) conduit or cable tray designated for telecommunications shall be assigned a unique identifier. All conduits/trays shall be labeled at each end, designating the opposite end as defined below.

1. Record Format: *[b-fs1]/[fs2]-PCN.n(s".l')*
   a. *"b-fs1"* = building identifier and TS identifier in which one end of the conduit/tray is located.
   b. *"fs2"* = the TS identifier in which the opposite end of the conduit/tray is located.
   c. *"PCN" or "PCT"* = TIA-606-A optional identifier for "Pathway Conduit" or "Pathway Cable Tray."
   d. *"n"* = 1-2 numeric characters uniquely identifying a single conduit/tray with one end terminated in the TS space designated *b-fs1* and the other end terminated in the TS designated as *fs2*. The *"n"* assignment shall be the same number for both ends of the conduit/tray and increment sequentially for multiple conduits/trays between the same TS's.
   e. *"s""* = the trade size of the conduit or width or the tray expressed in inches.
   f. *"l'"* = the end-to-end length of the conduit/tray expressed in lineal feet between the two TS's.
2. Label Format: *fs1/fs2-PCN.n* -or- *fs1/fs2-PCT.n*
   a. See *Record Format* above for identifier definitions.

N. <u>Building Backbone Cable Identifier:</u>
Each individual building backbone cable shall be assigned a cable identifier that is unique for that specific cable and different from all other cables throughout the entire facility.

1. Record Format where cable is within conduit or cable tray:
   [b-fs1]/[fs2]-PCN.n-UUU.n(l,q) -or- *PCT*

   Record Format where cable is not within conduit or cable tray:
   [b-fs1]/[fs2]-UUU.n(l,q)

2. Label Format: *fs1/fs2-UUU.n*
   a. See *Campus Backbone Cable* above for identifier definitions.

O. <u>Equipment Rack & Cabinet Identifier:</u>
Shall have identifiers in the form "*fs-PRK.nn*" or "*fs-PCB.nn*".
1. See Telecommunications Space for "fs".
2. Where *"PRK"* stands for Pathway Rack and *"PCB"* stands for Pathway Cabinet, and "*nn*" is the sequential rack and cabinet number within a given TS. Racks and cabinets shall be treated the same within a TS when assigning the sequential "nn" number.

o For example: Two racks with a cabinet in-between in telecommunications room 3A, would have the following labels:
   - 3A-PRK.01
   - 3A-PCB.02
   - 3A-PRK.03

P. Horizontal Patch Panel and IDC Connector (punch-down block) Identifier:
Shall have identifiers in the form of “fs-a”. Each horizontal patch panel and IDC connector panel shall be assigned a unique sequential alpha-numeric number within the TR or ER.

1. *“fs”* = As identified above.
2. *“a”* = Shall be a 2-3 alpha-numeric character.
    a. For patch panels within a given telecommunications space, regardless of media type (copper or fiber), shall have a “P” prefix with a sequential number starting with “01”, each subsequent patch panel shall be assigned the next sequential number.
    b. For IDC Connector panels within a given telecommunications space, shall have a “B” prefix with a sequential number starting with “01”, each subsequent IDC panel shall be assigned the next sequential number.

Q. Patch Panel Port Identifier:
Shall use the port numbers marked on the patch panel by the manufacturer with sequential numbers (i.e., 01 to 120, etc.). For ports which are not pre-labeled, label each port in the form of *“n”* where *“n”* is the sequential port number within the panel. The ports in each patch panel shall start at number “01”.

R. IDC Connector Identifier:
Refer to TCGS *16740 Inside Plant Communications Circuits.*

S. Horizontal Link Identifier:
Shall have identifiers in the form of “fs-an”. A horizontal link identifier, unique within a building, shall be assigned to each horizontal link and to its elements. Each end of a horizontal cable shall be labeled within 24 inches of the end of the cable jacket with the horizontal link identifier, which shall be visible on the exposed part of the cable jacket. This shall include each cable end (TS and work area) and at a consolidation point (CP), if present.

1. *“fs”* = the TS identifier as identified above.
2. *“a”* = the patch panel or IDC panel identified above.
3. *“n”* = two to four numeric character designating the port on the patch panel or the section of an IDC connector on which a four-pair horizontal cable is terminated in the TS.

T. Outlet Labeling on Face Plates at the Work Area:
Each connector shall be labeled with the *horizontal link identifier* in the form of *“fs-an”* as described above.

- For example: A work area with two horizontal copper cable connectors that terminate in the second telecommunications room on the fourth floor, in the third patch panel, in ports 5 and 6. The connectors would have the labels:
    - 4B-P3-05
    - 4B-P3-06
- For example: A work area with two horizontal CAT 3 copper cable connectors terminating in the first telecommunications room on the fourth floor on the second IDC connector (110 block) on termination block ports 1 and 2. The connectors would have the labels:

- 4A-B2-01
- 4A-B2-02

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 TR's. In such cases, the cable identification scheme for the new cables shall be consistent with the existing identification strategy already used at the facility.

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 DOC facilities.

4.15 FIRE STOPPING

Please 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 DOC 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 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 DOC facilities:

A. The Designer shall be responsible to determine that the power requirements for the work areas, TR's, and ER's are met as described in this document. For projects where an electrical engineer is involved, the Designer shall coordinate directly with the Architect and Engineer, to verify that the engineer's design documentation meets DOC's requirements and is fully conveyed in the Construction Documents. For projects without the involvement of an electrical engineer, the Designer shall alert DOC where additional power infrastructure is needed to meet DOC's requirements.

1. Most, if not all DOC telecommunications equipment requires single phase electrical service. Most buildings at DOC prisons have 3-phase electrical

service.
2. Please refer to the *Work Areas* section of the BICSI TDMM and this document for information on the power outlet requirements for work areas.
3. Please refer to the *Telecommunications Rooms* section of the BICSI TDMM and this document for information on the power outlet requirements for TR's.
4. Please refer to the *Equipment Rooms* section of the BICSI TDMM and this document for information on the power outlet requirements for ERs.

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-OSP for more information. The following requirements take precedence over the BICSI TDMM guidelines for telecommunications infrastructure at DOC facilities:

4.17.1 TELECOMMUNICATIONS GROUNDING AND BONDING INFRASTRUCTURE

A. The Designer shall check with the A/E and DOC Plant Manager to review the electrical design of the facility and specifically review in detail how the grounding is derived throughout the campus and for each building affected by the telecommunications installation activity. The Designer shall determine if the available service ground at each building is appropriate to use for the source of the telecommunications ground, including the ohms resistance to ground. The Designer may require testing of the soils for the grounding system to ensure the ohms resistance to ground is within the parameters required by the IT equipment. The Designer shall inform the A/E, DOC Plant Manager, and DOC-ITIS if additional electrical work will be required to establish an improved main building ground system for the telecommunications ground to connect to for preventing damage to IT equipment.
1. WAC 296-46B-250 (32) became effective 8/1/2003: "An equipment grounding conductor must be installed with the circuit conductor between buildings and/or structures. A grounded conductor (i.e., neutral) is not permitted to be used in place of a separate equipment grounding conductor between buildings and/or structures."
2. It's important to note that the electrical service at some older buildings, sections of buildings, and structures at DOC facilities is <u>fed from another building or building section</u> using the neutral conductor for the ground in lieu of a separate equipment grounding conductor, as described in the WAC above. Where this situation is encountered:
   a. The Designer shall check with the Local Authority to determine how to establish the source of the telecommunications ground so as not to create

a ground loop or violate other NEC or NESC rules.

b. The direction from the Local Authority "may" require establishing a separate grounding source in the sub-fed building specifically for the telecommunications ground, or require installation of an equipment grounding conductor between the building or structure.
    1. Where the separate ground source is established at the sub-fed building, the common telecommunications ground cable in ductbanks will most likely "not" be terminated in the sub-fed building because the larger size of this ground conductor could establish a ground loop. The Designer shall verify this action with the Local Authority.

B. A Telecommunications Main Grounding Busbar (TMGB) shall be installed at an accessible and convenient location in each Entrance Facility. A Telecommunications Grounding Busbar (TGB) shall be installed at an accessible and convenient location in each Equipment Room and Telecommunications Room. In larger ER/TR's and where more convenient access to a Busbar is needed, one or more additional TGB's shall be installed. TMGB's and TGB's shall be sized to accommodate 30% future growth.

C. A TBB of green insulated stranded copper conductor (sized between a minimum of #6 AWG and a maximum of 3/0 AWG) shall be provided between each TGB and TMGB, and a bonding conductor (BCT) from the TMGB to the building's main electrical service grounding electrode system. The Designer shall ensure the <u>Bonding Conductor's AWG size is based on the lengths</u> found in Table 10.1 *"Sizing of the telecommunications bonding backbone per ANSI J-STD-607-A"* of the 2003 BICSI TDM Manual, 10th edition, (2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG). This table is also included in TCGS 16453 *Grounding and Bonding for Telecommunications*.

4.17.2 <u>TELECOMMUNICATIONS CABLING</u>

While DOC 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 splices approved by the DOC-ITIS are made to backbone cables, the metallic shields of those cables shall be bonded 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 DOC 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

TR's shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) 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 for Designers to take seriously as EMI and RFI can render data networks inoperable and/or cause intermittent operational anomalies that require significant hours of technical staff resources over long periods to identify and resolve. **A design that allows for EMI problems in a correctional setting is not acceptable.** The post-design/construction solution for resolving EMI or RFI induced problems can run up to $millions, depending on the location of the problem within the telecommunications infrastructure. Designers shall ensure their designs and construction observations and construction administration activities will elevate the potential for EMI or RFI problems at TR and ER locations.

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:
   - o Less than or equal to 220 V_{rms}
   - o Greater than 220 V_{rms} and less than or equal to 480 V_{rms}
   - o Greater than 480 V_{rms}

B. Allowable proximity to the various sources of EMI is defined for each of four categories of telecommunications infrastructure:
   - o Cross connect locations that are shielded (such as swing racks enclosed in metal cabinets)
   - o Cross connect locations that are unshielded (such as floor-standing equipment racks)
   - o Telecommunications cabling that is shielded (cabling routed through metallic conduit or a metallic raceway that completely encloses the cabling).
   - o Telecommunications cabling that is unshielded (cabling routed through any raceway that does not completely enclose the cabling in metal).

C. The following table lists the required minimum separations between the different categories of EMI sources and telecommunications infrastructure. For cross-connect locations (unshielded), separation distances shall be measured from the EMI source to the outside walls of the Telecommunication rooms. (To minimize the effects of EMI, telecommunications pathways shall cross perpendicular to electrical power cables, electrical power conduits and fluorescent lighting.)

TABLE 4.4 ISP TELECOMMUNICATIONS CLEARANCES FOR EMI REDUCTION

Sources of Electromagnetic Interference	Telecommunications Infrastructure			
	Cross connect Locations		Horizontal Cabling	
	Unshielded	Shielded	***Unshielded***	Shielded
Power Circuits Not in Metallic Raceway				
Less than or equal to 220 V_{rms}	2”	2”	2”	2”
Greater than 220 V_{rms} but $\leq$ 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 or equal to 220 V_{rms}	2”	2”	2”	2”
Greater than 220 V_{rms} but $\leq$ 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 or equal to 220 V_{rms}	4 ft	2 ft	4 ft	1 ft
Greater than 220 V_{rms} but $\leq$ 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 or equal to 220 V_{rms}	4 ft	2 ft	2 ft	1 ft
Greater than 220 V_{rms} but $\leq$ 480 V_{rms}	10 ft	4 ft	4 ft	2 ft
Greater than 480 V_{rms}	20 ft	20 ft	10 ft	5 ft

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 have a minimum separation distance from electrical conduits and transformers or other unidentified underground conduits as identified earlier in Table 4.2.

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 DOC facilities:

A. All DOC facilities use the Ethernet LAN protocol for the Administrative LAN and any physically-separate Inmate LANs. Telecommunications infrastructure for all DOC facilities shall be designed, installed, and tested to support the Institute of Electrical and Electronic Engineers (IEEE) Ethernet 802.3 standards. DOC IT is in the process of migrating facilities to the Gigabit Ethernet protocol based on the IEEE 802.3z standard. All newly installed cabling shall support this protocol. 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.

B. DOC LANs are typically based on Cisco switches. DOC LAN backbones shall be designed to support 10 GB bandwidth and 1 GB bandwidth to the desktop (work area). The Designer shall coordinate with the DOC-ITIS to determine the requirements for supporting the network electronics in each space. The design shall include the infrastructure for hosting this equipment.

C. <u>Media converters shall not be used in DOC installations</u>.

4.21 BUILDING AUTOMATION SYSTEMS (BAS)

Telecommunications pathway and/or cabling systems designed for DOC facilities shall support and integrate low voltage systems that convey information within and between buildings. Telecommunications infrastructure for low voltage systems shall be designed in accordance with the requirements in this document to support the Ethernet communication channels or other similar protocols of low-voltage devices. For IT equipment and systems inherent to or required by BAS/LV systems, refer to *IT Equipment & Systems Used by BAS/Low Voltage Systems*, Section 2.2.10 of this document.

Throughout this document, references to “low voltage systems” shall apply as discussed in the *Building Automation Systems* section of the BICSI TDMM. Architects, engineers, and designers shall refer to the BICSI TDMM for information regarding the design of telecommunications infrastructure to support building automation systems at DOC facilities.

The common telecommunications infrastructure shall be designed and deployed as discussed below:

A. The common outside plant (OSP) telecommunications ***pathway*** infrastructure is intended for shared use by BAS, voice, and data systems.

B. The common outside plant (OSP) telecommunications media shall be 50.0/125 or 62.5/125 micron multimode fiber optic cable, singlemode fiber optic cable, and 22-24 AWG unshielded twisted pair (UTP) copper cable (Category 3-rated).

- For new or completely remodeled prison facilities, 50.0/125 micron multimode fiber shall be used in lieu of 62.5/125.
- The decision on which of the two types of multimode fiber optic cable to use at other DOC facilities shall be determined by the DOC Infrastructure Specialist.
- The OSP copper backbone cable shall not be used for BAS LAN or data applications other than where a modem has been approved for use based on requirements from previous Section 4.5.4.2.

C. The common inside plant (ISP) telecommunications ***pathway*** is intended for shared use by BAS, voice, and data systems.

D. The common ISP telecommunications media shall be 50/125 or 62.5/125 micron multimode fiber optic cable and 22-24 AWG unshielded twisted pair (UTP) copper cable (Category 6-rated).

1. For most leased facilities, the lower grade of Category 6 cable (SYSTIMAX® 71-series) can be used for data cable and Category 3 cable for voice. This decision shall be made by the DOC Regional IT Operations Manager in concurrence with the DOC-ITIS.

E. 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 typically homerun to a “Security Electronics Room” (also known as the Low Voltage Electronics Room) rather than to common shared telecommunications rooms.

1. Where horizontal copper cabling for the BAS is routed to and terminated in the TR, the Designer shall specify a separate copper patch panel for the BAS cabling with appropriate labeling. The Designer shall coordinate with the DOC-RITM and DOC Plant Manager to identify a special color for the BAS patch cords that differs from all others used at the site.

F. The Designer shall ensure that BAS (low-voltage systems) be designed to fully comply with the pathway and cable requirements specified in the table below.

1. Where *Pathway Compliance* is designated “*Yes*”, the Designer shall ensure the pathway is compliant to Ethernet cabling length limitations back to an existing telecommunications room or security electronics room.
2. Where UTP and/or fiber could be used for the BAS cabling media, either during the initial BAS design and construction or as a later upgrade (example

where coax is initially deployed), the BAS pathway shall be designed and constructed for the type of cabling media most-likely to be utilized in the future (UTP or fiber). The Designer shall meet with both the DOC Plant Manager and the DOC-ITIS to make this determination.

a. If there is no clear direction on the type of cabling media that's most-likely to be used in the future, and both UTP and fiber are options, the Designer shall ensure the pathway length is compliant with the shorter Ethernet UTP length limitations.

TABLE 4.5 BAS CABLE & PATHWAY COMPLIANCE

BUILDING AUTOMATION SYSTEMS (BAS) CABLE & PATHWAY COMPLIANCE

ID#	Building Automation Systems	Cabling Media - Type & Size	"Cable" TDIS Compliance Required	"Pathway" TDIS Compliance Required	Notes
A1	**Paging system**	<22 AWG TP audio & control	No	No=presently	Future review may change compliance.
A2	**Paging system**	22-24 AWG TP audio & control, Fiber	Yes	Yes	
B	**Cell intercoms**	TP audio & control	No	No	
C	**Door movement intercoms**	TP audio & control	No	No	
D	**Visitor/inmate duplex intercom**	18 AWG ScTP audio & control	No	No=presently	Currently using handsets - review again if changed.
E	**Inmate instruction @ visiting booth** (instructors on visitor side using microphone)	TP audio & control	No	No	Future review may change compliance.
F1	**Video surveillance & recording** Note: Camera to headend currently = coax, but new cameras are direct plug-in to Ethernet LAN, so pathway compliance is required.	Coax	No	Yes	CAT-6 compliant water-proof rigid metallic pathway allowed in slab with in-wall pull box every 100 ft.
F2	**Video surveillance & recording**	22-24 AWG UTP, Fiber	Yes		
G	**Holding cell button/light call system**	Control	No	No	
H1	**Taut wire fence protection system**	Coax, <22 AWG TP	No	Yes	Allow daisy-chaining.
H2	**Taut wire fence protection system**	22-24 AWG UTP, Fiber	Yes		
I	**Perimeter alarm & announciation system**	<22 AWG TP	No	Yes	Pathway compliant for

BUILDING AUTOMATION SYSTEMS (BAS) CABLE & PATHWAY COMPLIANCE					
ID#	**Building Automation Systems**	**Cabling Media - Type & Size**	**"Cable" TDIS Compliance Required**	**"Pathway" TDIS Compliance Required**	**Notes**
					future fiber media.
J1	**Fire alarm system - non-power limited**	na	No	No	
J2	**Fire alarm system - power limited**: Pathway section from sensors & relays to control panel.	<22 AWG TP			
J3	**Fire alarm system - power limited**: Pathway section from control panel to other control or reporting locations for telecommunications connection.	22-24 AWG UTP, Fiber	Yes	Yes	
K1	**Entertainment TV system**	RG-6, RG58	No	Yes	Pathway compliant for future fiber or 22-24 AWG UTP media, min. 1 inch conduit.
K2	**Entertainment TV system**	22-24 AWG UTP, Fiber	Yes		See special information under the CATV Section below.
L1	**PLC door logic control system**	<22 AWG TP	No	Yes	
L2	**PLC door logic control system**	22-24 AWG UTP, Fiber	Yes		
M	**Fixed duress alarm system**	<22 AWG TP	No	Yes	
N	**Panic Buttons**	22-24 AWG UTP	Yes	Yes	Horizontal & Backbone cable.
O1	**Environmental/temperature controls**	<22 AWG TP	No	Yes	
O2	**Environmental/temperature controls**	22-24 AWG UTP, Fiber	Yes		
P1	**Energy Management System, Lighting Control Systems**	<22 AWG TP	No	Yes	
P2	**Energy Management System, Lighting Control Systems**	22-24 AWG UTP,	Yes		

BUILDING AUTOMATION SYSTEMS (BAS) CABLE & PATHWAY COMPLIANCE					
ID#	**Building Automation Systems**	**Cabling Media - Type & Size**	**"Cable" TDIS Compliance Required**	**"Pathway" TDIS Compliance Required**	**Notes**
		Fiber			

4.22 PRIVATE CATV DISTRIBUTION SYSTEMS

Please 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 DOC facilities.

A. Analog CATV systems require angle-polished fiber terminations and FC-APC connectors. APC connectors should be used because analog CATV systems utilize 1 GHz transmitters and are particularly sensitive to attenuation and negative effects of reflection. APC connectors are specified at -60 to -65 db of reflectance compared to typical fiber connectors at -50 to -55 range. Analog CATV systems will not work with fiber optic cable terminations that are flat polished. They require factory terminated FC-APC fiber pigtails attached via the fusion splicing method. FC-APC patch cords should also be used between fiber patch panels and CATV equipment.

- **Note: FC-APC connectors are not compatible with SC connectors or flat-polished fiber.**

4.23 OVERHEAD PAGING SYSTEMS

Please 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 DOC facilities.

4.24 WIRELESS AND MICROWAVE SYSTEMS

Please refer to the *Wireless and Microwave Systems* section of the BICSI TDMM for information regarding the design of telecommunications infrastructure to support wireless and microwave communications systems at DOC facilities.

DOC does not allow wireless technology to be deployed at correctional settings for the Administrative LAN.

5 CONSTRUCTION DOCUMENT CONTENT

A. This section of the TDDG describes the content requirements the Designer shall include when creating the Construction Documents[6]. This content is in addition to the content found in some generally accepted document sets.

B. DOC's requirements with respect to Construction Documents is that a fully detailed and coordinated telecommunications distribution pathway design (rather than making adjustments in the field during construction) should result in reduced construction costs, fewer change orders, and a telecommunications pathway that will have significantly less EMI problems and a much longer life. The level of detail required to meet this objective may be substantially greater than some telecommunications designers may be accustomed to providing. This is also a significant change to the methods typically employed by many architects and contractors.

1. **The exact location of the telecommunications pathways shall be defined by the Designer in the drawings of the Construction Documents.** Their placement is now specifically defined rather than being subjected to coordination between the trades by the GC or the location determined by the electrical subcontractor. The methods used in the past mostly failed to maintain the installation requirements of the ANSI/TIA/EIA Telecommunications Standards, creating costly change orders when the problems were observed and costly operational problems when discovered after completion of the project.

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

5.1 PLANS AND DIAGRAMS

5.1.1 GENERAL

A. The drawing set shall include the following:
- Cover Sheet
- Sheet List
- Site Map
- Symbol Schedule
- List of Abbreviations

[6] As of this writing, the *Conditions of the Agreement* and the *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services* (both published by the Washington State Department of General Administration) make reference to the term "Construction Documents." However, the *Manual of Practice* from the Construction Specifications Institute (CSI) defines "Construction Documents" as a subset of the "Construction Documents" and indicates that drawings, specifications and other written documentation are contained within the Construction Document subset. The TDDG will use the term "Construction Documents" according to CSI's definition.

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.

5.1.2 OUTSIDE PLANT TELECOMMUNICATIONS SITE PLAN DRAWINGS

A. 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
- Elevation details for maintenance/handholes and TR/ER's
- Complete ductbank routing, details and elevations, including details for the conduit entrance through buildings into TR's and ER's.
- Section cuts
- Existing and new surface conditions
- Outside plant telecommunications cabling

B. These sheets should also identify coordination arrangements where possible conflicts could arise with site work for other disciplines, in particular:
1. Indicating the separation distances between telecommunications, electrical lines and equipment, steam lines, and other utilities.
2. Indicating the requirements for coordinating the elevations of maintenance/handholes to finished floor elevations of TR's and ER's to prevent ingress of water.

C. The sequencing of site work should also be shown, if applicable.

D. 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 the Contractor shall use, rather than a schematic depiction).
- Approximate locations of pull boxes, junction boxes, and conduit sweeps.
- The sizes of each pull box and junction box.
- The cable quantities and the raceway size and quantities 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. In all cases, the identification of the existing homerun conduits shall be specified.

5.1.4 TELECOMMUNICATIONS ROOM PLAN DETAILS

Construction drawings for DOC 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, but not limited to the following:

- Backboards
- Ladder Racking
- Work Area
- Grounding Busbar
- UPS Equipment
- Electrical wall outlets
- Entrance Conduits
- Backbone Cable Routing
- Cable Service Slack
- Space for Future Racks
- Termination Blocks
- PBX
- Inmate Phone Equipment
- Entrance Protection Equipment
- Racks and Vertical Cable Mgmt
- Space for other low voltage systems
- Space Reserved for Utility Demarc
- Rack/Cabinet Electrical Outlets

5.1.5 INTRA-BUILDING BACKBONE ELEVATION DIAGRAMS

A. Many DOC buildings are of a size and structure that requires only one TR per building. Where there are multiple TR's in a given building, DOC typically requires that each TR have a dedicated fiber optic backbone cable connecting it to the ER. Refer back to Section 4.5.2 *Intra-Building Backbone Cabling* of this document for more information.

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

5.2 PROJECT MANUAL

A. The *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services* (published by the Washington State Department of General Administration) lists requirements for the Project Manual. The *State of Washington Conditions of the Agreement* (also published by the Washington State Department of General Administration) lists additional requirements for the Designer.

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), and a discussion of the utility coordination requirements.

5.2.1 SPECIFICATIONS

5.2.1.1 DOC Telecommunications Construction Guide Specification

A. The DOC Telecommunications Construction Guide Specification (TCGS) is a *guide* specification as opposed to a *master* specification. It does not include an exhaustive listing of all possible products or installation methods that could be employed in a telecommunications infrastructure project.

B. The TCGS is a specification that shall be used for all DOC projects where telecommunications infrastructure is involved. It has verbiage that identifies issues the Designer shall consider throughout the adaptation process. The Designer shall adapt the sections in the TCGS to the particular requirements of the given project in producing a CSI-compliant specification. The Designer shall not create a new specification section based on the “intent” of the TCGS, rewrite the TCGS, or cut and paste content from the TCGS sections into other existing specification sections.

1. The TCGS shall also be used by contractors and installers where a formal design is not performed as it specifies DOC’s requirements for the appropriate construction and installation methods and products of telecommunications distribution systems at DOC owned and leased facilities.

C. The Designer shall directly edit the TCGS for use on each project. The Designer shall notify the DOC-ITIS where changes or additions to the specifications are desired. Edits to the TCGS documents by the Designer shall be performed with the “Revision Tracking” features of WORD activated. At the various project milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings with a vertical line and different colored text when viewed electronically.

D. The Designer shall be responsible for adding any necessary content to the specification that is applicable to the project and not already contained in the TCGS, or removing any content that does not apply to the project that may be misleading.

E. Please refer to the more detailed instructions contained in the TCGS, both in the Preface of that document as well as in the “hidden text” contained in the electronic files.

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. Butterfly diagrams shall be provided on 8½ x 11"-sized sheets in the Project Manual. It may be desirable to also show this information on large-format drawing sheets, but this shall not eliminate the requirement for the sheets identified above in the Project Manual.

E. The diagrams shall be formatted as shown in the sample butterfly diagram in Appendix 6.2. Upon request, DOC will provide an electronic AutoCAD file of this diagram to be used as a template.

5.2.3 ELEVATION DIAGRAMS

A. The Designer shall provide scaled wall elevation detailed diagrams for each TR and ER 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 TR's and ER's 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
- Ladder Racking
- Cable Service Slack
- Grounding Busbar
- Existing Devices
- Work Area
- UPS
- Entrance Pit
- Backbone Cable Routing
- Cable Management
- Termination Blocks
- Power Receptacles
- Entrance Conduits
- Space for Future Racks
- PBX and Voice Mail
- Wall-mounted Electronic Equipment
- Wall-mounted Swing Racks and Contents
- Racks and Vertical Cable Mgmt
- Entrance Protection Equipment
- Inmate Phone Equipment
- Other low voltage systems
- Space for Future Equipment
- Space Reserved for Utility Demarc

D. The diagrams shall also show elevation details for the telecommunications racks in each TR and ER. 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
- UPS Equipment
- Existing Devices
- Shelves / Drawers
- Termination Blocks
- Power Receptacles
- Space for Future Equipment
- Electronic Equipment
- 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 and 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 DOC 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 (on a project-by-project basis) may determine that the Plan Drawings are better suited for communicating the cutover requirements in lieu of the Project Manual. The Designer shall submit this request via an Alternative Design Request to the DOC-ITIS who will review with the DOC-RITM for a final determination.

B. For most projects, especially 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 DOC 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 shall include allowance for DOC to make partial use of the telecommunications infrastructure prior to substantial completion so that DOC IT personnel 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 DOC-ITIS 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 (ER and/or TR 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 (ER and/or TR ID)
- Link Type (i.e. backbone, riser, horizontal)
- Mode and product type and (MM 62.5 OptiSPEED, MM 50.0 LazrSPEED, SM OptiSPEED, SM TeraSPEED, etc.)
- 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, DOC 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, DOC will provide an electronic spreadsheet file to be used as a template.

5.3 RECORD DRAWINGS AND DOCUMENTATION

The *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services* (published by the Washington State Department of General Administration) lists requirements for Record Drawings and submittals.

The following requirements related to Record Drawings and submittals are in addition to the requirements listed in *Instructions for Architects and Engineers Doing Business with Division of Engineering and Architectural Services*:

- The Record Drawings shall show the identifiers for the telecommunications infrastructure components as constructed.
- Three sets of 8½x11"-sized butterfly diagrams on bond media shall be delivered, one each to:
    - DOC CPD Project Manager
    - DOC-ITIS
    - DOC-RITM.
- Three CDROM's containing the digital photographs taken by the Designer during the project shall be delivered, one each to:
    - DOC CPD Project Manager
    - DOC-ITIS
    - DOC-RITM.

6 APPENDIX

6.1 SAMPLE DESIGN REVIEW COMMENT REPORT

The following page shows an example 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 DOC electronically. Upon request, DOC will provide an electronic document for this form to be used as a template.

Figure 6.1 Sample Design Review Comment Report Format

Project # - Project Name - Project Phase - Reviewer - Review Date

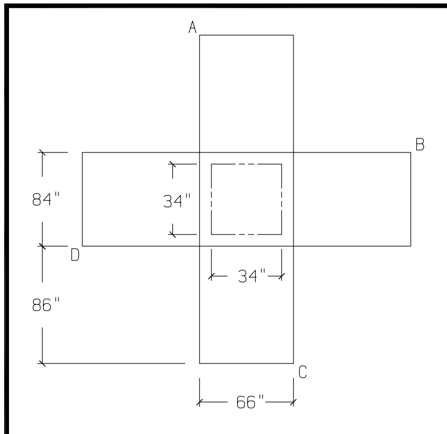
Cmt#	**General**	**Reviewer's Comments per DOC TIS Version 5.2**	**A/E/Designer Response**
G1		General: Comments or suggestions with references to applicable TDDG paragraphs.	Accept
G2			Suggest another alternative
G3			Reject per TDDG paragraph #
Cmt#	**Spec.**	**Reviewer's Comments per DOC TIS Version 5.2**	**A/E/Designer Response**
S1		Specification Section: Comments or suggestions references to applicable TDDG paragraphs.	Accept
S2			Suggest another alternative
S3			Reject per TDDG paragraph #
Cmt#	**Drawing**	**Reviewer's Comments per DOC TIS Version 5.2**	**A/E/Designer Response**
D1		Drawing Sheets: Comments or suggestions with references to applicable TDDG paragraphs	Accept
D2			Suggest another alternative
D3			Reject per TDDG paragraph #

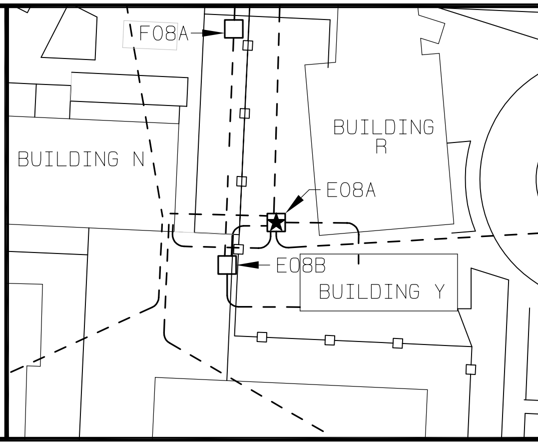
All items agreed to must be included in the final construction/bid documents.

6.2 SAMPLE MH BUTTERFLY DIAGRAM

The following page shows a sample maintenance hole / handhole Butterfly Diagram. The Designer shall follow this format and produce a butterfly diagram for each existing maintenance hole or handhole that is affected by an outside plant communications project. The Designer shall submit the completed diagrams to DOC in both electronic and paper forms. Upon request, DOC will provide an electronic AutoCAD file to be used as a template. <u>Please note that the sample does not reflect the correct MH/HH Duct Identifiers as required in Section 4.13.</u>

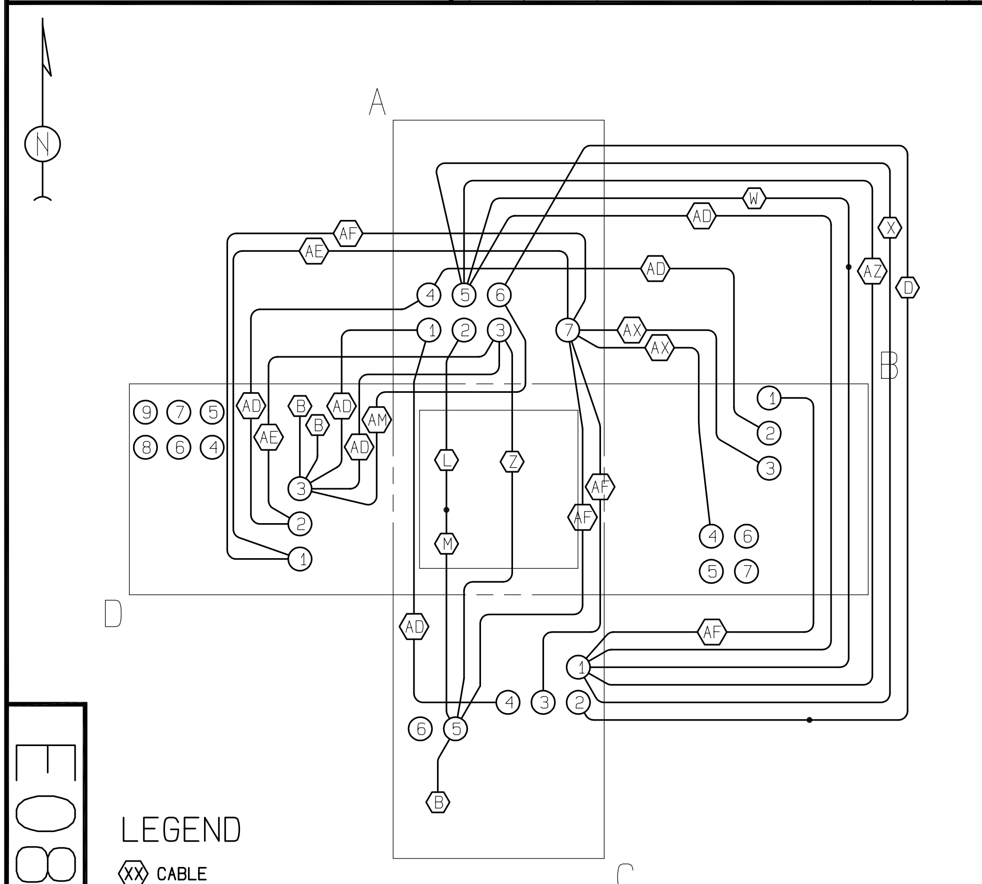
FIGURE 6.2 SAMPLE MAINTENANCE HOLE BUTTERFLY DIAGRAM





CONDUIT INFORMATION

FROM WALL	FROM DUCT	DIAMETER	MATERIAL	CONTENTS/CABLES	PULL STR.	DESTINATION PULLHOLE/BUILDING	DESTINATION WALL	DESTINATION DUCT	LENGTH
A	1	4	PVC	AD(2), AD(4)	N	G08A	C	13	189
A	2	4	PVC	L	Y	G08A	C	12	189
A	3	4	PVC	AE, AD(8), Z	Y	G08A	C	11	189
A	4	4	PVC	AD, AD(16)	Y	G08A	C	9	189
A	5	4	PVC	AD(2), W, X, AZ	N	G08A	C	8	189
A	6	4	PVC	D, AM	Y	G08A	C	7	189
A	7	2	PVC	AF, AE, AX, AX, AF, AF	Y	G08A	C	10	189
B	1	2	PVC	AF	Y	BUILDING Y ("1A")	-	1	310
B	2	2	PVC	AD	Y	BUILDING Y ("1A")	-	2	310
B	3	2	PVC	AX	N	BUILDING Y ("1A")	-	3	310
B	4	2	PVC	AX	N	BUILDING Y ("1A")	-	4	310
B	5	4	PVC	-	N	UNKNOWN (X)	X		
B	6	4	PVC	-	N	UNKNOWN (X)	X		
B	7	4	PVC	-	N	UNKNOWN (X)	X		
C	1	4	PVC	AF, AD(2), W, AZ, X	N	BUILDING S ("1A")	-	4	370
C	2	4	PVC	D	N	BUILDING S ("1A")	-	3	370
C	3	4	PVC	AF	N	BUILDING S ("1A")	-	2	370
C	4	4	PVC	AD(2)	Y	BUILDING S ("1A")	-	1	370
C	5	4	PVC	B, AF, Z, M, L	Y	BUILDING N ("1A")	-	2	260
C	6	4	PVC	-	Y	BUILDING N ("1A")	-	3	260
D	1	4	PVC	AF, AE	Y	BUILDING N ("1A")	-	3	260
D	2	4	PVC	AD(16), AE	N	BUILDING N ("1A")	-	1	260
D	3	4	PVC	B, B, AD(4), AD(8), AM	N	BUILDING N ("1A")	-	4	260
D	4	4	PVC	-	Y	E08B	A	15	135
D	5	4	PVC	-	Y	E08B	A	16	135
D	6	4	PVC	-	Y	E08B	A	17	135
D	7	4	PVC	-	Y	E08B	A	18	135
D	8	4	PVC	-	Y	E08B	A	19	135
D	9	4	PVC	-	Y	E08B	A	20	135



E08A

LEGEND

- (XX) CABLE
- (#) CONDUIT
- • SPLICE OR TAP

CONTENT/CABLE INFORMATION

I.D.	MATL.	DIA.	DESCRIPTION
AD	COPPER	0.16	FIRE/DOOR ALARM
AE	COPPER	0.14	GATE/LIGHTING CONTROL
AF	COPPER	0.11	HVAC/IC
AM	COAX	0.26	COAX
AX		1.25	INNERDUCT (NOT VACANT)
AZ			OTHER/UNKNOWN
B		1.25	VACANT INNERDUCT
D	COPPER	2.45	600 PAIR TO S, X, U, W, PPPP, H
L	COPPER	1.92	300 PAIR TO N, O, P
M	COPPER	1.24	200 PAIR TO N, O, P
W	FIBER	0.58	72 STRAND M/M TO X, U, W, H
X	FIBER	0.27	12 STRAND M/M TO S
Z	FIBER	0.27	12 STRAND M/M TO O

E08A

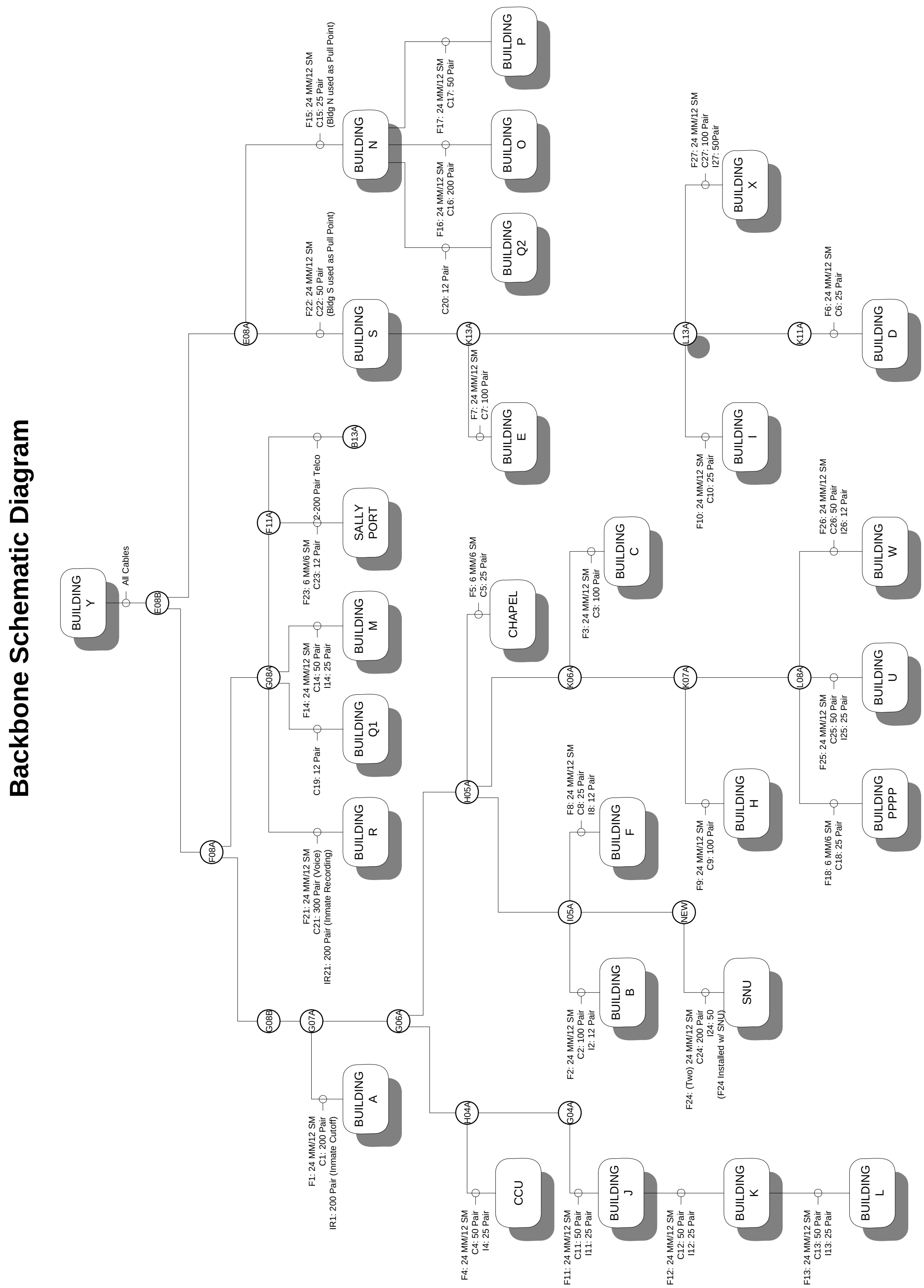
NAME OF SITE

WASHINGTON STATE
DEPT. OF CORRECTIONS

6.3 SAMPLE BACKBONE CABLING SCHEMATIC DIAGRAM

The following page shows 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.

FIGURE 6.3 SAMPLE BACKBONE CABLING SCHEMATIC DIAGRAM



6.4 SAMPLE COMBINATION RACK/WALL ELEVATION DETAIL WITH CUTOVER PLAN

The following page shows 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.

FIGURE 6.4 SAMPLE COMBINATION RACK/WALL ELEVATION DETAIL WITH CUTOVER PLAN

BUILDING ZZZ - MAIN TELECOMMUNICATIONS ROOM "1A"

FIGURE 1. EXISTING WEST WALL COMMUNICATIONS BACKBOARD

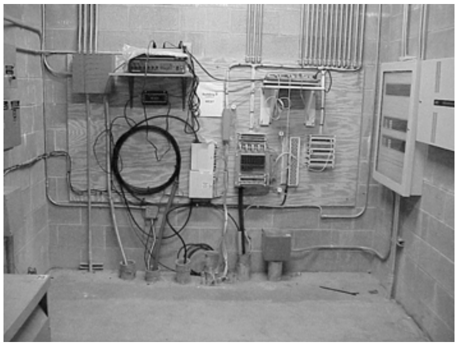
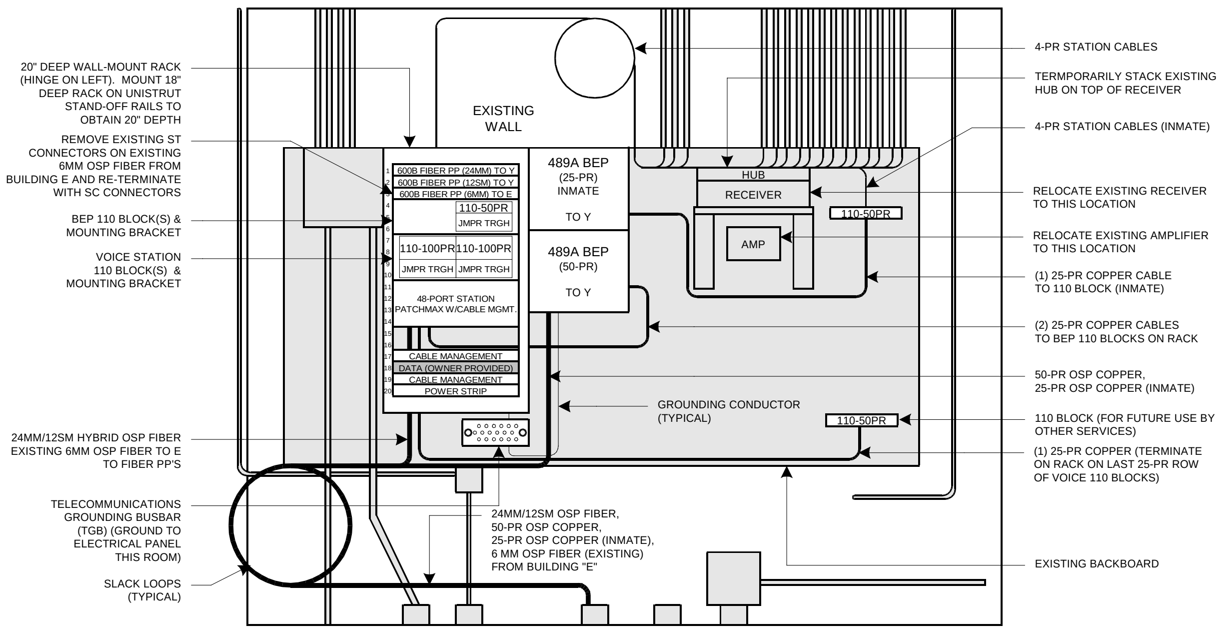


FIGURE 2. REVISED WEST WALL COMMUNICATIONS BACKBOARD (1/2" = 1')
(GRAYED-OUT EQUIPMENT IS EXISTING TO REMAIN OR PROVIDED BY OTHERS)



PHASING/CUTOVER NOTES:

PRIOR TO PROCEEDING WITH CONSTRUCTION FOR THIS BUILDING, REFER TO THE NOTES IN "GENERAL BUILDING PHASING/CUTOVER NOTES" FOR ADDITIONAL AND IMPORTANT GENERAL NOTES WHICH APPLY TO THIS BUILDING AND TO EACH OF THE PHASES BELOW.

PHASE 1 - PROVIDE NEW CAMPUS BACKBONE MATERIALS AND EQUIPMENT

THIS CLOSET WILL SERVE AS THE MAIN (AND ONLY) COMMUNICATIONS CLOSET FOR THE BUILDING. DETACH EXISTING CAMPUS BACKBONE OSP CABLES AND EXISTING STATION CABLES AND SUPPORT AWAY FROM THE BACKBOARD ENSURING THAT ALL EQUIPMENT AND CABLES REMAIN FULLY FUNCTIONAL. RELOCATE EXISTING RECEIVER TO SAME SHELF AS EXISTING DATA EQUIPMENT (STACK DATA EQUIPMENT ON TOP OF RECEIVER) AND EXISTING AMPLIFIER UNDERNEATH SHELF TO LOCATION SHOWN, ENSURING THAT ALL EQUIPMENT AND CABLES REMAIN FULLY FUNCTIONAL. DEMOLISH EXISTING AMPLIFIER SHELF. DEMOLISH EXISTING 66-BLOCK AND ASSOCIATED CABLES IN MIDDLE OF BACKBOARD NO LONGER IN USE. PROVIDE NEW EQUIPMENT, CABLE, MATERIALS, AND ANY INCIDENTALS IN LOCATIONS SHOWN. BOND ALL NON-CURRENT CARRYING METAL EQUIPMENT AND MATERIALS TO THE TGB WITH GROUNDING CONDUCTOR. INSTALL NEW CAMPUS BACKBONE OSP COPPER AND FIBER CABLES AND ENSURE THAT DURING INSTALLATION THE EXISTING CABLES ARE NOT DAMAGED OR DISCONNECTED. ENSURE THAT ADEQUATE CABLE SLACK EXISTS AND IS SECURED SUCH THAT THE RACK MAY BE SWUNG OPEN WITHOUT PINCHING, DISCONNECTING, OR OTHERWISE STRESSING THE CABLES. ONCE THE NEW FIBER PATCH PANELS ARE INSTALLED, REMOVE THE EXISTING 6MM FIBER CABLE FROM BUILDING E FROM THE EXISTING FIBER PATCH PANEL AND RE-TERMINATE ON THE NEW FIBER PATCH PANEL SHOWN USING SC CONNECTORS. TEST ALL CABLES PER SPECIFICATIONS.

PHASE 2 - DEMOLISH EXISTING STATION CABLING/INSTALL NEW STATION CABLING

INSTALL STATION CABLING IN RACK IN SUCH A WAY AS TO ENSURE THAT ADEQUATE CABLE SLACK EXISTS AND IS SECURED SUCH THAT THE RACK MAY BE SWUNG OPEN WITHOUT PINCHING, DISCONNECTING, OR OTHERWISE STRESSING THE CABLES. FOR EXISTING STATIONS WITH IN-USE (ACTIVE) PORTS, INSTALL TEMPORARY CROSS-CONNECTS AS DETAILED IN "GENERAL BUILDING PHASING/CUTOVER NOTES - PHASE 2."

PHASE 3 - CAMPUS BACKBONE CUTOVER

REMOVE THE TEMPORARY CROSS-CONNECTS AND CROSS-CONNECT THE VOICE AND INMATE PHONE STATIONS TO THE NEW CAMPUS COMMUNICATIONS CABLING (COPPER)

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 DOC in both electronic and paper forms. Upon request, DOC will provide an electronic document for this form to be used as a template.

FIGURE 6.5 SAMPLE CABLE RECORD

Sample Cable Record

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		

Comments:

6.6 SAMPLE FIBER OPTIC LINK-LOSS BUDGET ANALYSIS

The following 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 DOC in both electronic and paper forms. Upon request, DOC will provide an electronic spreadsheet of this form to be used as a template.

FIGURE 6.6 SAMPLE FIBER OPTIC LINK-LOSS BUDGET ANALYSIS

Fiber Optic Link Loss Budget

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

Passive Cable System Attenuation

				MM 850		MM 1300		SM 1310		SM 1550	
Fiber Loss at Operating Wavelength		Cable Length (in kilometers)									km
	x	Attenuation per km	x	3.75	x	1.5	x	0.5	x	0.5	dB/kn
	=	**Total Fiber Loss**		0.00		0.00		0.00		0.00	dB
Connector Loss		Number of Connector Pairs		2		2		2		2	pairs
(Excluding Tx & Rx Connectors)	x	Individual Connector Pair Loss	x	0.5	x	0.5	x	0.5	x	0.5	dB/pa
	=	**Total Connector Loss**		1.00		1.00		1.00		1.00	dB
Splice Loss		Number of Splices									splice
	x	Individual Splice Loss	x	0.3	x	0.3	x	0.3	x	0.3	dB/sp
	=	**Total Splice Loss**		0.00		0.00		0.00		0.00	dB
Other Components Loss		**Total Components Loss**									dB
Total Passive Cable System Attenuation		Total Fiber Loss		0.00		0.00		0.00		0.00	dB
	+	Total Connector Loss	+	1.00	+	1.00	+	1.00	+	1.00	dB
	+	Total Splice Loss	+	0.00	+	0.00	+	0.00	+	0.00	dB
	+	Total Components Loss	+	0.0	+	0.0	+	0.0	+	0.0	dB
	=	**Total System Attenuation**		1.00		1.00		1.00		1.00	dB

Link Loss Budget

				MM 850		MM 1300		SM 1310		SM 1550	
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

Performance

				MM 850		MM 1300		SM 1310		SM 1550	
System Performance Margin		Link Loss Budget		10.40		10.40		9.40		9.40	dB
	-	Passive Cable System Attenuation	-	1.00	-	1.00	-	1.00	-	1.00	dB
	=	**System Performance Margin**	=	9.40	=	9.40	=	8.40	=	8.40	dB

This worksheet is based on the Fiber Optic Link Loss Budget worksheet in the BICSI TDMM (rev 9)

6.7 DOC WORK ORDERS – REQUIRED ATTACHMENT

FIGURE 6.7 DOC WORK ORDERS – REQUIRED ATTACHMENT

“INSTALLATION OF TELECOMMUNICATIONS CABLING @ WSDOC”
-Washington State Department of Corrections (WSDOC) Facilities (effective 6/15/2005)

All voice & data cabling work performed by vendors must fully comply with all of the requirements listed below. A copy of this document must be attached to and referenced by the WSDOC work order. Vendor’s **bid document** and **invoice** must **acknowledge** this document and shall reflect **line item pricing** and DIS Master **Contract number**.

1. Only an authorized Washington SYSTIMAX VAR shall install cabling.
2. Cabling must be installed per SYSTIMAX Structured Connectivity Solutions (SCS) GigaSPEED “Design and Installation Guidelines”, and must be certified for the SYSTIMAX 20-year Extended Product Warranty and Application Assurance Program.
3. All SYSTIMAX VAR technicians installing cable and cable components must have current certifications for SYSTIMAX installation and Structured Cabling Systems training equal to *BICSI Installer Level 2.* The SYSTIMAX VAR must provide WSDOC with copies of installer’s current certifications upon request.
4. Infrastructure (new or existing) used for the cabling installation must fully comply to the current versions of the WSDOC Telecommunications Distribution Infrastructure Standards (TDIS), all current ANSI/TIA/EIA “Commercial Building Telecommunications Standards”, the National Electrical Code, and all local codes. For WSDOC Standards:
   - **WSDOC TDIS**: http://www.wa.gov/doc
     -under “Doing Business W/DOC”, select: “Telecom Standards”
5. If the SYSTIMAX VAR encounters “non-compliant” infrastructure that must be used for the cable installation, the VAR shall red tag the non-compliant infrastructure, stop installation of affected cable and components, and immediately notify the WSDOC Sr. IT Network/Infrastructure Specialist (S-ITIS) in Olympia of the issues. The VAR shall continue with the affected cable installation “only” after the infrastructure is brought into compliance or receives a letter/e-mail from the WSDOC S-ITIS identifying the necessary actions required for completion of the cable installation. The S-ITIS contact is:
   - **Charly Ryman**, WSDOC Sr. Network/Infrastructure Specialist
     - Office: 360-753-0140, Cell: 360-481-2857, Fax: 360-664-4247
     - E-mail: clryman@doc1.wa.gov
     - Mailing: POB 41110, 410 W. 5th Ave., Olympia, WA 98504-1110
6. All cable and cable components must be SYSTIMAX; no substitutions.
7. All cables must be tested per DOC TDIS and SYSTIMAX recommendations, be fully compliant to the “current” SYSTIMAX GigaSPEED guidelines, and fully compliant to the IEEE 802.3 Ethernet gigabit standards.
8. The SYSTIMAX VAR shall provide the WSDOC S-ITIS with all of the following:
   - a copy of the cable tests
   - a copy of the numbered “SYSTIMAX Registration Document”
   - “SYSTIMAX 20 year Warranty Certificate”
   - the most recent issue of the “SYSTIMAX SCS Performance Specifications”
9. When cabling additions are made to an existing SYSTIMAX installation, the VAR shall contact the WSDOC S-ITIS to determine if the additional cabling will be: **A)** included in the “original” Extended Product Warranty and Application Assurance; or **B)** a new SYSTIMAX warranty issued.
10. Please refer to the WSDOC TDIS Telecommunications Distribution Design Guide (TDDG) section titled “Alternative Design Request” for any request to deviate from the requirements listed above.

6.8 TELECOMMUNICATIONS CONSTRUCTION GUIDE SPECIFICATION (TCGS)

The five TCGS sections listed below will follow the TDDG *"Index"* when viewing online in PDF format.

- Section 16108 – Outside Plant Communications Site Work
- Section 16131 – Raceway and Boxes for Communications Circuits
- Section 16453 – Grounding and Bonding for Telecommunications
- Section 16740 – Inside Plant Communications Circuits
- Section 16741 – Outside Plant Communications Circuits

6.9 GLOSSARY

AIA

American Institute of Architects

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 backboard must be three-quarter (¾)-inch thick A-C grade plywood, mounted with the "A" side exposed. The backboard must be coated with two coats of light colored, non-conductive fire retardant paint.

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.

BEND RADIUS

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

BICSI

BICSI was originally known as "Building Industry Consulting Service International", but now is only referenced as BICSI.

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-B 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)

A formal process during the construction phase that documents the modifications to an existing contract and reflects changes to construction from the design or method as defined in the construction documents. 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. The CPD Project Manager is only authorized individual to approve the CO allowing the contractor to proceed.

CHANGE ORDER PROPOSAL (COP)

A formal process during the construction phase in which the contractor presents a proposal to modify the actual design, construction method, or products that differ from the construction documents. The COP includes details of the modifications and changes (increase or decrease) to the contract pricing. A COP must precede a Change Order when request by a contractor.

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 DOC facilities receive cable TV service from a local service provider for a subscription fee. Other DOC 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. DOC commonly uses CCTV for security monitoring at strategic locations, with TV monitors located in officer's stations or control booths.

CONSTRUCTION MANAGER (CM)

CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI)

An organization that develops and maintains standards for the building construction industry specifically for design and construction specifications.

CORRECTIONAL INDUSTRIES (CI)

Correctional Industries (CI) buildings are facilities located at a corrections institution where certain private companies or industries on contract to the state can utilize an inmate labor force to produce goods and materials. The goods and materials are then made available for sale to state and local government agencies. CI buildings have additional unique requirements for telecommunications systems.

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

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 Entrance Facility.

DDC

Direct Digital Controls. Systems can use 24 AWG UTP cable and run on Ethernet LANs.

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.

DOC IT INFRASTRUCTURE SPECIALIST (DOC-ITIS)

ONE OR MORE POSITIONS WITHIN DOC INFORMATION TECHNOLOGY WHO ARE RESPONSIBLE FOR THE DEPARTMENT 'S TELECOMMUNICATIONS INFRASTRUCTURE.

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.

ENTRANCE FACILITY (EF)

See Telecommunications Service Entrance Facility (EF).

ETHERNET 10/100 BASE-TX PIN ASSIGNMENTS

At the WA outlet, Ethernet 10/100/1000 Base-TX (pin/pair assignment T568B) uses Pair 2 (pins 1=Tip & 2=Ring) for transmit and Pair 3 (pins 3=Tip & 6=Ring) for receive in the associated 4 pair cable. The LAN switch uses Pair 2 for receive and Pair 3 for transmit. For the jack at the workstation and the patch panel, wire colors are: pin-1 = W-O, pin-2 = O, pin-3 = W-G, pin-4 = BL, pin-5 = W-BL, pin-6 = G, pin-7 = W-BR, pin-8 = BR. White wires are all tip conductors (+), while colors are all ring conductors (-). Pair 1 go to pins 4 & 5, and Pair 4 to pins 7 & 8.

EXISTING BUILDINGS

The vast majority of telecommunications projects involve installing or upgrading the telecommunications infrastructure in existing buildings in order to make use of new technology. Most buildings older than 15 or 20 years 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., and often have unsuitable electrical equipment grounding capabilities. Upgrade projects in existing buildings are frequently impacted by inadequate requirements analysis and insufficient funding.

FIELD AUTHORIZATION (FA)

Field Authorization

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.

GENERAL CONTRACTOR (GC)

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. DOC is migrating from LAN hubs to LAN switches.

IDC CONNECTOR

Insulation displacement contact (IDC) connector. This is typically some type of punch down block for copper cabling.

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.

INMATE TELEPHONE EQUIPMENT ROOM (ITER)

Inmate Telephone Equipment Room.

INMATE TELEPHONE SYSTEM PROVIDER (ITSP)

Provides the telephone switch and other specialty devices for telephone call restrictions to support the inmate telephone systems at prisons.

INMATE TELEPHONES

Telephone service for inmate use is provided through a contract with the Local Exchange Carrier and/or Long Distance Carrier. The telecommunications infrastructure to support inmate telephone service is normally part of the overall facility infrastructure, and is owned by the Department of Corrections. Provisions must be made at the Main Cross-connection point or Main Equipment Room to separate inmate telephone services from official DOC services. Provisions are also usually made through the service provider for monitoring and recording of inmate telephone services for security purposes.

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 CROSS-CONNECT (IC)

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).

INTERMEDIATE DISTRIBUTION FRAME (IDF)

An obsolete term referring to the Intermediate Cross-connect (IC).

ITER

Inmate Telephone Equipment Room

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 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, usually U S WEST Communications, GTE, or PTI.

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 Telecommunications Equipment Room (ER).

MAIN DISTRIBUTION FRAME (MDF)

An obsolete term referring to the Main Cross-connect (MC).

MAIN EQUIPMENT ROOM (M-ER)

MAIN TELECOMMUNICATIONS EQUIPMENT ROOM (ER)

The Main Telecommunications Equipment Room is the central location on a campus or in a building where the major telecommunications equipment is located. The ER 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 ER.

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 Entrance Facility.

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 DOC 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.

NFPA

National Fire Protection Association

NON-SECURED AREAS

Non-secured Areas are defined as those areas where inmates do not normally have routine, unescorted access. Non-secured Areas include buildings outside of the fenced security perimeter of a corrections institution. Community Corrections offices and the DOC Headquarters building are Non-secured Areas. Non-secured Areas generally do not require any unique security precautions to protect the telecommunications systems or infrastructure beyond those that would normally be applied to a similar style building. See Secured Areas.

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 ER 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 ER.

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.

POP

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

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.

PSC

PVC Coated Rigid Steel Conduit, also known as "Rob-Roy"

PULLBOX

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

RACEWAY

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

RADIO FREQUENCY INTERFERENCE (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.

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.

RGC

Rigid Galvanized Steel Conduit

REQUEST FOR INFORMATION (RFI)

A formal process during the construction phase where a contractor submits a question regarding the design or required construction method identified in the construction documents.

RISER CABLE

An obsolete term referring to backbone cable.

RNC

Rigid Non-Metallic Conduit, includes Schedule 40 PVC.

ROUTER

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

SECONDARY EQUIPMENT ROOM (S-ER)

SECURED AREAS

Secured Areas are defined as those areas where inmates are housed, confined, contained, or have unescorted access. The Secured Area is the area within the fenced security perimeter of a corrections institution. Telecommunications systems, information processing systems and telecommunications distribution systems must be protected from unauthorized access or tampering by inmates inside the Secured Area. Special security precautions must be taken for equipment rooms, telecommunications closets, and cable routing pathways inside Secured Areas. See Non-secured Areas.

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.

SERVICE SLACK

All horizontal and backbone copper and fiber cables shall be installed to provide an additional length of cable (service slack) near each end of the cable within the area where the cable terminations are made. The service slack is to accommodate future moves or changes to the locations of the cable termination equipment. Within a telecommunications or equipment room, the service slack shall be long enough to reach the longest, opposite side of the room plus the distance from ceiling to floor, or whichever is longer - a minimum of ten feet for horizontal cable or twenty-five feet for backbone cable. At the work area, a minimum of 4-6 inches of service slack is required within the telecommunications outlet box, and 12 inches stored within the ceiling area where conduit stub-ups end above the ceiling and the cable is not fully within conduit to the TR. For fiber optic cable, additional service slack is required – a minimum of ten feet stored within each fiber shelf or cabinet.

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 DOC.

SUBSTRUCTURE

The ISP and OSP pathways and spaces for the low voltage signaling systems including but not limited to voice, data, building controls, security etc. Substructure does not include 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.

SYSTIMAX® STRUCTURED CABLING SYSTEM

The SYSTIMAX® 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 SYSTIMAX® 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 22-24 AWG unshielded twisted pair (UTP) copper cable, and multimode and singlemode, graded-index fiber optic cables.

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 Busbars (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 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 years. 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 Entrance Facility (EF), 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 SERVICE ENTRANCE FACILITY (EF)

The Telecommunications Service Entrance Facility is the point where the telecommunications service enters the customer's property. The EF may contain electronics equipment and line protection equipment required by the service provider. The EF may be combined with the Main Telecommunications Equipment Room, or the EF may be an outdoor pedestal or cabinet near the street. Other terms that are used in conjunction with the EF 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 EF.
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 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 DOC 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 Corrections, State of Washington, all law enforcement 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 work.

INDEX

Washington State Department of Corrections

Telecommunications Distribution Infrastructure Standards
(TDIS)

<u>Telecommunications Construction Guide Specification</u>
(TCGS)

Revision 5.3
April 30, 2008

TABLE OF CONTENTS

1 PREFACE

The Telecommunications Construction Guide Specification (TCGS) is written for designers and installers of Washington State Department of Corrections (DOC) telecommunications distribution systems. For Designers, it is intended to assist in developing project specifications. For contractors and installers (including DOC staff), it is intended to communicate DOC's requirements for the appropriate construction and installation of telecommunications distribution systems at DOC owned and leased facilities. The TCGS consists of several sections written based on the 1995 Construction Specifications Institute (CSI) format, using Master Format, Section Format, and Page Format[1] structure. The TCGS reflects DOC and industry standards in effect as of this publication.

1.1 DOCUMENT INTENT

The Department of Corrections has developed the TCGS with the intent that DOC standards and practices are followed during the design and construction of telecommunications distribution systems.

Each TCGS specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC telecommunications projects. For DOC staff performing telecommunications work, this information shall be followed to fulfill the requirements of a fully compliant installation.

Each TCGS section includes products DOC has standardized on that are current at the time the specification section was written. When newer products become available, or when a different product appears to be better suited for a particular project, the Designer, Contractor or Installer shall bring this recommendation to the attention of the DOC-TDI Specialist for review and final approval before making changes to the TCGS section or installing the newer or different product.

The TCGS is intended to be a "Guide Specification" rather than a "Master Specification". The products listed and other information included in each section are not intended to be all-inclusive for any given project. Instead, each specification section is meant to serve as a starting point for developing the respective project specification section, with content to be added or removed as required. However, all additions and changes must be pre-approved as indicated above.

[1] For more information on CSI and the Master Format, contact the Construction Specifications Institute at:
601 Madison Street, Alexandria, VA 22314. Phone: (800) 689-2900 Email: csimail@csinet.org; Internet: www.csinet.org

In addition to having DOC standards and practices followed, the intent of the TCGS is to reduce the time required for DOC to review telecommunications project specifications. DOC has proven that consistently formatted and structured specifications reduces the amount of time needed by DOC staff and RCDD Consultants to review the telecommunications specifications for each project.

Unless otherwise stated, the information in the TCGS applies to both new construction and remodel projects and (as appropriate) to leased facilities.

1.2 HOW TO USE THIS DOCUMENT

The TCGS contains ten 1995 CSI Master Format specification sections:

- 06101 – Rough Carpentry for IT Telecommunications Rooms
- 09001 – Room Finish Schedule for IT Telecommunications Rooms
- 09651 – Resilient Flooring for IT Telecommunications Rooms
- 09961 – Fire-Resistant Paints for IT Telecommunications Rooms
- 15301 – Sprinkler Systems for IT Telecommunications Rooms
- 16108 – Outside Plant Communications Site Work
- 16131 – Raceway and Boxes for Communications Circuits
- 16453 – Bonding and Grounding for Telecommunications
- 16711 – Inside Plant Communications Circuits
- 16715 – Outside Plant Communications Circuits

Note that the first five specification sections listed above, preceding the Division 16 sections, can either stand alone (with appropriate editing) or be included within the respective sections of the Construction Document specifications. They have been added to the TCGS solely because this information has continually been missed by the Engineer/Designer on projects.

The ten 1995 TCGS specification sections identified above would fit into the following 2004 CSI Master Format divisions (appropriately modified for revised numbering):

- 06101 to 061010 – Rough Carpentry
- 09001 to 090600.13 – Room Finish Schedule
- 09651 to 096536.13 – Static-Dissipative Resilient Flooring
- 09961 to 099646 – Intumescent Painting
- 15301 to 211313.xx – Wet-Pipe Sprinkler Systems
- 16108 to 270543 – Underground Ducts & Raceways for Communications Systems
- 16131 to 270528 – Pathways for Communications Systems
- 16453 to 270526 – Grounding and Bonding for Communications Systems
- 16711 to 271500 – Communications Horizontal Cabling
- 16715 to 271300 – Communications Backbone Cabling

The TCGS is not a stand-alone document, but is to be used in conjunction with the Telecommunications Distribution Design Guide (TDDG) to produce Construction Documents for bidding or to assist DOC selected personnel in the design and administration of small telecommunications construction projects, including installation of telecommunications distribution systems at DOC Community Corrections offices that are typically facilities leased by DOC.

DOC has standardized on the format and content of the specification sections that are included in the TCGS. For this reason, the Engineer/Designer shall edit each electronic specification section provided by DOC directly in Microsoft Word 2003, adding and/or removing content where required to meet the unique needs of a given project. The Engineer/Designer shall not create a new specification section based on the "intent" of the TCGS or cut and paste content from TCGS sections into other existing specification sections unless first reviewed and approved by the DOC-TDI specialist.

To this end, and in order to assist DOC staff with the specification review process, all edits by the Engineer/Designer to the original TCGS electronic documents provided by DOC, shall be made using Microsoft Word with **"Revision Marks"** turned on. The specification sections shall be submitted in hardcopy format when required by DOC during the design review process with the "Show Revision Marks in Printed Document" option selected. The Engineer/Designer shall not perform the function of "Accept Change/Insertion" or "Accept Change/Deletion" of any text on the specification until after the DOC-TDI Specialist has approved the specification for the project.

Text in shaded boxes in each TCGS section is formatted in Microsoft Word as "hidden text" and can be made to not appear on screen and/or not appear in the printed document by selecting the appropriate check boxes in the options menu. The hidden text is included to aid the Engineer/Designer in understanding areas of the Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only.

The Engineer/Designer shall not assume that the content of each specification section is suitable or sufficient for any given project in its current form and shall remain responsible for changing, adding, and/or removing content as required to develop a thorough and complete specification section that meets the requirements of the project being designed.

1.3 OTHER CONSTRUCTION DOCUMENT SPECIFICATION SECTIONS

The ten TCGS specification sections referenced above do not convey all of the information required in the Construction Document (CD) specifications for construction of the telecommunications distribution system. As identified in the TDDG under *Architectural Provisioning*, *Environmental Provisioning*, and *Power Requirements* for both Telecommunications Rooms and Equipment Rooms, the Designer shall be responsible for providing the appropriate information to the Architect/Engineer for these requirements. The Architect/Engineer is responsible for ensuring the appropriate information is fully specified in the appropriate divisions of the CD Specifications and Drawings.

SECTION 06101 – ROUGH CARPENTRY FOR IT TELECOMMUNICATIONS ROOMS

SECTION 06101 — ROUGH CARPENTRY FOR IT TELECOMMUNICATIONS ROOMS

> Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, written 4/30/2008 by C.Ryman.
>
> The Engineer/Designer shall include the following contents of this section when appropriate by incorporating into the Contract Document specifications either as a standalone section or include with other rough carpentry for the project.
>
> This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many WSDOC telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.
>
> The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a particular project, but shall not create a new specification section based on the “intent” of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD “Revision Tracking” features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.
>
> Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1 PART 1 - GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Related sections include but are not necessarily limited to the following:

> Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the contractor’s responsibility for coordinating work.

1. Division 09 Section — “Paint and Coatings”

1.2 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. Communications

a. Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plywood:

1. Plywood for backing of telecommunications room walls: APA Rated Sheathing 32/16, A-C, ¾ inch thick, void free, shall not be fire-retardant.

3 PART 3 - EXECUTION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plywood Backing in Telecommunications Equipment Rooms: Backboards shall be capable of supporting attached telecommunications equipment. Install in equipment rooms 8 feet high or as specified on drawings with “A” side exposed; securely attach to backup wall studs with mechanical fasteners. Install only after primer and finish coat painting of “C” side (non-exposed side) as specified elsewhere.

END OF SECTION

SECTION 09001 – ROOM FINISH SCHEDULE FOR IT TELECOMMUNICATIONS ROOMS

SECTION 09001 — ROOM FINISH SCHEDULE FOR IT TELECOMMUNICATIONS ROOMS

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, written 4/30/2008 by C.Ryman.

The Engineer/Designer shall include the following information in this section when appropriate by incorporating into the Contract Document specifications or drawings either as a standalone Room Finish Schedule or include with other rooms in the Room Finish Schedule for the project.

1.1 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. Communications

a. Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.

****

Room Space: IT Telecommunications Room

Floor Material: CONC (Concrete)

Floor Finish: VCT-SDT (Static Dissipative Vinyl Composition Tile)

Floor/Wall Base: NB (No Base)

Walls - (N,S,E,W): GWB (Gypsum Wallboard); Concrete walls are also acceptable if sealed against water intrusion. Walls shall be continuous to the structure above and sealed to prevent dust or dirt from entering and ensure a clean agent fire suppression system and/or HVAC cooling and humidity control is contained within the telecommunications space.

Walls Finish - (N,S,E,W): For GWB - Paint Light Color (White)

Walls Additional Note: A-C Plywood (non-fire retardant) backboard, onto all four walls, “A” side exposed, painted with fire retardant primer and finish.

Ceiling Material: Exposed Steel Structure (preferred), Hard Lid - GWB (2nd choice)

Ceiling Finish: For GWB = Paint Light Color (White)

Ceiling Height: 10’ 0” (preferred), 9’ 0” (2nd choice)

END OF SECTION

SECTION 09651 – RESILIENT FLOORING FOR IT TELECOMMUNICATIONS ROOMS

SECTION 09651 — RESILIENT FLOORING FOR IT TELECOMMUNICATIONS ROOMS

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, written 4/30/2008 by C.Ryman.

The Engineer/Designer shall include the following contents of this section when appropriate by incorporating into the Contract Document specifications either as a standalone section or include with other floor tiles.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many WSDOC telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a particular project, but shall not create a new specification section based on the "intent" of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1 PART 1 - GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Related sections include but are not necessarily limited to the following:

Review and edit the section below for relevance to this project and include only those that are directly related to this section. Ensure the referenced section(s) are included in the project manual and titles are correct.

1. Division 16 Section — "Grounding and Bonding for Telecommunications"

1.2 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. Communications:

a. Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.

b. ANSI-J-STD-607-A: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

1.3 DEFINITIONS

A. “TGB” shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB’s per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

1.4 SUBMITTALS

> Review and edit the following submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:
>
> “The Contractor shall apply Contractor’s stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Contract Documents.
>
> Any deviations from the Contract Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC IT through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.
>
> If the deviation is not approved by the Engineer/Designer it remains the Contractor’s responsibility to provide what is required in the Contract Documents”

A. Product Data: Submit product data for Static Dissipative Vinyl Composition floor tile.

B. Related sections include but are not necessarily limited to the following:

1. Division 16 Section — “Grounding and Bonding for Telecommunications”

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 MATERIALS

A. Static Dissipative Vinyl Composition floor tile for Telecommunications Rooms:

1. Armstrong Excelon SDT or approved equal

3 PART 3 - EXECUTION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Static Dissipative Vinyl Composition floor tile in Telecommunications Equipment Rooms:

1. Shall be installed in Telecommunications Equipment Rooms prior to installation of any floor standing equipment racks, cabinets, or other floor mounted devices.

2. Shall be installed on concrete floors only after concrete has thoroughly dried a minimum of one (1) week per every one (1) inch of concrete thickness.

3. Install as a system in strict conformance with manufacturer’s instructions and other requirements including required manufacturer’s adhesive, grounding strips, and polish.

4. Coordinate the location of the grounding strips with the Electrical contractor so they will be located along the same wall and within 3 feet of the telecommunications grounding busbar.

5. Coordinate with the Electrical contractor to bond the grounding strips to the closest telecommunications grounding busbar with a minimum 6 AWG copper conductor, per Conductor Size table based on conductor length from ANSI/TIA/EIA J-STD-607-A, as specified in the *Grounding and Bonding for Telecommunications* section, or as specified on drawings.

END OF SECTION

SECTION 09961 – FIRE RESISTANT PAINTS FOR IT TELECOMMUNICATIONS ROOMS

SECTION 09961 — FIRE-RESISTANT PAINTS FOR IT TELECOMMUNICATIONS ROOMS

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, written 4/30/2008 by C.Ryman.

The Engineer/Designer shall include the following contents of this section when appropriate by incorporating into the Contract Document specifications either as a standalone section or include with other paint and coatings for the project.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many WSDOC telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a particular project, but shall not create a new specification section based on the "intent" of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1 PART 1 - GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Related sections include but are not necessarily limited to the following:

Review and edit the section below for relevance to this project and include only those that are directly related to this section. Ensure the referenced section(s) are included in the project manual and titles are correct.

1. Division 06 Section — "Rough Carpentry"

1.2 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. Communications

a. Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.

1.3 SUBMITTALS

Review and edit the following submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:

"The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Contract Documents.

Any deviations from the Contract Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC IT through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.

If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Contract Documents."

A. Product Data: Submit product data for Fire Retardant Coatings.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fire Retardant paint for Telecommunications Room Backboards shall be light colored, non-conductive, manufactured by Flame Control Coatings, LLC, or Owner approved equal.

1. Flame Control No. 3003 Acrylic Primer.

2. Flame Control No. 20-20A Flat Latex Intumescent Fire Retardant Paint.

3 PART 3 - EXECUTION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Painting of Telecommunications Room Plywood Backboards with non-conductive Fire Retardant Paint:

1. Apply a minimum of one coat of paint over primer on "C" side of plywood and allow drying prior to installation of "A" side exposed.

2. Apply two coats of paint (over primer) on "A" side of plywood and allow drying prior to installation of any equipment.

END OF SECTION

SECTION 15301 – SPRINKLER SYSTEMS FOR IT TELECOMMUNICATIONS ROOMS

SECTION 15301 — SPRINKLER SYSTEMS FOR IT TELECOMMUNICATIONS ROOMS

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, written 4/30/2008 by C.Ryman.

The Engineer/Designer shall include the following contents of this section when appropriate by incorporating into the Contract Document specifications either as a standalone section or include with other fire protection sprinkler system information for the project.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many WSDOC telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a particular project, but shall not create a new specification section based on the "intent" of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1 PART 1 - GENERAL

PART 1 - GENERAL

1.1 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. Communications

a. Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.

1.2 SUBMITTAL

A. Telecommunications and Low-Voltage Security Electronics (LVSE) Room Layout Submittal

1. Contractor shall submit one set of shop drawings for the sprinkler system design, including valve controls and head placement for each Telecommunications Room and LVSE room to the A/E's RCDD for review.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sprinkler Guards: Hard-wire cage sprinkler guard, designed to protect sprinkler from mechanical damage, with chrome plated finish.

B. Drainage Troughs: Troughs designed to direct any water leakage from pipe joints or heads away from sensitive equipment or materials.

3 PART 3 - EXECUTION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide wire cage sprinkler guard protectors for heads susceptible to damage (this includes all heads in IT Telecommunications Rooms).

B. Coordinate with the Telecommunications and LVSE Designer(s) to position sprinkler heads to avoid locating directly above equipment racks, enclosures, and network equipment.

1. Provide drainage troughs under sprinkler heads where installed in Telecommunications and LVSE Rooms where heads are above floor mounted racks, cabinets, and equipment to divert water from pipe or head leakage away from sensitive electronic equipment and telecommunications cabling and components.

END OF SECTION

SECTION 16108 – OUTSIDE PLANT COMMUNICATIONS SITE WORK

SECTION 16108 — OUTSIDE PLANT COMMUNICATIONS SITE WORK

1 PART 1 — GENERAL

PART 1 — GENERAL

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, updated 4/30/2008 by C.Ryman.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a particular project, but shall not create a new specification section based on the "intent" of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1.1 RELATED DOCUMENTS

Review and edit the following paragraph to ensure appropriate references are included.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

Review and edit the following list of generic type products and work for relevance to this project. This listing should not include procedures or processes, preparatory work, or final cleaning.

A. Provide all materials and labor for the installation of a pathway system for outside plant (OSP) communications circuits fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standard. Work in this section includes, but is not limited to excavation and trenching, conduit (raceway) construction, cutting and patching, firestopping, concrete, maintenance hole construction, electrical grounding and bonding, and landscaping.

B. Related Sections

Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the contractor's responsibility for coordinating work.

1. Division 16 Section — "Basic Electrical Materials and Methods"
2. Division 16 Section — "Raceway and Boxes for Communications Circuits"
3. Division 16 Section — "Grounding and Bonding for Telecommunications"
4. Division 16 Section — “Outside Plant Communications Circuits”

C. Products furnished (but not installed) under this section:

Include this paragraph only if products will be furnished under this section but installed under other sections or by the Owner. DOC frequently has the Contractor furnish patch cords, but uses their IT staff to install. When installations are “By Owner” consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner- Installed Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

D. Products installed (but not furnished) under this section:

Include this paragraph only if products will be installed under this section but furnished under other sections or by the Owner. When products are furnished “By Owner” consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner-Furnished Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

Consider including busbars, grounding conductors, and any other items that are installed under this section but not furnished under this section.

1. Busbars and grounding conductors: See Division 16 *Grounding and Bonding for Telecommunications.*

E. Provide Unit Prices for:

Include this paragraph only if unit pricing will be required for a specific part of the project. Include statements on how to measure the quantity. For example, unit prices may be requested for trenching, conduit, etc. Specify technical information on the products and installation associated with the required unit pricing in the appropriate articles of PART 2 and PART 3.

1.3 REFERENCES

Review and edit the following list of references. Check for completeness, currency and applicability to this project. Rarely should anything be removed from under the General or Communications categories. The Engineer/Designer shall verify with the DOC-CPDPM and/or the DOC-TDI Specialist assigned to the project whether the latest edition and/or addenda of each required reference is appropriate and specify the edition and addenda below accordingly.

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

   a. National Electrical Code (NEC)

   b. National Electrical Safety Code (NESC)

   c. Washington Industrial Safety and Health Act (WISHA)

   d. Occupational Safety and Health Act (OSHA)

   e. WSDOT/APWA 1998 Standards Specifications for Road, Bridge and Municipal Construction (APWA Standard Specifications)

   f. Revised Code of Washington (RCW)

   g. Washington Administrative Code (WAC)

   h. DOC Policy Directive *Electrical Construction and Maintenance*, DOC 700.130

2. Communications:

   Unless specifically indicated otherwise in the Construction Documents, the latest Edition and all current Addenda's and approved Amendments for the following publications shall be considered Communications references. (This section of the Construction Documents is based on the Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008).

   a. ANSI/TIA/EIA–568-B: *Commercial Building Telecommunications Cabling Standard*

   b. ANSI/TIA/EIA-569-B: *Commercial Building Standard for Telecommunication Pathways and Spaces*

   c. ANSI/TIA/EIA-606-A: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

   d. ANSI-J-STD-607-A: *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

   e. ANSI/TIA/EIA-758: *Customer-owned Outside Plant Telecommunications Cabling Standard*

   f. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

   g. BICSI: *BICSI Information Transport Systems Installation Manual (ITSIM)*

   h. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

   i. BICSI: *BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)*

3. Concrete:

   a. Reinforcement:

      1) ACI 301: Structural Concrete for Buildings

      2) ACI SP-66: American Concrete Institute - Detailing Manual

3) ANSI/ASTM A82: Cold Drawn Steel Wire for Concrete Reinforcement

4) ANSI/AWS D1.4: Structural Welding Code for Reinforcing Steel

5) ANSI/AWS D12.1: Reinforcing Steel Welding Code

6) ASTM A615: Deformed and Plain Billet Steel Bars for Concrete Reinforcement

7) AWS D12: Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction

b. Cast-in-Place:

1) ACI 212.3R: Chemical Admixtures for Concrete

2) ACI 301: Structural Concrete for Buildings

3) ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

4) ACI 305R: Hot Weather Concreting

5) ACI 306R: Cold Weather Concreting

6) ASTM C33: Concrete Aggregates

7) ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

8) ASTM C94: Ready-Mixed Concrete

9) ASTM C150: Portland Cement

10) ASTM C143: Standard Test Method for Slump of Hydraulic Cement Concrete

11) ASTM C173: Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

12) ASTM C231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

13) ASTM C260: Air Entraining Admixtures for Concrete

14) ASTM C309: Standard Specifications for Liquid Membrane Forming Compound for Curing Concrete

15) ASTM C494: Chemical Admixtures for Concrete

c. Pre-Cast:

1) ASTM C478: Standard Specification for Pre-cast Reinforced Concrete Manholes Sections

2) ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Pre-cast Utility Structures

3) ASTM C858: Standard Specification for Underground Pre-cast Concrete Utility Structures

4) ASTM C891: Standard Practice for Installation of Underground Pre-cast Concrete Utility Structures

5) ASTM C1037: Standard Practice for Inspection of Underground Pre-cast Concrete Utility Structures

6) ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

4. Trenching and Backfill:

a. ASTM D1557: Test Method for Laboratory Compaction Characteristics Using Modified Effort

1.4 DEFINITIONS

> Review and edit the following list of definitions for applicability to this project. Add and/or remove definitions for unusual terms that are not explained in the conditions of the Contract and that are used in ways not common to standard references.
>
> NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:
>
> Furnish - "Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations".
>
> Install - "Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations".
>
> Provide - "To furnish and install, complete and ready for the intended operation".

A. Aggregate: Mineral materials such as sand or stone used in making concrete

B. Backfill: Earth material used specifically for filling and grading excavations back to a finished state. Backfill is placed on top of the bedding surrounding encased ductbanks and direct-buried conduits.

C. Base: Earth material used specifically to level and grade an excavation's subgrade for the subsequent placement of encased ductbanks, direct-buried conduit, maintenance holes and handholes. Base material is placed on top of the subgrade and beneath the bedding surrounding encased ductbanks, conduits, maintenance holes or handholes.

D. Bedding: Earth material used specifically for filling excavations. Bedding is placed around encased ductbank, conduits, maintenance holes or handholes. Bedding is placed on top of the base and beneath the backfill.

E. Fill: The collective term for base, bedding, and backfill.

F. Handhole (HH): A structure similar to a small maintenance hole through which communications cable can be pulled, but not large enough for a person to fully enter to perform work. Owner typically does not allow installation of new HH's or installation of telecommunications cable into/through existing HH's. Do not use an existing HH unless specifically identified for use on construction document drawings.

G. Maintenance Hole (MH): A vault located in the ground or earth as part of an underground conduit system and used to facilitate placing, connecting, and maintaining communication cables as well as placing associated equipment, in which it is expected that a person will enter to perform work.

H. RNC: Rigid Non-Metallic Conduit (PVC)

I. PSC: PVC Coated Rigid Steel Conduit.

J. RGC: Rigid Galvanized Steel Conduit

K. "TGB" shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB's per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

L. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. There is typically one TMGB per building, located in the main telecommunications room of the building. This busbar is directly bonded to the electrical service grounding electrode system by the Bonding Conductor for Telecommunications (BCT) and bonded to building structural steel or other permanent metallic systems. The TMGB serves as the dedicated extension of the building's grounding system for the building's telecommunications infrastructure. A TMGB may serve in lieu of a TGB in a telecommunications room.

1.5 SYSTEM DESCRIPTION

> Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system.
> Verify for accuracy the section numbers and titles referenced below.

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, necessary appurtenances, and grounding & bonding to provide a complete Outside Plant (OSP) pathway system as hereinafter specified and/or shown on the Construction Documents. The OSP pathway system shall be fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standards and support an ANSI/TIA/EIA and ISO/IEC fully compliant communications Structured Cabling System (SCS) as specified in Division 16 *Outside Plant Communications Circuits*, and *Grounding and Bonding for Telecommunications*.

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

C. Coordinate closely with other contractors and subcontractors on the project.

D. By the act of submitting a bid, this Contractor shall be deemed to have:

1. Examined all drawings and specifications which are a part of this project.

2. Visited the site of the work and accepted the provisions made by others or excepted specific parts of those provisions.

3. Made proper allowances for coordination with other trades and Owner/User.

4. Provided for the requirement to work with other contractors.

5. Considered the complexity, scheduling and all other special and unusual circumstances involved which this contractor has determined to be connected with this project.

6. Made an affirmative statement that this Contractor has read the documents, understands their meaning and intent, is able to install the work in the manner shown as satisfactory to the Owner, and is willing and able to execute the work of this Division 16 Section with the requirements, restrictions, and limitations stated or implied in these construction documents.

1.6 SUBMITTAL INFORMATION

Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:

"The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Construction Documents.

Any deviations from the Construction Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC IT through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.

If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Construction Documents".

A. Telecommunications OSP Conduit Layout Submittals:

1. Contractor shall submit a telecommunications conduit layout showing:

a. Routing and placement of the proposed OSP telecommunications pathway and components

b. Identify all details not specifically identified in the Construction Documents including:

1) Size, material types, and lineal footage of each conduit segment

2) Radius size and material types of conduit sweeps

3) Conduit depth and slope including a diagram identifying elevations of conduit stub-ups AFF within building(s) and the elevation of the top of the closest MH(s) used in the conduit pathway to the building(s)

4) Conduit stacking design within ductbank

5) Labeling of all conduit terminations at buildings and MHs

6) Labeling of all MHs

7) Butterfly drawing for each MH with detailed locations of Term-a-Ducts or conduit entrances matching the ductbank configuration and/or plan drawings

8) Telecommunications OSP grounding diagram including conduits into buildings

2. All diagrams and drawings shall be submitted for review, comment, and written approval by Architect/Engineer/Owner <u>prior to ordering MH and commencing fabrication and installation</u>.

3. All submittals shall be accompanied by a transmittal letter indicating date, project name, Contractor's name and address, sub-contractor's name and address, and deviations from the Construction Documents if any.

4. Submittals in parts will not be accepted. Only a complete conduit layout will be reviewed.

5. Regardless of the action indicated, the Architect/Engineer/Owner's review does not relieve the Contractor of responsibility to comply with the contract documents and shall not be construed as authorizing any deviations from the specifications or drawings or references specified in the Construction Documents unless the Contractor attaches a letter to the submitted item clearly listing the deviations.

B. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

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

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

C. Quality Assurance/Control Submittals: Provide submittal information for review as follows:

1. Submit a copy of the delivery receipt for each concrete delivery. Include date, strength ordered, and location used.

D. Closeout Submittals: Provide submittal information for review as follows:

> A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under other related communications sections (e.g. Raceway and Boxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications. The requirement that the Contractor provide an O&M Manual for Communications should be stated in the Outside Plant Communications Circuits section or in Inside Plant Communications Circuits.

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

Portions of the text below may be contained in other Sections (e.g. 16010 (or equivalent) - General Electrical). Coordinate text for accuracy and content.

a. Document changes to the system from that originally shown on the Construction Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

State any requirements for coordinating work with potentially unusual or specifically required sequencing. DOC may choose to construct a project under two bid packages - one for OSP Site Work as described in this specification section as well as other General Contractor specific work, and a second bid package for the Structured Cabling System. The Engineer/Designer must coordinate with DOC to determine if two bid packages will be used and include verbiage in the appropriate specification sections requiring the contractors to coordinate construction phasing, schedules and the use of DOC provided security escorts.

1.8 COORDINATION

A. Coordinate telecommunications site work with other construction elements to ensure setback clearances, access, and building startup requirements.

1.9 QUALITY ASSURANCE

A. Comply with NEC.

B. Comply with NESC.

1.10 CONTRACTOR WARRANTY

Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. A thorough understanding of the warranties applicable on this project is required. The Engineer/Designer shall consider and account for unique warranty situations that may arise from owner furnished equipment, owner installed equipment, or other situations that may conflict with warranty requirements.

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

2 PART 2 — PRODUCTS

PART 2 — PRODUCTS

Ensure that products listed under the PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.

The following paragraphs include products that do not indicate that they allow "or equal" substitutions. If the Engineer/Designer wishes to use other products, **an alternative product request shall be submitted in writing to the DOC IT Infrastructure Specialist**. This request shall follow the format and procedures of the Alternative Design Request identified in the TDDG, and include detailed literature from the manufacturer of the alternative product. If the alternative product is approved, the Engineer/Designer shall ensure the specification is written with equal or greater detail to the following paragraphs.

The products listed throughout PART 2 - Products below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified with equal or greater detail to the following paragraphs. The Engineer/Designer shall also verify that the most current part number of each specified product is listed in this section.

2.1 GENERAL

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

2.2 BASE, BEDDING AND BACKFILL

Review and edit the following products/part numbers as applicable to this project.

A. Use of on-site soils for base, bedding, and backfill is not acceptable.

B. Base: Readily compactible and meet the following gradation requirements.

1. For Maintenance Holes and Handholes (provide gravel):

Sieve Size	Percent Passing
1" Square	100
¼" Square	25 - 80
U.S. No. 200	15 max
Sand Equivalent	30 min

2. For Trenches (provide sand):

Sieve Size	Percent Passing
U.S. No. 10	35 - 100
U.S. No. 20	20 - 80
U.S. No. 40	10 - 55

U.S. No. 100	0 - 10
U.S. No. 200	0 - 3

C. Bedding: Same as Base - For Trenches, above.

D. Backfill:

1. For Maintenance Holes and Handholes - Same as Base - For Maintenance Holes and Handholes, above.

2. For Trenches

Sieve Size	Percent Passing
½" Square	100
¼" Square	65 - 100
U.S. No. 10	40 - 100
U.S. No. 50	3 - 50
U.S. No. 100	0 - 4
U.S. No. 200	0 - 3

2.3 CAST-IN-PLACE CONCRETE

Review and edit the following products/part numbers as applicable to this project.

A. Formwork:

1. Forms: Metal or plywood in good condition

a. Form Release Agent: Burke Form Coating (or equal)

2. Gypsum board

B. Reinforcement:

1. Reinforcing Steel: ASTM A615, Grade 40. Uncoated, free from rust, dirt, and loose scale.

2. Tie Wire: 18 gauge 40 or heavier black annealed wire.

3. Embedded Anchor Bolts: Mild galvanized steel, cold bent.

C. Concrete:

1. Cement: Different types of cement, including the same type of cement provided by more than one manufacturer, are not acceptable: Cement shall conform to:

a. ASTM C150-7, type 1.

b. 2500 psi. minimum compressive at 28 days per ASTM C39.

c. 4 inches maximum slump per ASTM C-143.

2. Aggregate:

a. Course: ASTM C33-71 with a maximum size of 1-¼".

b. Fine: ASTM C33-71.

3. Water: Fresh, clean, potable and not detrimental to concrete.

4. Admixtures:

a. Air Entrainment: Conform to ASTM C260 and ASTM C173 or C231 with 5% to 7% air entrainment.

b. Other: Not allowed without prior approval from the Engineer/Designer.

5. Curing Compound: Conform to ASTM C309. Free from petroleum resins or waxes. Formulated for sealing, surface hardening, and curing concrete.

List additional products above as applicable to this project.

2.4 CONDUIT AND DUCTBANKS

Review and edit the following products/part as applicable to this project.

A. Conduit

1. Rigid Non-Metallic Conduit (RNC):

a. UL listed, NEMA TC2 Schedule 40 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement

b. Fittings: NEMA TC3, matched to conduit and material.

c. See Fittings section below.

2. Rigid Galvanized Steel Conduit (RGC):

a. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.

b. Couplings: Un-split, NPT threaded with galvanizing equal to (and compatible with) conduit. Running thread or set screw threaded fittings (except for three piece and watertight split couplings) are not acceptable.

c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

d. Grounding collars: Per conduit manufacturer's specifications.

e. See Fittings section below.

3. PVC Coated Rigid Steel Conduit (PSC):

a. NEMA RN 1 rigid steel conduit coated with rigid polyvinyl chloride (PVC).

b. Fittings: NEMA RN 1.

c. Grounding collars: Per conduit manufacturer's specifications.

d. See Fittings section below.

4. Fittings:

a. Sweeps: Where less than a 40' radius, factory manufactured with a single arc of <u>not less than a 15 foot radius</u>.

1) **<u>NOTE:</u>** 15 foot radius sweep is typically a **<u>"Special Order"</u>** item, adding additional lead time!

b. End Caps (Plugs): Pre-manufactured and water-tight. Tape is not an acceptable end cap or cover.

c. Conduit outlet bodies (LB's, UB's, etc.) are not allowed.

5. Pull Ropes: ¼ inch polypropylene with a minimum tensile strength of 200 pounds.

6. Coatings:

a. Scotchrap No. 51 plastic tape.

b. Kopper's Bitumastic No. 505.

B. Ductbanks:

1. Conduit Spacers/Supports, high-density plastic interlocking spacers/supports:

a. Underground Devices Inc.: WUNPEECE

2. Conduit Hold Down Bars (anti-float concrete pour):

a. Underground Devices Inc.: WUNPEECE (or Owner approved equal)

3. Warning Tape:

a. Underground Hazard Tape, <u>Detectable Laminated Aluminum</u>, 6 inches wide, Orange background and Black legend colors. Legend: "CAUTION CAUTION CAUTION FIBER OPTIC CABLE BURIED BELOW."

1) Panduit: HTDU6O-FO (or Owner-approved equal).

4. Grounding/Bonding: Minimum #2 AWG bare copper conductor, or larger as required per NESC.

List additional products to the above information as applicable to this project.

2.5 UNDERGROUND SPACES

Review and edit the following products/part numbers as applicable to this project.

A. General: Underground spaces include Maintenance Holes (MH) and Handholes (HH). Installation of new HH's or uses of existing HH's are prohibited unless specifically identified on construction document drawings as available to use.

1. Incidental and miscellaneous equipment supplied with a MH or HH shall be supplied by the same manufacturer.

2. The Contractor shall insure the soil cover and water table depth per MH placement is within the MH manufacturer's design assumptions for structural and buoyancy purposes.

B. Maintenance Holes: Precast, conform to ASTM C478 and other ASTM standards and specifications as listed in REFERENCES above. Complete with concrete floors, lockable covers, manhole steps, hook ladders, (2) galvanized pulling iron per longitudinal side (four (4) total), complete “C” channel, racking and cable supports, ground rod knockouts, and a closed sump.

1. Sizes and Types:

> The Engineer/Designer shall include MH sizes as required for the project. The sizes described below are DOC Standards. Alternate sizes must be submitted as an Alternative Design Request.

a. *(Large)* Utility Vault Company: 612-7-TCA 6’-8” W x 12’-8” L x 8’-3” H (exterior dimensions). Complete with Alternate Top Section 612-T42C, Center Section 612-MTC, Base Section 612-DBT, and section gaskets. Equipped with (3) galvanized “C” imbedded channels per longitudinal side, 2 pulling eyes – each end.

1) Duct entrances shall be equipped with (4” TERM-A-DUCT ’90).

a) **NOTE:** TERM-A-DUCT is a **“Special Order”** requirement, adding additional lead time! Term-a-duct ‘80 is not acceptable.

b. *(Medium)* Utility Vault Company: 4484-TCA 5’-0” W x 9’-0” L x 7’-2” H (exterior dimensions). Complete with Alternate Top Section 4484-T42C, Center Section 4484-MTC, Base Section 4484-BT, and section gaskets. Equipped with (3) galvanized “C” imbedded channels per longitudinal side, 2 pulling eyes – each end.

1) Duct entrances shall be equipped with (4” TERM-A-DUCT ’90).

a) **NOTE:** TERM-A-DUCT is a **“Special Order”** requirement, adding additional lead time! Term-a-duct ‘80 is not acceptable.

c. (Small) Utility Vault Company: 504-LA 4’-8” W x 4’8” L x 4’0” H (exterior dimensions). Complete with base section 504-BL, Optional Top section 55-38C, and section gaskets. Equipped with (1) galvanized “C” imbedded channel per each side, 4 pulling eyes – each corner.

1) Duct entrances shall be equipped with (4” TERM-A-DUCT ’90).

a) **NOTE:** note that TERM-A-DUCT is a **“Special Order”** requirement, adding additional lead time! Term-a-duct ‘80 is not acceptable.

2) Optional Top Section to include: 42” Round Access

2. Cover and Frame: Utility Vault Company CASTINGS 30” x 10”

a. Covers shall be ordered as Bolt-Down.

b. Cover shall be labeled: “Communications”.

3. Racking and Hardware: Galvanized.

a. Manhole Step.

b. Hook Ladder (length close to vertical, not more than 25 degree angle).

c. Racking, Cable Rack Brackets, Cable Support Arms, and Corner Brackets.

4. Risers:

a. 4 inch high: Utility Vault Company No. 4204

b. 6 inch high: Utility Vault Company No. 4206

c. 12 inch high: Utility Vault Company No. 4212

C. Grounding:

1. ¾" x 10' copper-clad steel ground rods.

2. #4/0 AWG bare copper pigtail for connection to MH interior ground conductors.

List additional products to the above information as applicable to this project.

2.6 FIRESTOPPING MATERIAL:

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

1. Specified Tech. Inc.

Review and edit the following products/part numbers as applicable to this project.

2.7 LABELS:

A. Identifiers shall follow the format and definitions per ANSI/TIA/EIA-606-A Class 3 administration and as identified in the Construction Documents.

B. Labels shall be permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus, IDXPERT, HandiMark, TLS2200 (or approved equal).

2. Labels applied directly to small 4-pair cable (or equal size), not for Marker Tags:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

3. Labels for Marker Tags shall be a minimum size of 2.0" W x 1.0" H:

a. Panduit:

1) Clear L3PL3CL

2) White L3PL3WH

C. Marker Tags for Conduit and Cable shall be a minimum size of 3.5" W x 2.0" H, constructed of rigid vinyl with a clear over-laminate protection (self-laminating), with slots for installing as a wrap and/or flag with nylon cable ties with a minimum loop tensile strength of 40 pounds. Labels applied to tags shall be typed and created by a label maker or an approved equivalent software-based label making system (see above). Handwritten labels are not acceptable.

1. Tags:

a. Panduit: Self-Laminating Cable Marker Rigid (Non-Adhesive) Tag #PST-FOBLNK (no substitutions)

2. Nylon Cable Ties (minimum 40 LB loop tensile strength):

a. Panduit: PAN-TY #PLTxI-C (or approved equal)

D. Signs: Permanent plastic or metal engraved, not subject to fading or erasure, waterproof and solvent resistant, permanently affixed.

2.8 LANDSCAPING:

Review and edit the following products/part as applicable to this project.

A. Topsoil: Imported from off construction site.

3 PART 3 — EXECUTION

PART 3 — EXECUTION

Ensure that products incorporated into the project under PART 3 paragraphs have corresponding Product information in PART 2 – Products, or in another specification Section if installed but not supplied under this Section.

The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If it is desirable to use other products, the Engineer/Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and written with equal or greater detail to the following paragraphs.

The products listed throughout PART 2 – Products and the installation requirements below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified in Part 2 with corresponding installation requirements specified in Part 3.

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

The Engineer/Designer shall ensure the following text also appears in Division 1 General Requirements and/or Division 2 Site Construction.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc., inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

1. In the event of damage to DOC telecommunications infrastructure, Contractor shall immediately stop any work that could potentially further the damage and contact the Owner:

   - For Capital Projects, Owner shall be the DOC Capital Programs Project Manager
   - For all other projects, Owner shall be the DOC Regional IT Manager

   a. The DOC Owner shall immediately provide information of the damage to the DOC Regional IT Manager and/or the DOC Telecommunications Distribution Infrastructure (TDI) Specialist assigned to support the facility, and the facility manager.

   b. Only the DOC TDI Specialist working in concert with DOC IT, Plant, and Capital Programs managers shall determine the repair and/or replacement strategy. Contractor shall not make this determination, make any temporary repairs or replace any telecommunications infrastructure unless directed to do so in writing by the DOC TDI Specialist.

   c. All damaged telecommunications infrastructure shall be restored to within the scope of the original design, installation, operational, and warranty parameters (or better) by a contractor of Owners choosing. Only a certified SYSTIMAX® Value Added Reseller (VAR) shall work on the telecommunications cabling. Restoration shall include, but not be limited to all repair and/or replacement work and materials, testing, and re-certification of the infrastructure for full compliance to Owner's TDI Standards and SYSTIMAX® SCS and/or other manufacturer's warranty requirements.

F. Owner and Engineer/Designer Observations: Contractor shall coordinate with Owner and Engineer/Designer to schedule in advance dates for observations by Owner and Engineer/Designer as indicated below. Owner and Engineer/Designer will determine if onsite observations are required for all work listed below or portions thereof.

1. Contractor shall provide one week advance notice to Owner and Engineer/Designer when work listed below is scheduled.

2. Contractor shall provide a minimum of 2 days advance notice to Owner and Engineer/Designer of dates when work listed below will be ready for observation.

3. Work requiring observation by Owner and Engineer/Designer:

   a. Placement of conduit and telecommunications ground cable in open trenches and at MH and building entrances. Observations shall occur prior to placement of conduit, during placement of conduit, and prior to pouring of concrete encasement and/or prior to backfill.

   b. Placement of maintenance holes and handholes: Observation shall occur after excavation and during the MH placement work.

   c. Other work as identified by Owner and Engineer/Designer during construction meetings.

G. Remove surplus material and debris from the job site and dispose of legally and per contract document requirements.

H. Where hand holes (HH's) are allowed, all references to MH shall also apply to HH's unless specified otherwise.

Engineer/Designer shall coordinate steam line/utilidor design with the civil engineer for both existing and new TDI based on the following specifications. Include with appropriate modifications, the following section only where telecommunications pathways will be installed in proximity to steam lines or a steam utilidor.

3.2 PROXIMITY TO STEAM LINES AND STEAM UTILIDOR

A. Telecommunications conduits **crossing direct-buried OSP steam lines** shall meet the minimum requirements listed below:
   1. Telecommunications conduits shall "only" route under direct-buried steam lines and shall cross perpendicular.
   2. The telecommunications conduit crossing point shall be positioned a minimum of five (5) feet away from all steam and condensate pipe welds and connections.
   3. The telecommunications conduits and steam lines shall be separated by all of the following:
      a. Telecommunications conduit shall be fully encased with a minimum of four (4) inches of concrete. Concrete shall extend a minimum of three (3) feet beyond both sides of the telecommunications conduit and three (3) feet beyond both sides of the steam lines of the crossing axis.
      b. Six (6) inches of insulation shall be installed covering the entire concrete extension described above:
         i. One (1) inch of Unifrax Duaboard HD.
         ii. Five (5) inches of Insulfoam 40.
      c. A minimum of twelve (12) inches of controlled density fill (CDF) concrete shall be placed on top of the insulation.
      d. An outside sleeve of galvanized steel or class 3 ductile iron casing with a bitumastic coating shall fully encase the steam line and a second sleeve fully encasing the condensate line at the crossing. Both sleeves shall extend five (5) feet beyond both sides of the telecommunications conduit. The maximum amount of insulation shall be installed around both the steam and condensate lines (inside the two sleeves).
         i. Both ends of the two sleeves shall be vented above finished grade to allow steam to escape from a potential line rupture.
            1. Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.

B. Telecommunications conduits **run parallel to direct-buried OSP steam lines** shall meet the minimum requirements listed below:
   1. Telecommunications conduits shall have a minimum separation distance from steam lines of five (5) feet of well-compacted soil.
   2. Telecommunications conduit shall be fully encased with a minimum of four (4) inches of concrete.

C. Telecommunications conduits **crossing an OSP steam utilidor** shall meet the minimum requirements listed below:
   1. It is preferable for telecommunications conduits to route under a steam utilidor whenever possible.
   2. Telecommunications conduits shall cross perpendicular to the steam utilidor.
   3. The telecommunications conduit crossing point shall be positioned a minimum of five (5) feet away from all steam and condensate pipe welds and connections and in the middle of a utilidor section (not above a joining of two utilidor sections).
   4. At the point of crossing, the steam utilidor shall be constructed as follows:
      a. An outside sleeve of galvanized steel or class 3 ductile iron casing with a bitumastic coating shall fully encase the steam line and a second sleeve fully encasing the condensate line at the crossing. Both sleeves shall extend five (5) feet beyond both sides of the telecommunications conduit. The maximum amount of insulation shall be installed around both the steam and condensate lines (inside the two sleeves).

i. At both ends of the sleeves, vents shall be installed through the utilidor lid to above finished grade to allow steam to escape from a potential line rupture.
   1) Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.

5. Where telecommunications conduit **crosses under** a steam utilidor:
   a. Telecommunications conduit shall be fully encased in a minimum of four (4) inches of concrete.
   b. The base below the telecommunications conduit shall be well-compacted to structurally support the weight of the steam utilidor with no settling damage to the telecommunications conduit.
   c. The steam utilidor base shall be a minimum thickness of four (4) inches of concrete.
   d. Six (6) inches of insulation shall be installed on the floor inside the utilidor under the steam lines, extending a minimum of three (3) feet beyond both sides of the telecommunications conduit crossing:
      i. One (1) inch of Unifrax Duobond HD.
      ii. Five (5) inches of Insulfoam 40.
6. Where telecommunications conduit **crosses over** a steam utilidor:
   a. The steam utilidor lid shall be a minimum thickness of seven (7) inches of concrete. Along the entire length of the utilidor lid where it meets the top of the utilidor walls, a water-tight sealant shall be applied that maintains sealing integrity under extreme operation (major steam leak).
   b. Insulation shall be installed on top of the utilidor lid, extending a minimum of three (3) feet beyond both sides of the telecommunications conduit crossing and three (3) feet beyond the sides of the utilidor wall:
      i. One (1) inch of Unifrax Duabond HD.
      ii. Five (5) inches of Insulfoam 40.
   c. A minimum of twelve (12) inches of controlled density fill (CDF) concrete shall be placed on top of the entire area covered by the insulation.
   d. The telecommunications conduit shall be fully encased in a minimum of three (3) inches of concrete.
   e. The top of the telecommunications ductbank shall be placed a minimum of thirty (30) inches below finished grade.

D. Telecommunications conduits **run parallel to an OSP steam utilidor** shall meet the minimum requirements listed below:
   1. The steam utilidor walls shall be a minimum of four (4) inch thick concrete.
   2. Vents shall be installed through the steam utilidor lids to above finished grade every one hundred (100) feet along the parallel run to allow steam to escape from a potential line rupture.
      a. Vents shall be a minimum of four (4) inch diameter and include a 180 degree bend at the top.
   3. All steam utilidor section joints shall be sealed with a water-tight sealant that maintains integrity under extreme operation (major steam leak).
   4. Telecommunications conduits shall be fully encased in a minimum of four (4) inches of concrete and shall maintain a minimum of two (2) feet separation from the outside utilidor wall.
   5. The top of the telecommunications ductbank shall be placed a minimum of thirty (30) inches below finished grade.

3.3 EXCAVATING, TRENCHING AND FILL

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Excavation:

1. Do not excavate when the outside temperature is less than 35° F or when there is standing water or snow on the subgrade.

2. Where crossing of concrete or asphalt is required, saw cut and remove surface material prior to excavating. Remove concrete in complete sections from control joint to control joint regardless of the width of the excavation. Restore concrete and asphalt surfaces following excavation to match existing depth, strength, color, and type of material.

3. If an adjacent structure may be compromised or damaged by excavation work, underpin the structure as required. If the structural integrity is in question, obtain an evaluation and recommendation from a registered structural Engineer/Designer employed by the Contractor prior to proceeding with the work.

4. Maintain adequate separation between the excavation and adjacent underground utilities. Locate excavations such that ductbanks, maintenance holes, and handholes have a minimum separation as specified below and as specified in the Construction Documents. Contact the Engineer/Designer prior to proceeding if minimum separation distances listed below can not be achieved.

   a. For gas lines: a minimum separation of eighteen (18) inches is required.

   b. For water and sewer lines: a minimum separation of thirty-six (36) inches is required. Telecom conduits shall not be installed:

      1) Above water lines (telecom shall be below)

      2) Below sewer lines (telecom shall be above)

   c. For steam lines and steam utilidor: contact Engineer/Designer prior to proceeding if separation distance is less than ten (10) feet, or telecommunications conduit will be placed above steam line or utilidor, and detailed construction methods to mitigate the potential adverse effects of a failed steam line are not specified in construction documents.

   d. For electrical lines, conduits, and transformers, see Table below:

Outside Plant (OSP) Conduit Clearances for Electromagnetic Interference (EMI) Reduction

Ref #	**Electrical & Telecommunication Conduits *Crossing Perpendicular* - Regardless of Voltage/Current**	**Min. Separation**
1	Electrical and Telecom conduits both RNC. See Notes 1, 2, 3, and 6.	48" (4 ft)
2	Electrical or Telecom conduit RGC/PSC (**one must be metallic**). Extend RGC/PSC conduit a minimum of 5 ft. on both sides of intersect. See Notes 1-6.	12" (1 ft)
Ref #	**Electrical & Telecommunication Conduits *Running Parallel -* Regardless of Voltage/Current**	**Min. Separation**
3	Electrical and Telecom conduits both RNC. See Notes 1, 2, 3, and 6.	60" (5 ft)
4	Electrical or Telecom conduit RGC/PSC (**one must be metallic**). See Notes 1-6.	12" (1 ft)

Outside Plant (OSP) Conduit Clearances for Electromagnetic Interference (EMI) Reduction		
Ref #	**Electrical & Telecommunication Conduits *Crossing Perpendicular* - Regardless of Voltage/Current**	**Min. Separation**
5	Electrical and Telecom conduits both RGC/PSC (**both in metallic)**. See Notes 1-6.	12" (1 ft)
Ref #	**Telecommunication Conduits *Running Adjacent to Electrical Transformer* - Regardless of Voltage/Current**	**Min. Separation**
6	Telecom conduit RNC. See Notes 1, 2, 3, and 6.	84" (7 ft)
7	Telecom conduit RGC/PSC (**must be metallic**). Extend RGC/PSC conduit a minimum of 10 ft. beyond footprint of transformer. See Notes 1-6.	36" (3 ft)
Notes:		
1)	The 20 ft. set back of NESC 2002 Corrected Edition Section 097.F supersedes above distances.	
2)	Conduits surrounded & separated by well-tamped earth/sand per DOC TIS 16108.	
3)	#2 bare copper ground wire in entire length of telecom duct bank per DOC TIS 16108.	
4)	Grounding collars required on metallic telecom conduit & bonded per DOC TIS 16108.	
5)	Metallic conduit properly grounded per NEC and NESC.	
6)	Where conduit encased in concrete, add concrete thickness to separation distance.	

5. Protect excavations at the end of the work shift. Cover with steel sheets and barricade prior to leaving the job site, in accordance with all applicable rules, regulations, building codes, ordinances, and security requirements as directed by DOC Superintendent or designated security personnel.

6. Install, operate and maintain pump or dewatering equipment as necessary to prevent water from accumulating in the excavation.

7. Excavation Depth/Width:

    a. Coordinate excavation with the depth and slope requirements found later in the *Conduits and Ductbanks* section.

        1) Finished grade at MH lid shall be lower than conduit stub-ups at finished floor grade of the designated building(s).

    b. **For MH**:

        1) Excavate to a sufficient depth to cover the overall assembled height of the vault plus the added height of risers, covers and bedding material consisting of a minimum six (6) to twelve (12) inches of base.

        2) Excavate to a sufficient width to provide a minimum of six (6) inches clearance around each side of the MH.

    c. **For Trenches**:

1) Excavate to a sufficient depth to provide a minimum of thirty (30) inches cover between the finished grade and the top of the conduit or ductbank formation and to allow for the proper alignment of conduits into the MH.

2) Where less than the maximum numbers of conduits are installed in main distribution pathways, excavate to a sufficient depth to allow future placement of additional conduits on top of ductbank and maintain the 30 inches of cover.

3) Excavate to a sufficient width to provide a minimum of six (6) inches to each side of the ductbank formation.

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

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

10. Slope trench grade to fall 4 inches per 100 feet in general and ¼" per foot where possible.

a. Slope trench toward lower MH or from high points toward MH at both ends.

b. Slope trench away from building entrances.

c. Trenches shall not have a low spot between ends.

B. Fill:

1. Drain and/or pump groundwater and surface water from the recipient area prior to the placement of fill.

2. Do not place frozen fill.

3. Base:

a. Scarify and moisture condition the subgrade bed to receive fill prior to placing materials.

b. Moisture condition base material to within three (3) percent of optimum moisture content and place in loose, horizontal layers.

c. Level the subgrade bed using sand for trenches and 6" to 12" of compacted sand or gravel for MH per manufacturer's installation guidelines to form an even base.

4. Bedding:

a. For concrete encased ductbank:

1) Do not exceed 4" depth of bedding lifts/layers before compacting.

b. For Direct-buried Ductbank:

1) Provide a minimum of 3" hard tamped sand around conduit. Do not exceed 1" to 2" depth of bedding lifts/layers before compacting until the top of the ductbank is reached and do not exceed 4" thereafter. Place bedding simultaneously on both sides of ductbank for the full width of the trench. Carefully work the materials above, to each side, and below the conduits with a tool capable of preventing the formation of void spaces and without damaging the structure or waterproofing of the conduits.

5. Backfill:

a. Do not exceed 6" depth of backfill lifts/layers before compacting.

b. For MH: Backfill shall be of a good compacting material such as pea gravel or sand. In no case shall the material be saturated soil or contain large rocks or chunks. No voids shall remain between the MH walls and native soil of excavation. Compact the backfill progressively from the bottom to the top surface.

c. Where conduit in ductbank is encased in concrete, native soil may be allowed “only” for backfill. Check with the Engineer and DOC CPD Project Manager before proceeding.

6. Compaction: Compact using a vibratory plate or roller or other mechanical device. Compaction through jetting and/or pounding is not acceptable. Compact per APWA Standard Specification Paragraph 7-10.3 (11).

a. Bedding: Compact material to a dense state equaling at least 95% of the maximum dry density per ASTM D1557.

b. Backfill: Compact material up to two (2) feet below the finished grade with a minimum relative compaction of 90% of the maximum dry density per ASTM D1557. Compact material from two (2) feet below the finished grade up to the finished grade with a minimum relative compaction of 95% of the maximum dry density per ASTM D1557.

The Engineer/Designer shall coordinate with local DOC authorities to determine whether DOC wishes to have the fill material from the trenching deposited elsewhere on the site or hauled away. Review and edit the following waste disposal requirements to accommodate DOC’s fill material removal wishes as applicable to this project.

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

3.4 CAST-IN-PLACE CONCRETE

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Construct concrete in accordance with the applicable portions of the specifications, standards, codes and regulations (latest editions and/or amendments) listed in Section 1, References.

B. Formwork:

1. Construction:

a. Forms: Use the most advantageous panel sizes and panel joint locations. Neat patches and minor surface imperfections will be permitted. Form surfaces in true planes within ¼ inch in 10 feet. Clean forms and remove debris prior to pouring concrete. Make braces unyielding and tight to prevent leakage. Maintain formwork construction tolerances complying with ACI 347. Formwork shall be readily removable without impact, shock, or damage to concrete surfaces and adjacent materials. Use chamfer strips fabricated to produce uniform smooth lines and tight edge joints for exposed corners and edges. Note: chamfer strips are not required for concrete encased ductbank corners and edges.

1) Gypsum board shall not be used for forms except to form concrete encased ductbank.

b. Reinforcement: Construct reinforcement in accordance with ACI SP-6. Weld reinforcement in accordance with ANSI/AWS D1.4 or ANSI/AWS D12.1. Accurately position, support, and secure reinforcement against displacement. Support reinforcement by metal/plastic chairs, runners, bolsters, spacers, hangers, or other incidental materials as required.

c. Where metal or plywood forms are used, coat the forms with a form release agent prior to placement of concrete. Coat faces and edges of forms applied at a rate of 500 to 550 square feet per unit.

d. Curved Surfaces: Use only curved forms for constructing curved structures and surfaces.

2. Slope: For flatwork, construct forms with 1% side slope to both south and east sides.

3. Joints:

a. Control: Build into form.

b. Expansion: Build expansion joints into form, premolded ½” thick, and conforming to ASTM D1751. Seal the top ½” of expansion joints with an approved joint sealer.

4. Removal: Remove forms after concrete has cured (see Curing below) for 7 days or after concrete has attained a compressive strength of 2000 psi.

a. Where gypsum board forms are used to form concrete encased ductbank they can be left in place and backfilled after the specified curing period.

C. Concrete:

1. Transport: Comply with ACI 304. Transport concrete from the mixer to the construction location via methods preventing separation of materials.

2. Application:

a. Prior to placement, inspect and complete formwork construction, reinforcement, and items to be embedded or cast-in.

b. Deposit concrete in forms in layers not deeper than 24” and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer on the preceding layer while the preceding layer is still plastic. Cold joints are not acceptable.

c. Deposit concrete in a plastic condition and uniformly work around reinforcements.

d. Consolidate concrete using internal machine vibration (stinger) during pouring.

e. Once concrete work has commenced, work continuously until the work segment and/or section has been completed.

f. Cold Weather: Protect concrete from damage caused by frost, freezing, or low temperatures in compliance with ACI 306R. When temperature is below 40° F, heat water and aggregates before mixing to obtain a concrete mixture of not less than 50° F and not more than 80° F.

g. Hot Weather: Protect concrete from damage caused by hot weather in compliance with ACI 305R. When temperature is above 90° F chill water before mixing to obtain a concrete mixture of not more than 90° F. Cover reinforcing steel with water-soaked burlap if it becomes too hot immediately before placement of concrete. Temperature of steel shall not exceed the ambient air temperature.

3. Curing:

a. Curing method and rate of application shall be according to manufacturer’s recommendations.

b. Protect concrete from premature drying, rain, excessive temperatures, and mechanical injury during the curing period.

c. Cure concrete for 7 days in accordance with ACI 301 and keep continuously moist during this time. Maintain concrete temperature between 50° and 90° F during the curing period.

d. Provide curing and sealing compound to exposed slabs, sidewalks, curbs, etc. as soon as final finishing operations are complete (within 2 hours). Re-coat areas subjected to heavy rainfall within 3 hours of the initial application.

4. Finish:

a. Consolidate, level and screen surfaces for evenness and uniformity. Remove excess concrete. Fill low spots. Float the surface after water sheen has disappeared from surface.

b. Finish flatwork with a special tool to match patterned finish of adjacent existing concrete.

c. Tool edges, control, and expansion joints to make finish work straight and even.

5. Ductbanks:

a. Reinforce ductbanks along full length with formed sides. Install reinforcement at each corner of the conduit spacers/supports.

b. Do not pour concrete against native soil trench walls (forms shall be used). Consolidate concrete during placement using an internal concrete vibrator.

c. Provide each MH penetration with reinforcing bars tied to MH reinforcement. Dowel reinforcement in foundation wall of building penetrations.

d. Secure conduit spacers/supports and reinforcing to anchors to prevent movement or floating during concrete placement. Use stakes or rebar as anchors to attach wire ties to minimize floating and spreading.

e. Concrete encased ductbanks shall dry a minimum of two days prior to covering with fill material.

6. Protection for exposed concrete: Cover exposed concrete (i.e. sidewalk, driveway, etc.) with plywood, weighted with concrete blocks or similar heavy object in order to prevent surface damage.

7. Bond and ground reinforcement bars to the nearest approved ground.

3.5 CONDUITS AND DUCTBANKS

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Conduits:

1. Outdoor underground: Provide either:

a. RNC Schedule 40 (Type 1).

b. RGC with half lapped wrap of Scotchrap No. 51 plastic tape, or a coat of Kopper's Bitumastic No. 505 (minimum 20 mil thickness), and grounding collar. Coating is not required where RGC encased in concrete.

c. PSC.

2. Outdoor exposed: Provide RGC.

3. Slope: Per NEC 800.12(C), "*Raceways shall slope upward* (toward the building) *from the outside."* See *Ductbanks* Section below for additional information.

4. Separation from utilities:

a. Maintain adequate separation between the telecommunications conduit and adjacent utilities. Locate conduit to ensure the minimum separation distance is maintained per the requirements under previous Sections: *Excavating, Trenching and Fill*. Contact the Engineer/Designer prior to proceeding if minimum separation distance can not be achieved.

5. Transitions:

a. Stub up locations shall be PSC or RGC.

b. Sweeps below the slab and finished grade shall be PSC or concrete encased RGC/RNC.

c. Conduit passing through the building foundation shall transition to PSC or RGC encased in concrete the greater of:

1) Ten (10) feet out from the entry point through the outside of the building foundation wall.

2) Beyond the outer edge of the backfill for the building foundation.

d. Where allowed by code, conduit passing through the building foundation and under the floor slab can transition to RNC after passing a minimum of five (5) feet beyond the inside of the building foundation wall.

e. Where allowed by code, conduit routed under the base of the foundation (not through) can be RNC, but shall be encased in concrete:

1) The greater of ten (10) feet out from the outside of the building foundation wall or beyond the outer edge of the backfill for the building foundation

2) Minimum of five (5) feet beyond the inside of the building foundation wall.

f. Where shown on Construction Documents and where allowed by code, conduit within the slab shall be RGC or PSC.

1) Contractor shall ensure conduit is protected from damage of structural integrity and loosening of waterproof joints that could occur after fabrication and installation but prior to or during pouring of the slab.

g. All conduits located within ten (10) feet along the outside of any foundation or slab, but not entering through or under the specified foundation or slab, shall transition to PSC or concrete encased RGC/RNC.

h. Where conduit is installed above the slab, if more than twenty-five (25) feet of outdoor-rated cable will be required between the cable entry point of the building and the cable termination point, RGC must be used inside the building to at least within twenty-five (25) feet of the cable termination point.

1) Note: This reduction in length from the fifty feet specified in the NEC allows for the mandatory minimum 25 foot service loop (typically within the telecommunications room) required by Owner for outside plant communications circuits.

i. Where conduits are installed under vehicular traffic (roadways, drives, parking areas), and the minimum backfill between finished grade and top of conduits is less than thirty (30) inches, transition to RGC.

j. All metallic conduits (RGC and PSC) shall have an attached grounding collar.

k. All metallic conduits and raceways at stub up locations, building entrances, and within ductbanks shall be bonded to the ductbank ground conductor and electrical service ground of buildings (do not bond to TMGB or TGB).

6. Sweeps:

a. Shallow curves comprised of continuous lengths of individual straight RNC conduit shall be installed with a minimum sweep radius of 40 feet. Where the radius is less than 80 feet, the conduit shall be fully encased in concrete with a minimum of 3 inch cover on top, bottom and sides.

b. Where conditions prevent a conduit sweep radius less than 40 feet and a 15-foot radius sweep can be achieved, a <u>factory-manufactured</u> PSC, RGC, or RNC conduit sweep is permissible. For RNC, the sweep shall be concrete-encased. Bending conduit in the field using manual or mechanical methods is not acceptable.

c. A factory-manufactured sweep with a minimum radius not less than 4 feet is allowed for vertical turn-up into floor of a building’s telecommunications room.

d. <u>Where pre-existing conditions demand a sweep radius less than 15 feet, all of the following conditions shall be met:</u>

1) Contractor shall verify in writing with A/E to ensure the pathway will not be used as a service provider entrance pathway.

2) Contractor shall verify in writing with A/E and Owner to ensure the pathway will not be used for OSP copper backbone cable above 300 pair.

3) The distance between pull points shall be less than 600 feet.

4) The number of sweeps between pull points shall be two or less with no more than a total of 180 degrees.

5) Bending conduit in the field using manual or mechanical methods is not acceptable.

6) Conduit for the sweep shall be:

a) PSC (concrete encasement not required)

b) RGC (concrete encasement not required)

c) RNC (concrete encasement required)

e. Do not exceed 90 degrees for an individual sweep.

f. A conduit section shall have not more than the equivalent of two 90-degree sweeps (a total of 180 degrees) between pull points. The 180-degree maximum shall include all kicks and offsets. Where it is not possible to construct a section of conduit within the 180-degree sweep maximum, an intermediate MH shall be installed.

g. Two 90-degree sweeps separated by less than 10 feet is not permissible.

h. Construct sweeps for conduits within a common ductbank parallel, measured from the same center-point.

i. Do not install LB's, condulets, or 90 degree electrical elbow.

7. Fittings:

a. Cut conduit ends square and ream to remove burrs and sharp ends. Extend conduits the maximum distance into fittings, couplings, and/or connectors. Tighten fittings securely and seal watertight (see below).

b. End Caps (Plugs): Provide end caps on conduit ends throughout construction to prevent the intrusion of water or debris. Install end caps on conduit that is not directly being worked on during the work day and on conduits at night. Leave end caps in place upon final completion of the work.

c. End Bells: Provide end bells for terminating conduit in maintenance holes where Term-A-Duct was not used. Install protective end bells on conduits flush with MH walls.

8. Sealing:

a. Apply a watertight, conductive thread compound (for RGC/PSC) or solvent-type cement (for RNC) to make conduit connections waterproof and rustproof.

b. Seal and grout conduit entrances through maintenance holes and handholes to ensure all voids in the joints are filled.

c. Seal conduit ends in buildings and MH until used for cable.

d. At the end of each days work shift, cap the ends of all exposed conduits not completely installed to keep debris out.

9. Cleaning:

a. After installation, and within five days prior to releasing conduit for cabling installation, clean each conduit with a wire brush and swab. Clean each conduit a minimum of two times in the same direction and swab with clean rags until the rag comes out of the conduit clean and dry. Pull swab away from buildings for conduit sections connected to buildings.

10. Test Mandrels:

a. Prove out each conduit with a minimum 16 inch long test mandrel that is ¼ inch smaller than the inside diameter of the conduit.

b. Pull the test mandrel after backfilling but prior to the replacement of landscaping.

c. Repair or replace any conduit that does not prove out at no cost to the Owner.

11. Conduit Entrances – MH:

a. MH: Conduit shall be placed in MH entrances starting at the bottom knockouts/Term-A-Ducts and working towards the top of the MH. Under no circumstances shall conduits be placed above unused knockouts/Term-A-Ducts.

b. MH: Conduit entrances at opposite ends of a maintenance hole or handhole shall be at the same level and in the same position with respect to the side walls. Ensure that each conduit leaving a MH in any position enters the next MH in the same relative position where possible.

c. Conduit entrances shall use existing MH knockouts/Term-A-Ducts. Creating new MH entrances shall require an approval from the Engineer/Designer.

12. Conduit Entrances – Buildings:

a. Where conduit enters a space through the floor or ceiling, the conduit shall enter the space within 4-inches of a wall unless noted otherwise on drawings.

b. Where conduit enters a space through the floor and terminates in that space, terminate the conduit 4-inches above the finished floor unless noted otherwise on drawings.

c. Do not terminate conduits in wet, hazardous, or corrosive locations.

d. Where conduit exits from grade or concrete, provide rigid steel (RGC/PSC).

e. Conduit outlet bodies (LB's, UB's, etc.) are not allowed.

13. Labels:

a. See the *Labeling and Administrative* Section below.

14. Length:

a. Unless otherwise noted on the Construction Documents, construct ductbanks at lengths not to exceed 450 feet between pulling points. Under no circumstances shall ductbanks exceed 600 feet. Contact the Engineer/Designer prior to proceeding if a ductbank section will exceed 600 feet.

15. Pull Ropes

a. Install in each conduit immediately after the conduit has been cleaned and a mandrel passed through. Leave a minimum of 10 feet looped and tied off at each end of the conduit.

b. For innerduct: Install in each as identified above.

16. Protection:

a. Insure that after installation the conduit coatings and finishes are without damage. Repair as follows:

1) PVC Coated Rigid Steel Conduit (PSC): Patch nicks and scrapes in PVC coating after installing conduits with coating recommended by manufacturer.

2) Rigid Non-metallic Conduit: Repair damage with matching touchup coating recommended by the manufacturer.

B. Ductbanks:

1. Contractor has option to concrete encase the entire ductbank in lieu of sand and compaction for bedding unless otherwise noted on the Construction Documents. Concrete encasement required for RNC sweep radius.

a. Unless otherwise noted on the Construction Documents, where shown as concrete encased, use concrete encased RNC (see CAST-IN-PLACE CONCRETE, above).

2. Encased in Concrete:

   a. See CAST-IN-PLACE CONCRETE, above.

   b. Place vertical stabilization hold down bars, per manufacturer's installation instructions, over the tops of conduit to prevent duct floating during the concrete pour.

   c. Concrete encased ductbanks <u>shall remain uncovered until concrete is dry, no less than a minimum of two days</u>.

   d. Where ductbank is placed under vehicular traffic (roadways, drives, parking areas), fully encase on all four (4) sides with a minimum of three (3) inches of concrete.

3. Conduit Spacers/Supports:

   a. Along the length of the duct run spacers shall be stagger at least six (6) inches vertically and shall be placed at an interval of two (2) spacers per ten (10) feet. Spacers shall be interlock horizontally only.

4. Warning Tape:

   a. Install metallic warning tape half the distance between the top of the ductbank and finished grade.

5. Grounding/Bonding:

   a. Install ground conductor along length of ductbank. Bond to grounding electrodes of MH, grounding collar of all metallic conduit (NEC 2002 800.12(C)), and to service ground of buildings (do not bond to TMGB or TGB).

   b. Per WAC 296-46B-250 (32): Where a grounded conductor (i.e., neutral) is used in place of a separate equipment grounding conductor for electrical service between buildings or structures, check with the Local Authority to determine how to establish the termination of the ductbank ground wire to this specific building or structure's service ground.

6. Slope:

   a. Slope ductbank grade to fall a minimum of 4 inches per 100 feet in general and ¼" per foot where possible.

   b. Slope ductbank toward lower MH or from high points toward MH at both ends.

   c. Slope ductbank downwards away from building entrances (upwards towards building entrances from MH) per NEC 2005 800.50(C).

   d. Conduit shall not have a concave section (no section lower than the elevation of the lowest conduit opening).

3.6 UNDERGROUND SPACES

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Precast maintenance holes shall be free from damaged joint surfaces, cracks, or other damage that would permit infiltration. Repair of defects is not acceptable. MH and incidental and miscellaneous equipment (such as cable racking brackets and supports) shall be supplied by a single manufacturer.

B. Install MH according to manufacturer's instructions.

1. Use 30" wide x 10" high circular frames/covers and provide with minimum 4" and maximum 12" high circular maintenance hole entrance riser sections as required.

2. Use the riser sections to maintain the top of the maintenance hole cover 1" above the existing ground line or finished grade.

3. Taper pavement surfaces up to the top of the maintenance cover.

4. Provide covers embossed in the lid casting with minimum 2" high letters stating "COMMUNICATIONS", and conform to AASHTO H20 loading.

a. Provide lock-down bolts.

5. Cover frames shall be cast ductile iron, conforming to the same AASHTO requirements as the covers.

6. Covers and frames shall be of uniform quality, free from blowholes, porosity, shrinkage, distortion, cracks and other defects. Repair of defects is not acceptable. Mating surfaces between covers and frames shall be machine finished to ensure a non-rocking fit.

C. Setting and Placement: Remove water from excavation and properly install and compact bedding material prior to setting the MH. Clean MH section seal surfaces so that they are free from dirt or other material.

1. Set MH in place by lowering each section into the excavation, ensuring that the section is level, plumb, and firmly positioned, and ensuring that the section gasket/seal is properly installed and watertight prior to setting the next section.

a. <u>The excavation hole must not contain water when setting vaults. This is a Utility Vault Company requirement.</u>

2. Carefully set the MH to ensure that the rim or lid elevation is set one inch above finished grade. For vaults located in paved areas, taper pavement up to the MH rim.

D. Knockouts: Remove knockouts striking the knockout with a single moderately heavy blow with a hammer or similar tool.

E. Grouting: Apply grout in a manner to insure filling of all voids in the joints being sealed. Apply grouting to conduit entrances, risers, and covers in addition to any other voids.

1. Utility Vault Company recommends a cement grout consisting of two parts sand and one part cement and sufficient water to form a plastic slurry.

F. Racking and Hardware: Install racking and hardware and incidental materials. Provide three (3) cable racks per longitudinal side (six (6) racks total) per maintenance hole. Provide eight (8) 7-½" cable support arms per manhole. Provide additional incidental hardware for mounting racks and cable support arms.

G. Risers: Provide riser sections that are a minimum of 4" high and a maximum 12" high, sized for the MH entrance. Provide riser sections in quantities sufficient to meet the minimum and maximum height requirements discussed above.

H. Grounding/Bonding: Provide a minimum of one ¾" x 10' copper clad steel ground rods, and one #4/0 pigtail for connection to interior ground conductors. Bond metallic hardware in the vault to the pre-cast bonding tabs. Bond the bonding tabs to the ground rod and to the ductbank ground wire.

I. Cleaning: Clean and dry the MH after construction activity is complete and prior to releasing the MH to the Owner for the Owner's use.

J. Labeling: See *Labeling and Administration* Section below.

** NOTE **

Review and edit the following Labeling & Administration requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project. Labeling format shall be reviewed and agreed to with the DOC-TDI Specialist and DOC Plant Manager.

3.7 LABELING AND ADMINISTRATION

Labeling and administration of OSP communications components shall follow the format and definitions of Owner's telecommunications administration plan based on the form of ANSI/TIA/EIA-606-A Class 3 Standard and as defined in the construction documents.

A. MH's.

1. Lids shall be labeled/signed per MH identifier in construction documents. Label/sign shall be permanent, appropriate for lid environment, waterproof, and solvent resistant. Identification can be by welding.

2. A sign shall be attached to the North wall of each MH stating "North Wall" direction and stating the "MH Identifier" per construction documents. The sign shall be permanent, permanently attached, waterproof, and solvent resistant.

3. Provide new labeling and identification to existing maintenance holes or hand holes where indicated on the construction documents.

B. Identify and label all conduits at the entrance to each building, typically within the Telecommunications Room (TR) or where specified by Drawings using Marker Tags or signage. Conduit Marker Tags/signage shall reflect the conduit identifier information per the construction drawings at the locations and in the formats defined below. Provide new labeling and identification to existing conduits where indicated on the construction documents.

1. At the building termination point:

a. Where conduit ends are not flush with walls: Attach Marker Tags using one-piece nylon cable ties to conduit entering into the room within four inches of stub-up entry from floors or most visible and accessible area within the room. Marker Tags shall be attached for the most visible position.

b. Where conduit ends are flush with walls: attach a sign to the room wall next to each conduit entering the room. Signs shall be permanently attached.

2. <u>Conduit from building to building without passing through a MH</u> shall have labeling identifiers at both ends in the form of:

"PCN To: *Building ID-Floor# and Space ID.Conduit#"*

Example: Four conduits between the "IT" building, 1st floor room "1A", and the "Adm" building, 1st floor room "1A". "PCN" represents "Pathway" and "Conduit." A unique sequential number is assigned to each of the four conduits.

Conduit labels at the IT building:

"PCN To: Adm-1A.01"
"PCN To: Adm-1A.02"
"PCN To: Adm-1A.03"
"PCN To: Adm-1A.04"

Conduit labels at the Administration building:

"PCN To: IT-1A.01"
"PCN To: IT-1A.02"
"PCN To: IT-1A.03"
"PCN To: IT-1A.04"

3. Conduit from building to MH shall have a labeling identifier at the building end in the form of:

"PCN To: PMH.*MH ID.MH.wall direction and MH duct identifier#"*

"PMH" represents "Pathway" and "Maintenance Hole." Example: Four conduits from the IT building to the east wall of telecommunications maintenance hole "A01B", entering into MH Duct Identifier's 1 through 4:

"PCN To: PMH.A01B.E1"
"PCN To: PMH.A01B.E2"
"PCN To: PMH.A01B.E3"
"PCN To: PMH.A01B.E4"

3.8 LANDSCAPING

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Topsoil: Provide imported topsoil for excavations in grass and/or landscaped areas. Provide loosely compacted topsoil to a depth of 4" or depth of excavation for excavations less than 12". Restore existing grades where disturbed. Rake and smooth topsoil following proper placement. Installation shall be approved by the Owner prior to placing sod. Place topsoil per APWA Paragraph 8-01.3(2).

B. Provide sod for grass areas disturbed by construction activity and replace shrubbery and trees damaged, removed or disturbed by construction activity. The use of seed/hydro-seed shall be approved by the Owner and the Engineer/Designer prior to installation.

END OF SECTION

SECTION 16131 – RACEWAY AND BOXES FOR COMMUNICATIONS CIRCUITS

SECTION 16131 — RACEWAY AND BOXES FOR COMMUNICATIONS CIRCUITS

1 PART 1 - GENERAL

PART 1 - GENERAL

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, updated 4/30/2008 by C. Ryman.

This specification should also be used in Division 17 for Security Electronics/Low Voltage Electronic systems.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a project, but shall not create a new specification section based on the "intent" of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1.1 RELATED DOCUMENTS

Review and edit the following paragraph to ensure appropriate references are included.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

Review and edit the following list of generic type products and work for relevance to this project. This listing should not include procedures, processes, preparatory work, or final cleaning.

Note that this section is specific to the communications system and shall be included in the Project Manual in addition to 16130 (or equivalent) - Raceway and Boxes for Electrical Circuits. When an Electrical Circuits section and a Telecommunications Circuits section are both in the Project Manual, a statement shall be added to the Raceway and Boxes for Electrical Circuits section similar to the following:

"For Telecommunications Raceway and Boxes, the requirements in Section 16131 (or equivalent) - Raceway and Boxes for Telecommunications Circuits shall supersede the requirements in this section where they differ."

A. Provide all materials and labor for the installation of a pathway system for inside plant and horizontal communications circuits fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standard. Work in this section includes, but is not limited to extensions of OSP backbone raceways, horizontal and building backbone raceways, fittings, boxes specific to communications circuits (cabling) for voice, data, and building automation systems, electrical grounding and bonding, firestopping, and any cutting and patching as required.

B. Related Sections:

Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure the referenced sections are included in the project manual and the titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the Contractor's responsibility for coordinating work.

1. Division 16 Section — "Basic Electrical Materials and Methods"
2. Division 16 Section — "Outside Plant Communications Site Work"
3. Division 16 Section — "Grounding and Bonding for Telecommunications"
4. Division 16 Section — "Inside Plant Communications Circuits"
5. Division 16 Section — "Outside Plant Communications Circuits"

C. Products furnished (but not installed) under this section:

Include this paragraph only if products will be furnished under this section but installed under other sections or by the Owner. When installations are "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner Installed Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

D. Products installed (but not furnished) under this section:

Include this paragraph only if products will be installed under this section but furnished under other sections or by the Owner. When products are furnished "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner-Furnished Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

1. Busbars and Grounding Conductors: See Division 16 *Grounding and Bonding for Telecommunications*

E. Provide Unit Prices for:

Include this paragraph only if unit pricing will be required for a specific part of the project. Include statements on how to measure the quantity. Specify technical information on the products and installation associated with the required unit pricing in the appropriate articles of PART 2 and PART 3.

1.3 REFERENCES

> Review and edit the following list of references. Check for completeness, currency and applicability to this project. Rarely should anything be removed from under the General or Communications sections. The Engineer/Designer shall verify with the DOC-CPDPM and/or the DOC-TDI Specialist assigned to the project whether the latest edition and/or addenda of each required reference is appropriate and shall specify the edition and addenda below accordingly.

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Washington Industrial Safety and Health Act (WISHA)

d. Occupational Safety and Health Act (OSHA)

e. Revised Code of Washington (RCW)

f. Washington Administrative Code (WAC)

g. DOC Policy Directive: *Electrical Construction and Maintenance*, DOC 700.130

2. Communications:

Unless specifically indicated otherwise in the Construction Documents, the latest Edition and all current Addenda's and approved Amendments for the following publications shall be considered Communications references. (This section of the Construction Documents is based on the Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.)

a. ANSI/TIA/EIA-568-B: Commercial Building Telecommunications Cabling Standard

b. ANSI/TIA/EIA-569-B: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. ANSI/TIA/EIA-606-A: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. ANSI-J-STD-607-A: *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

e. ANSI/TIA/EIA-758: *Customer-owned Outside Plant Telecommunications Cabling Standard*

f. ISO/IEC IS 11801: Generic Cabling for Customer Premises

g. BICSI: *BICSI Information Transport Systems Installation Manual (ITSIM)*

h. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

1.4 DEFINITIONS

Review and edit the following list of definitions for with applicability to this project. Add definitions for unusual terms that are not explained in the Conditions of the Contract and that are used in ways not common to standard references.

NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:

Furnish - "Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations".

Install - "Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations".

Provide - "To furnish and install, complete and ready for the intended operation".

A. "EMT": Electrical Metallic Tubing.

B. "Junction box": a metallic box with a removable cover wherein a conduit run transitions from a feeder conduit to multiple distribution conduits, and is used to facilitate pulling cable through the conduits. Conduits entering and exiting the box shall be at opposite ends.

C. "PSC": PVC-coated rigid Steel Conduit.

D. "Pullbox": a metallic box with a removable cover having no more than two conduits attached that is used to facilitate pulling cable through conduit runs longer than 100' or in which there are more than 180 degrees of bends. Conduit entering and exiting the box shall be at opposite ends.

E. "Raceway": any enclosed channel for routing wire, cable or busbars.

F. "RGC": Rigid Galvanized steel Conduit.

G. "RMC": Rigid Metal Conduit.

H. "TBB" shall mean *Telecommunications Bonding Backbone.* A conductor that interconnects all TGBs with the TMGB. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. The TBB originates at the TMGB and extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Whenever two or more TBBs are used within a building, the TBBs shall be bonded together with a TBBIBC. Size of TBB conductor is based on length from the TMGB to the electrical service grounding point.

I. "TGB" shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB's per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

J. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. There is typically one TMGB per building, located in the main telecommunications room of the building. This busbar is directly bonded to the electrical service grounding electrode system by the Bonding Conductor for Telecommunications (BCT) and bonded to building structural steel or other permanent metallic systems. The TMGB serves as the dedicated extension of the building's grounding system for the building's telecommunications infrastructure. A TMGB may serve in lieu of a TGB in a telecommunications room.

1.5 SYSTEM DESCRIPTION

> Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system. Verify for accuracy the section numbers and titles referenced below.

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, necessary appurtenances, and grounding & bonding to provide a complete Raceway system as hereinafter specified and/or shown on the Construction Documents. The Raceway system shall be fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standards and support an ANSI/TIA/EIA and ISO/IEC fully compliant communications Structured Cabling System (SCS) as specified in Division 16 *Inside Plant Communications Circuits,* and *Grounding and Bonding for Telecommunications*.

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

C. Coordinate closely with other contractors and subcontractors on the project.

D. By the act of submitting a bid, this Contractor shall be deemed to have:

1. Examined all drawings and specifications which are part of this project.

2. Visited the site of the work and accepted the provisions made by others or excepted specific parts of those provisions.

3. Made proper allowances for coordination with other trades and Owner/User.

4. Provided for the requirements to work with other contractors.

5. Considered the complexity, scheduling and all other special and unusual circumstances involved which this contractor has determined to be connected with this project.

6. Made an affirmative statement that this Contractor has read the documents, understands their meaning and intent, is able to install the work in the manner shown as satisfactory to the Owner, and is willing and able to execute the work of this Division 16 Section with the requirements, restrictions, and limitations stated or implied in these construction documents.

1.6 SUBMITTAL INFORMATION

> Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:
>
> "The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Construction Documents.

> Any deviations from the Construction Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC IT through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.
>
> If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Construction Documents".

A. Telecommunications Conduit Layout Submittals:

1. Contractor shall submit a telecommunications conduit layout showing:

   a. Routing and placement of the proposed telecommunications pathway and components

   b. Identify all details not specifically identified in the Construction Documents including:

      1) Size, material types, and lineal footage of each conduit segment

      2) Radius size and material types of conduit sweeps

      3) Dimensions of each pull box and junction box

      4) Labeling of all conduit terminations

      5) Telecommunications grounding/bonding diagram

2. All diagrams and drawings shall be submitted for review, comment, and written approval by Architect/Engineer/Owner prior to ordering materials and commencing fabrication and installation.

3. All submittals shall be accompanied by a transmittal letter indicating date, project name, Contractor's name and address, sub-contractor's name and address, and deviations from the Construction Documents if any.

4. Submittals in parts will not be accepted. Only a complete conduit layout will be reviewed.

5. Regardless of the action indicated, the Architect/Engineer/Owner's review does not relieve the Contractor of responsibility to comply with the contract documents and shall not be construed as authorizing any deviations from the specifications or drawings or references specified in the Construction Documents unless the Contractor attaches a letter to the submitted item clearly listing the deviations.

B. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

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

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

C. Closeout Submittals: Provide submittal information for review as follows:

A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under this section shall be included in the O&M Manual for Communications and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications. The requirement that the Contractor provide an O&M Manual for Communications should be stated in Inside Plant Communications Circuits or in Outside Plant Communications Circuits.

1. O&M Manual for Communications - At the completion of the project, submit all O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

Portions of the text below may be contained in other Sections (e.g. 16010 (or equivalent) - General Electrical). Coordinate text for accuracy and content.

a. Document changes to the system from that originally shown on the Construction Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

Sate any requirements for coordinating work with potentially unusual or specifically required sequencing. DOC may choose to construct a project under two bid packages - one for OSP Site Work as described in this specification section as well as other General Contractor specific work, and a second bid package for the Structured Cabling System. The Engineer/Designer must coordinate with DOC to determine if two bid packages will be used and include verbiage in the appropriate specification sections requiring the contractors to coordinate construction phasing, schedules and the use of DOC provided security escorts.

1.8 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, setback clearances, access, and building startup requirements.

1.9 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NEC.

1.10 CONTRACTOR WARRANTY:

> Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. The Engineer/Designer is required to have a thorough understanding of the manufacturer warranties applicable on this project. The Engineer/Designer shall consider, account for, and advise DOC regarding any unique warranty situations that may arise from Owner-furnished equipment, Owner-installed equipment, or other situations that may conflict with warranty requirements.

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

> Ensure that products listed under the PART 2 Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.
>
> The products listed in this Guide Specification throughout Part 2 - Products below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by the design are specified with equal or greater detail to the following paragraphs. The Engineer/Designer shall also verify that the most current part number of each specified product is used.

2.1 GENERAL

A. Materials shall consist of conduit, outlet boxes, fittings, enclosures, pull boxes, and other raceway incidentals and accessories as required for inside plant communications circuits.

2.2 MATERIALS

> Review and edit the following list of products/part numbers as applicable to this project.

A. Conduit:

1. Electrical Metallic Tubing (EMT), 1” minimum conduit size. Flexible metal conduit (FMC) is not acceptable.

a. Conduit: Galvanized steel tubing meeting ANSI C80.3.

b. Couplings: Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. Indent-type and setscrew-type couplings are not permitted.

c. Insulating bushings.

d. 90° Elbows: only special large radius elbows, minimum 10” radius. Note: <u>Standard radius electrical elbows are not allowed.</u>

1) For factory manufactured:

a) Cal Conduit Products or equal

i. 9650 Washburn Road, Downey, CA 90241

ii. Tel: 800-225-7473, FAX: 562-803-9883

iii. www.calconduit.com

iv. Isaac Sanchez, Isaac@calpipe.com

2. Rigid Metallic Conduit (RMC), 1” minimum conduit size.

a. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.

b. Couplings: Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.

c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

3. Rigid Galvanized Steel Conduit (RGC), 1” minimum conduit size.

a. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.

b. Couplings: Un-split, NPT threaded with galvanizing equal to (and compatible with) conduit. Running thread or set screw threaded fittings (except for three piece and watertight split couplings) are not acceptable.

c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

d. Grounding collars: Per conduit manufacturer’s specifications.

4. Lay-in wire ways or wiring troughs are not acceptable for CAT3, CAT6, and fiber optic cable except for pull boxes below.

B. Outlet boxes: Large size, minimum 4 11/16”x4 11/16” size, 2 1/8” minimum depth, with extension rings (if needed) and single gang covers (i.e. mud rings or industrial covers), with knockouts for 1” trade size conduit or connector entrance, unless otherwise noted on the Construction Documents. Combined interior depth of outlet box, extension ring and cover shall be a minimum 2-1/2”.

1. Stamped steel, deep drawn, galvanized:

a. Appleton, Raco, Steel City, or equal

2. SYSTIMAX® Surface-mount Box (depth requirement exempted):

a. SYSTIMAX® M204SMB (760045013 Ivory) or other color.

3. Wiremold Extra Deep Switch and Receptacle Box:

a. V5744-2 (two gang) for Owner-approved steel surface raceway.

b. 2344-2 (two gang) for Owner-approved non-metallic surface raceway.

C. Junction Boxes and Pull Boxes: Galvanized with knockouts for conduit or connector entrance. Boxes may be code gauge fabricated steel continuously welded at seams. Fabricated boxes shall be painted after fabrication.

1. Manufacturer:
    a. Hoffman or equal.
2. Dry locations: meeting NEMA OS 1.
3. Wet locations: NEMA OS 3R.
4. Junction box covers shall be hinged on one side and fully accessible if the weight of the cover is equal to or greater than 15 pounds.
5. Secured areas: Junction and Pull Boxes shall have locking covers.
6. Pull boxes: Can be Hoffman “Lay-in Type I Wireway” or “Wire Troughs”, or equal.

D. Miscellaneous Fittings:

1. Locknuts and conduit bushings: Malleable iron
    a. Appleton, Crouse Hinds, OZ Gedney, or equal
2. Through wall seals and floor seals shall be:
    a. OZ Gedney FS and WS series.
3. Interior fire-rated wall or floor penetrations shall be:
    a. Specified Technologies, Inc. (STI) EZ-Path Fire-Rated Pathways, or approved equal.
        1) Pathway terminations shall include radius control cable support modules.

E. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

> Additional products shall be added to the above list as applicable to this project.
>
> If firestopping material is specified in another section, the Engineer/Designer shall reference that section in Part 1 - General above as a related section, and delete the following paragraph in its entirety.

2.3 FIRESTOPPING

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

1. Specified Tech. Inc.

> Review and edit the following products/part numbers as applicable to this project.

2.4 LABELS

A. Identifiers shall follow the format and definitions per ANSI/TIA/EIA-606-A Class 3 administration and as identified in the Construction Documents.

B. Labels shall be permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

a. Brady: ID Pro Plus, IDXPERT, HandiMark, TLS2200 (or approved equal).

2. Labels for Junction & Pull Boxes, etc. shall be sized to accommodate a 19 Font size and 72 Point size.

3. Labels for Marker Tags shall be a minimum size of 2.0” W x 1.0” H:

a. Panduit:

1) Clear L3PL3CL

2) White L3PL3WH

C. Marker Tags for Conduit shall be a minimum size of 3.5” W x 2.0” H, constructed of rigid vinyl with a clear over-laminate protection (self-laminating), with slots for installing as a wrap and/or flag with nylon cable ties with a minimum loop tensile strength of 40 pounds. Labels applied to tags shall be typed and created by a label maker or an approved equivalent software-based label making system (see above). Handwritten labels are not acceptable.

1. Tags:

a. Panduit: Self-Laminating Cable Marker Rigid (Non-Adhesive) Tag #PST-FOBLNK (no substitutions)

2. Nylon Cable Ties (minimum 40 LB loop tensile strength):

a. Panduit: PAN-TY #PLTxI-C (or approved equal)

D. Signs: Permanent plastic or metal engraved, not subject to fading or erasure, waterproof and solvent resistant, permanently affixed.

Additional products shall be added to the above list as applicable to this project.

3 PART 3 - EXECUTION

Ensure that products listed under PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.

The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If it is desirable to use other products, the Engineer/Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and written with equal or greater detail to the following paragraphs.

The products listed throughout PART 2 – Products and the installation requirements below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by the design are specified in Part 2 with corresponding installation requirements specified in Part 3.

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

The Engineer/Designer shall ensure the following text also appears in Division 1 General Requirements and/or Division 2 Site Construction.

F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc., inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

1. In the event of damage to DOC telecommunications infrastructure, Contractor shall immediately stop any work that could potentially further the damage and contact the Owner.

- For Capital Projects, Owner shall be the DOC Capital Programs Project Manager.
- For all other projects, Owner shall be the DOC Regional IT Manager.

a. The DOC Owner shall immediately provide information of the damage to the DOC Regional IT Manager and/or the DOC Telecommunications Distribution Infrastructure (TDI) Specialist assigned to support the facility, and facility manager.

b. Only the DOC TDI Specialist working in concert with DOC IT, Plant, and Capital Programs managers shall determine the repair and/or replacement strategy. Contractor shall not make this determination, make any temporary repairs or replace any telecommunications infrastructure unless directed to do so in writing by the DOC TDI Specialist.

c. All damaged telecommunications infrastructure shall be restored to within the scope of the original design, installation, operational, and warranty parameters (or better) by a contractor of Owner's choosing. Only a certified SYSTIMAX® Value Added Reseller (VAR) shall work on the telecommunications cabling. Restoration shall include, but not be limited to all repair and/or replacement work and materials, testing, and re-certification of the infrastructure for full compliance to Owner's TDI Standards and SYSTIMAX® SCS and/or other manufacturer's warranty requirements.

G. Remove surplus material and debris from the job site and dispose of legally and per contract document requirements.

3.2 EXAMINATION

A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

Review and edit the following to determine if any additional construction, installation, or materials must be observed.

B. Owner and Engineer/Designer Observations: Contractor shall coordinate with Owner and Engineer/Designer to schedule in advance, dates for observations by Owner and Engineer/Designer as indicated below. Owner and Engineer/Designer will determine if onsite observations are required for all work listed below or portions thereof.

1. Contractor shall provide one week advance notice to Owner and Engineer/Designer when work listed below is scheduled:

   a. Placement of conduit, pull boxes, junction boxes, enclosures, and cabinets.

   b. Labeling.

2. Contractor shall provide a minimum of 2 days advance notice to Owner and Engineer/Designer of dates when work listed below will be ready for Owner and Engineer/Designer observations.

   a. Placement of conduit, pull boxes, junction boxes, enclosures, and cabinets. Observations shall occur during initial placement and prior to covering with wall or ceiling material.

   b. Labeling. Observations shall occur prior to covering with wall or ceiling material.

3.3 INSTALLATION

> Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Provide raceways, boxes, enclosures, and cabinets as indicated and install according to manufacturer's written instructions. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval from the Engineer/Designer. Do not group home runs or circuits without approval from the Engineer/Designer.

B. Conduit:

1. Install EMT unless other conduit is shown on the Construction Documents, is required by Code, or is permitted under these specifications. Where conduit size is not shown on Construction Documents, the conduit shall be sized so the quantity of cable placed inside the conduit shall not exceed the 40% fill limitation as identified by the table below. For cable types not identified in the table below, other types of conduit, or questions, Contractor shall contact the Engineer/Designer for instructions before proceeding.

EMT Raceway		**4-Pair UTP Systimax Cables, OD (in.)**										
		CAT 3		**CAT 5e**		**CAT6**				**OSP**	**CAT6A**	
		1010	**2010**	**1061**	**2061**	**1071E**	**2071E**	**1081**	**2081**	**1571**	**1091**	**2091**
Trade		**0.170**	**0.180**	**0.215**	**0.196**	**0.232**	**0.226**	**0.250**	**0.233**	**0.250**	**0.315**	**0.310**
Size	I.D. (in.)	**Max # of Cables per Conduit (@ 40% fill)**										
3/4"	0.824	9	8	5	7	5	5	4	5	4	2	2
1"	1.049	15	13	9	11	8	8	7	8	7	4	4
1 1/4"	1.380	26	23	16	19	14	14	12	14	12	7	7
1 1/2"	1.610	35	32	22	26	19	20	16	19	16	10	10
2"	2.067	59	52	36	44	31	33	27	31	27	17	17
2 1/2"	2.731	103	92	64	77	55	58	47	54	47	30	31
3"	3.356	155	139	97	117	83	88	72	82	72	45	46
3 1/2"	3.834	203	181	127	153	109	115	94	108	94	59	61
4"	4.334	259	231	162	195	139	147	120	138	120	75	78

2. Install conduit as a complete, continuous system without wires, mechanically secured and electrically connected to metal boxes, fittings and equipment. Blank off unused openings using factory-made knockout seals.

3. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored.

4. Keep conduit at least 6 inches away from parallel runs of flues and hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit.

    a. Keep conduit at least 10’ away from steam lines.

5. Install horizontal conduit runs above water piping.

6. Keep conduit away from sources of electromagnetic interference per the table below:

"ISP Telecommunications Clearances for EMI Reduction"

Sources of Electromagnetic Interference	**Telecommunications Infrastructure**			
	Crossconnect 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 $\leq$ 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 $\leq$ 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 $\leq$ 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 $\leq$ 480 V_{rms}	10 ft	4 ft	4 ft	2 ft
Greater than 480 V_{rms}	20 ft	20 ft	10 ft	5 ft

7. Install conduit so the maximum lineal cabling distance from the cable termination points at the outlet box in the work area and the rear of the patch panel in the telecommunications room is <u>295 feet (90 meters) or less</u>.

   a. The maximum conduit length shall be reduced by the following lineal cable distances:

      1) Up to twelve (12) inches of cable service slack at the outlet box, and

      2) Whichever is greater: a minimum of ten (10) feet in the telecommunications room or sufficient cable to relocate the patch panel to the furthest point in the telecommunications room away from the cable entrance, plus the distance from floor to ceiling.

   b. No section of conduit shall be longer than 100 feet (30M) between pull points.

   c. The maximum length of a given conduit run shall be equal to or less than the criteria described above, including intermediate conduits and junction boxes. If this distance can not be achieved, immediately contact the Engineer/Designer.

8. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install conduit below grade/slab unless specifically shown on the Construction Documents as being installed below grade/slab (previously authorized by Owner).

   a. Below grade or slab is a NEC designated “wet location” , shall require RGC/PSC conduit, and shall require cable suited for outside plant “wet locations”.

9. Install exposed conduit in lines parallel or perpendicular to the building or structural member’s lines except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the conduit in a different sequence or a uniform line.

   a. Run parallel or banked conduits together, on common supports where practical.

   b. Make sweeps in parallel or banked runs from same centerline to make sweeps parallel.

10. Conduits concealed above ceilings, furred spaces, etc., which are normally inaccessible may be run at angles not parallel to the building lines.

11. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks, maintaining EMI setback clearances identified within this document. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.

12. Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.

Verify for accuracy the section number and title referenced below.

13. Support conduits as specified in Section 16050 "Basic Electrical Materials and Methods."

   a. Provide anchors, hangers, supports, clamps, etc. to support the conduits from the structures in or on which they are installed. Do not space supports farther apart than five feet.

   b. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc., in the future.

   c. Support conduit within three feet of each outlet box, junction box, gutter, panel, fitting, etc.

14. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings to protect cable from abrasion.

15. Seal each conduit after installation (until cable is installed) with a removable mechanical-type seal to keep conduits clean, dry and prevent foreign matter from entering conduits.

16. Install a pull string in each conduit.

17. Where conduit enters a space through the floor or ceiling, the conduit shall enter the space within 4-inches of a wall unless noted otherwise on drawings.

18. Where conduit enters a space through the floor and terminates in that space, terminate the conduit within 4-inches above the finished floor unless noted otherwise on drawings.

19. Do not install communications conduits in wet, hazardous, or corrosive locations unless specifically shown on the Construction Documents as being installed in wet, hazardous, or corrosive location.

   a. EMT conduit shall not be installed in wet, hazardous, or corrosive locations.

20. Where conduit is shown embedded in masonry, embed conduit in the hollow core of the masonry. Horizontal runs in the joint between masonry units are not permitted.

21. Where conduit is shown embedded in concrete, embed conduit a minimum of two inches from the exterior of the concrete. Do not place conduit in concrete less than five inches thick.

    a. One inch trade size RGC conduit shall be used. Conduits sized larger or smaller than one inch trade size conduit are not permitted embedded in concrete.

    b. Run conduit parallel to main reinforcement.

    c. Conduit crossovers in concrete are not permitted.

22. Where conduit exits from grade or concrete, provide RGC or PSC conduit.

23. Where several circuits follow a common route, stagger pullboxes or fittings.

24. Where several circuits are shown grouped in one box, individually fireproof each conduit.

25. Bend and offset metal conduit with large radius sweeps. Keep legs of sweeps in the same plane and straight legs of offsets parallel, unless otherwise indicated.

    a. Conduit sweeps:

        1) Sweeps shall not exceed 90 degrees.

        2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).

        3) Sweep radius shall be at least 10 times the internal diameter of the conduit.

        4) 90-degree condulets (LB's) and standard electrical elbows (radius less than 10 times the conduit internal diameter) are not acceptable.

    b. Factory-manufactured large radius sweeps are required in conduit larger than 1 inch trade size.

    c. For sweeps in 1 inch trade size conduit, the minimum radius shall be 10 inch. Field-manufactured sweeps shall only be made using a hydraulic bender with a 1" boot, shall be without crimping or flattening, and permitted only when factory-manufactured sweeps are not suitable for the conditions. "Hickey-bender" use is prohibited. In all other cases, factory-manufactured sweeps are required.

26. Connect conduit to hub-less enclosures, cabinets, and boxes with double locknuts and with insulating type bushings.

    a. <u>Use grounding type bushings where connecting to concentric or eccentric knockouts</u>.

    b. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area, where the devices are located, to which the circuits contained in the conduit will connect.

27. Penetrations for raceways:

    > The Engineer/Designer shall consider requiring approval by a licensed Structural Engineer prior to designing penetrations through building structural components.

    a. Do not bore holes in floor joists and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be 1-¼ inch diameter maximum.

b. Penetrate finished walls and finished surfaces with a PVC, metallic, or sheet metal sleeve with an interior diameter (ID) at least 1/4" greater than the outer diameter (OD) of the conduit, set flush with walls, pack with fiberglass, seal with silicone sealant and cover with escutcheon plate.

c. Penetrate poured-in-place walls and free slabs with a cast iron sleeve (or Schedule 40 PVC black pipe sleeve for above-grade only) with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant.

28. Raceway terminations and connections:

a. Join conduits with fittings designed and approved for the purpose and make joints tight. <u>Do not use set indent-type or screw-type couplings</u>.

b. Make threaded connections waterproof and rustproof by applying a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.

c. Make conduit terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

d. Cut ends of conduit square using a hand saw, power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Where conduit threads are cut in the field, cut threads to have same effective length, same thread dimensions and same taper as specified for factory-cut threads.

e. Provide <u>double locknuts</u> and <u>insulating bushings</u> at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. <u>Use grounding type bushings where connecting to concentric or eccentric knockouts</u>.

f. Where conduits are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

g. <u>Where raceway terminations will result in a cable elevation drop, radius cable support modules (waterfalls) shall be installed</u> to support the cables downward transition to eliminate stress and deformation of the outside cable sheath.

h. Where available for type of raceway used, provide Bell Ends at both ends of a riser raceway unless noted otherwise.

29. Install conduit sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

a. Where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs.

b. Where otherwise required by the NEC.

30. Prove out each conduit with a minimum 16 inch long test mandrel that is ¼ inch smaller than the inside diameter of the conduit. Repair or replace any conduit that does not prove out at no cost to the Owner.

31. After installation, and within five days of releasing conduit for cabling installation, clean each conduit with a wire brush and swab. Clean each conduit a minimum of two times in the same direction and swab with clean rags until the rag comes out of the conduit clean and dry. Swab away from buildings for conduit sections connected to buildings.

Add conduit product installation requirements to the above information as applicable to this project.

C. Outlet Boxes:

Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Provide outlet boxes and covers as shown on the Construction Documents and as needed. Verify that the appropriate cover type and depth is provided for each type of wall and finish. Provide extension rings as needed.

   a. Outlet boxes at or smaller than 4 11/16” x 4 11/16” shall have no more than four (4) horizontal cables terminated (no more than four information outlets or jacks inside the outlet box).

2. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.

3. Install boxes in dry locations (not wet, corrosive, or hazardous).

4. Attach boxes securely to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one hundred pounds minimum, applied vertically or horizontally.

5. Install boxes at the following heights to the bottom of the box, except where noted otherwise:

   a. Wall mounted telephones: 46 inches above finished floor.

      1) Install box to maintain a minimum 12 inch radius clearance from any other wall mount device. Coordinate clearance with other trades.

   b. Workstation outlets: 16 inches above finished floor.

   c. Place boxes for outlets on cabinets, countertops, shelves, and similar boxes located above countertops two inches above the finished surface or two inches above the back splash. Verify size, style, and location with the supplier or installer of these items prior to outlet box installation.

6. Wall mounted devices shall attach “only” to an outlet box or similar mounting device which is secured to a solid building component. Dry wall mounting brackets, like the Caddy MP1P, are not acceptable.

7. Recessed mounted outlet boxes:

   a. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Single gang opening shall extend at least to the finished wall surface and extend not more than 1/8 inch beyond the finished wall surface. Provide backing for boxes using structural material to prevent rotation on studs or joists.

b. Install floor boxes level and adjust to finished floor surface.

c. Outlet boxes for wall mounted telephones shall be recessed unless noted otherwise on drawings.

8. Surface mounted outlet boxes:

a. For boxes surface mounted on finished walls, provide Wiremold outlet box. Cut box as necessary to accept conduit.

b. For boxes surface mounted on unfinished walls (i.e. electrical rooms, mechanical rooms), provide 4 11/16"x4 11/16" (minimum) outlet box with single gang cover, or industrial cover with appropriate holes or squares cut out for SYSTIMAX® Flush Mounted Modular Mounting Frames where specified.

> Add outlet box product installation requirements to the above information as applicable to this project.

D. Junction Boxes:

> Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Provide junction boxes as shown on the Construction Documents and as required.

a. **<u>Do not confuse junction boxes with pull boxes.</u>**

b. **<u>Outlet boxes (4 x 4 size) shall not be used as a junction box</u>.**

c. Where sizing is not shown on the Construction Documents, **<u>junction box sizes</u>** shall be sized as listed below.

d. Junction box sizes shall not be oversized more than 2 inches in any direction beyond the table below without prior approval by the Owner.

Maximum Trade Size of Conduit	Junction Box Width	Junction Box Length	Junction Box Depth	For Each Additional Conduit Increase Width
1"	4"	16"	3"	2"
1-¼"	6"	20"	3"	3"
1-½"	8"	27"	4"	4"
2"	8"	36"	4"	5"
2-½"	10"	42"	5"	6"
3	12"	48"	5"	6"
3-½"	12"	54"	6"	6"
4"	15"	60"	8"	8"

2. A junction box may not be substituted for a 90-degree bend. *90 degree condulets (LB's) are not acceptable.*

3. Install junction boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install junction boxes in inaccessible interstitial building space.

4. Where junction boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4' above grid (mount on wall instead).

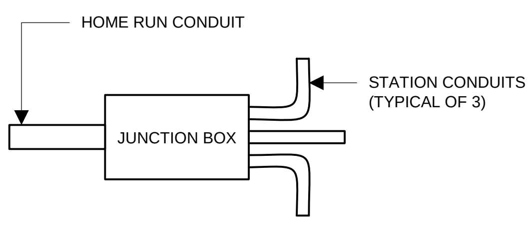
5. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

6. Install junction boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side, of the box).

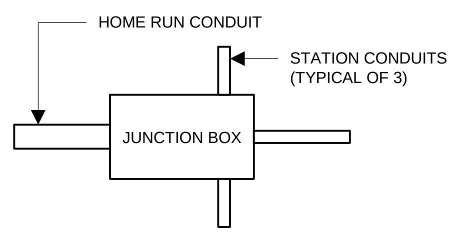
   a. Where a junction box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or junction box door if exposed) in hard pan ceilings.

7. Install junction boxes such that conduit enters and exits at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

> Add junction product installation requirements to the above information as applicable to this project.

E. Pull Boxes:

> Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Provide pull boxes as shown on the Construction Documents and as required.

   a. **Outlet boxes (4 x 4 style) shall not be used as a pull box.**

   b. **Do not confuse pull boxes with junction boxes.** Pull boxes shall not be used as junction boxes.

   c. Where sizing is not shown on the Construction Documents, **minimum pull box sizes** are as follows:

Maximum Trade Size of Conduit	Pull Box Width	Pull Box Length	Pull Box Depth
1”	4”	12”	4”
1-¼”	4”	12”	4”
1-½”	4”	12”	4”
2”	4”	24”	4”
2-½”	6”	24”	6”
3	6”	36”	6”
3-½”	6”	48”	6”
4”	6”	60”	6”

2. A pull box may not be substituted for a 90-degree bend. “*90 degree condulets (LB’s”)* are not acceptable.

3. Install pull boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install pull boxes in inaccessible interstitial building space.

4. Where pull boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).

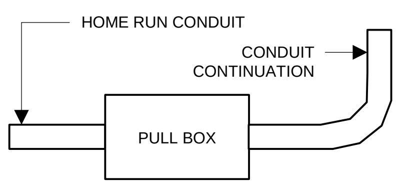
5. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

6. Install pull boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side of the box).

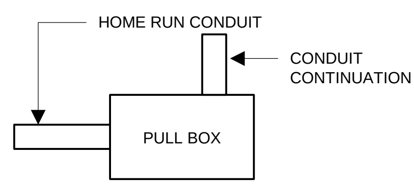
   a. Where a pull box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

   b. Provide a lockable access cover (or pull box door if exposed) in hard pan ceilings.

7. Pull boxes shall have “only” two conduits, one entering and one exiting. Install pull boxes such that “only” one conduit enters and “only” one conduit exits at opposite ends of the box as shown below:



CORRECT INSTALLATION



INCORRECT INSTALLATION

Add pullbox product installation requirements to the above information as applicable to this project.

F. Firestopping:

Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain fire rating of penetrated fire walls and floors. Firestop and seal each penetration made during construction.

   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

   b. Install firestops in strict accordance with manufacturer's detailed installation procedures.

   c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply sealing material in a manner acceptable to the local fire and building authorities.

3. Label each penetration upon completion of Firestop installation using label compliant with the most-current ANSI/TIA/EIA-606-A format. After labeling, take digital photo of each penetration including label within photo, and submit to both Owner and Engineer/Designer.

Add firestop product installation requirements to the above information as applicable to this project.

Review and edit the following installation requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

Verify for accuracy the section number and title referenced below.

G. Grounding/Bonding: Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, UL 467, ANSI/TIA/EIA standards, and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond metallic raceway together, including all conduit ground bushings, and to the nearest TGB (as provided under Division 16 Section "Grounding and Bonding for Telecommunications"). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

2. Contractor shall provide TGB and/or TMGB and grounding conductors required to complete the grounding/bonding installation as indicated above. Bonding telecommunications conduit and metallic raceways for horizontal telecommunications cabling to other than a TGB or TMGB in a telecommunications room or equipment room is not allowed.

Add grounding/bonding product installation requirements to the above information as applicable to this project.

** **NOTE** **

Review and edit the following Labeling & Administration requirements based on the products specified in Part 2 above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project. Labeling format shall be reviewed and agreed to with the DOC-TDI Specialist and DOC Plant Manager.

3.4 LABELING AND ADMINISTRATION:

Labeling and administration of raceways, boxes, and communications components shall follow the format and definitions of Owner's telecommunications administration plan based on the form of ANSI/TIA/EIA-606-A Class 3 Standard and as defined in the construction documents.

A. Conduits: Identify and label each conduit end with a Marker Tag/signage in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.). Indicate conduit length on the label. Provide new labeling and identification to existing conduits where indicated on the construction documents.

1. Where a conduit is intended for future cabling use outside of this Contract, the conduit shall be labeled in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, etc.) along with a sequential number for each spare conduit terminated into a single room. Indicate conduit length on the label.

a. Suggestion: The second spare conduit (whether spare or in use) between Room 100 and telecommunications room 1A might be labeled in the telecommunications room as "Room 100 - #2, __ feet." In Room 100 the same conduit might be labeled "1A - #2, __ feet."

B. Pull and Junction Boxes: Label each box with a unique identifier. Identifiers shall be of the form "RN-Y" where "RN" is the room name of the room closest to (or containing) the box, and "Y" is the sequential number of the box for each "RN".

1. Example: The second box in the vicinity of room "100" would have the label "100-2".

C. Pull Strings: Label each pull string in a clear manner by designating the location of the other end of the pull string (i.e. room name, telecommunications room name, pull/junction box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

1. Where a pull string is installed in a conduit intended for future cabling use outside of this Contract, the pull string shall be labeled similar to the spare conduit in which it is installed.

D. Firestopping: Label each fire rated penetration using label compliant with the most-current ANSI/TIA/EIA-606-A format.

Add label product installation requirements to the above information as applicable to this project.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CLEANING

1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 16453 – GROUNDING AND BONDING FOR TELECOMMUNICATIONS

SECTION 16453 — GROUNDING AND BONDING FOR TELECOMMUNICATIONS

1 PART 1 - GENERAL

PART 1 - GENERAL

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, updated 4/30/2008 by C. Ryman.

This specification should also be used in Division 17 for Security Electronics Low Voltage Electronic systems.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a project, but shall not create a new specification section based on the “intent” of the TCSG, or cut and paste content from TCSG sections into other existing specification sections. **Edits to the section shall be performed with WORD “Revision Tracking” features activated**. At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1.1 RELATED DOCUMENTS

Review and edit the following paragraph to ensure appropriate references are included.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

Review and edit the following list of generic type products and work for relevance to this project. This listing should not include procedures, processes, preparatory work, or final cleaning.

Note that this section is specific to the communications system and shall be included in the Project Manual in addition to 16060 (or equivalent) - Grounding and Bonding for Electrical. When an Electrical Circuits section and a Telecommunications Circuits section are both in the Project Manual, a statement shall be added to the Grounding and Bonding for Electrical section similar to the following:

> "For Telecommunications Grounding and Bonding, the requirements in Section 16453 (or equivalent) - Grounding and Bonding for Telecommunications shall supersede the requirements in this section where they differ.

A. Provide all materials and labor for the installation of a grounding and bonding system for communications infrastructure fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standard. Work in this section includes, but is not limited to providing a permanent grounding and bonding infrastructure for communications circuits and pathways including metallic raceways, cable trays, communications equipment racks/cabinets, etc.

B. Related Sections

> Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the contractor's responsibility for coordinating work.

1. Division 09 Section — "Resilient Flooring for IT Telecommunications Rooms"
2. Division 16 Section — "Basic Electrical Materials and Methods"
3. Division 16 Section — "Outside Plant Communications Site Work"
4. Division 16 Section — "Raceway and Boxes for Communications Circuits"
5. Division 16 Section — "Inside Plant Communications Circuits"
6. Division 16 Section — "Outside Plant Communications Circuits"

C. Products furnished (but not installed) under this section:

> Include this paragraph only if products will be furnished under this section but installed under other sections or by the Owner. When installations are "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner- Installed Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

D. Products installed (but not furnished) under this section -

> Include this paragraph only if products will be installed under this section but furnished under other sections or by the Owner. For example, DOC may pre-purchase fiber, but have the Contractor install. When products are furnished "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner-Furnished Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

E. Provide Unit Prices for:

> Include this paragraph only if unit pricing will be required for a specific part of the project. Include statements on how to measure the quantity. For example, unit prices may be requested for grounding busbars, grounding conductors, etc. Specify technical information on the products and installation associated with the required unit pricing in the appropriate articles of PART 2 and PART 3.

1.3 REFERENCES

Review and edit the following list of references. Check for completeness, currency and applicability to this project. Rarely should anything be removed from under the General or Communications categories. The Engineer/Designer shall verify with the DOC-CPDPM and/or the DOC-TDI Specialist assigned to the project whether the latest edition and/or addenda of each required reference is appropriate and specify the edition and addenda below accordingly.

A. The applicable portions of the following specifications, standards, codes and regulations shall be incorporated by reference into these specifications.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Washington Industrial Safety and Health Act (WISHA)

d. Occupational Safety and Health Act (OSHA)

e. Revised Code of Washington (RCW)

f. Washington Administrative Code (WAC)

g. DOC Policy Directive *Electrical Construction and Maintenance*, DOC 700-130

2. Communications:

Unless specifically indicated otherwise in the Construction Documents, the latest Edition and all current Addenda's and approved Amendments for the following publications shall be considered Communications references. (This section of the Construction Documents is based on the Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.)

a. TIA/EIA-568-B: *Commercial Building Telecommunications Cabling Standard*

b. TIA/EIA-569-B: *Commercial Building Standard for Telecommunication Pathways and Spaces*

c. TIA/EIA-606-A: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

d. ANSI-J-STD-607-A: *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

e. ANSI/TIA/EIA-758: *Customer-owned Outside Plant Telecommunications Cabling Standard*

f. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

g. BICSI: *BICSI Information Transport Systems Installation Manual (ITSIM)*

h. BICSI: *BICSI Telecommunications Distribution Methods Manual (TDMM)*

i. BICSI: *BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)*

1.4 DEFINITIONS

> Review and edit the following list of definitions for applicability to this project. Add and/or remove definitions for unusual terms that are not explained in the conditions of the Contract and that are used in ways not common to standard references.
>
> NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:
>
> Furnish - “Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations”.
>
> Install - “Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations”.
>
> Provide - “To furnish and install, complete and ready for the intended operation”.

A. “BCT” shall mean *Bonding Conductor for Telecommunications*. The conductor that interconnects the telecommunications bonding infrastructure at the TMGB to the building’s electrical service grounding electrode system. Size of conductor is based on length from the TMGB to the electrical service grounding point. The BCT should be as short and straight as possible.

B. “CBC” shall mean *Coupled Bonding Conductor*. A #6 AWG conductor attached to the length of an unshielded riser cable or to a shielded riser cable where the integrity of the shield is not assured. The CBC is bonded to a TGB at both end locations of the riser cable.

C. “TBB” shall mean *Telecommunications Bonding Backbone.* A conductor that interconnects all TGBs with the TMGB. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. The TBB originates at the TMGB and extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Whenever two or more TBBs are used within a building, the TBBs shall be bonded together with a TBBIBC. Size of TBB conductor is based on length from the TMGB to the electrical service grounding point.

D. “TBBIBC” shall mean *Telecommunications Bonding Backbone Interconnecting Bonding Conductor, also known as a Grounding Equalizer (GE)*. The conductor that interconnects elements of the telecommunications grounding infrastructure. Whenever two or more TBBs are used within a multi-story building, the TBBs shall be bonded together with a TBBIBC at the top floor and at a minimum of every third floor in between. Size of TBBIBC conductor is based in length. The TBBIBC reduces or equalizes potential differences between the grounding capabilities of the buildings electrical power ground on different floors which can seriously impact equipment performance where components are located on different floors.

E. “TGB” shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB’s per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

F. “TMGB” shall mean *Telecommunications Main Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. There is typically one TMGB per building, located in the main telecommunications room of the building. This busbar is directly bonded to the electrical service grounding electrode system by the Bonding Conductor for

Telecommunications (BCT) and bonded to building structural steel or other permanent metallic systems. The TMGB serves as the dedicated extension of the building's grounding system for the building's telecommunications infrastructure. A TMGB may serve in lieu of a TGB in a telecommunications room.

1.5 SYSTEM DESCRIPTION

Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system.

A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete, permanent Grounding and Bonding infrastructure for communications circuits, pathways, metallic raceways, cable trays, equipment racks/cabinets, static dissipative floor tile grounding strips, and OSP pathways as hereinafter specified and/or shown on the Construction Documents. The Grounding and Bonding system shall be fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standards and support an ANSI/TIA/EIA and ISO/IEC fully compliant communications Structured Cabling System (SCS) as specified in Division 16 *Outside Plant Communications Site Work*, *Raceways and Boxes for Communications Circuits, Inside Plant Communications Circuits, Outside Plant Communications Circuits* and other areas of the Construction Documents where specified.

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

1.6 SUBMITTAL INFORMATION

Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:

"The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Construction Documents.

Any deviations from the Construction Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC IT through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.

If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Construction Documents".

A. Telecommunications Grounding/Bonding Diagram Submittal:

1. <u>Contractor shall submit a telecommunications grounding/bonding diagram showing</u>:

a. Routing and placement of the proposed telecommunications grounding and bonding components

b. Identify all details not specifically identified in the Construction Documents including:

1) Size and material types of all grounding components

2) Labeling of grounding and bonding conductors

3) Telecommunications OSP grounding locations and conduit collars

c. This diagram or portions may be included in submittals required in other Division 16 specifications: Outside Plant Communications Site Work, Raceways and Boxes for Communications Circuits, Inside Plant Communications Circuits, and Outside Plant Communications Circuits. A separate submittal diagram for this section will not be required if all grounding and bonding information for this project is presented within the other Division 16 submittals identified above.

2. All such diagrams and drawings shall be submitted for review, comment, and written approval by Architect/Engineer/Owner prior to ordering materials and commencing fabrication and installation.

3. All submittals shall be accompanied by a transmittal letter indicating date, project name, Contractor's name and address, sub-contractor's name and address, and deviations from the Construction documents if any.

4. Submittals in part will not be accepted. Only a complete grounding/bonding diagram will be reviewed.

5. Regardless of the action indicated, the Architect/Engineer/Owner's review does not relieve the Contractor of responsibility to comply with the contract documents and shall not be construed as authorizing any deviations from the specifications or drawings or references specified in the Construction Documents unless the Contractor attaches a letter to the submitted item clearly listing the deviations.

B. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

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

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

C. Closeout Submittals: Provide submittal information for review as follows:

> A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under this section shall be included in the O&M Manual for Communications and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications. The requirement that the Contractor provide an O&M Manual for Communications should be stated in Inside Plant Communications Circuits or in Outside Plant Communications Circuits.

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of

construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets.

> Portions of the text below may be contained in other Sections (e.g. 16010 (or equivalent) - General Electrical). Coordinate text for accuracy and content.

a. Document changes to the system from that originally shown on the Construction Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

1.7 SEQUENCING

> Include any requirements for coordinating work with potentially unusual or specifically required sequencing. DOC may choose to construct a project under two bid packages - one for OSP Site Work as described in this specification section as well as other General Contractor specific work, and a second bid package for the Structured Cabling System. The Engineer/Designer must coordinate with DOC to determine if two bid packages will be used and include verbiage in the appropriate specification sections requiring the contractors to coordinate construction phasing, schedules and the use of DOC provided security escorts.

1.8 COORDINATION

A. Coordinate telecommunications grounding and bonding with other construction elements to ensure building startup requirements.

1.9 QUALITY ASSURANCE

A. Comply with NEC.

B. Comply with NESC.

1.10 CONTRACTOR WARRANTY

> Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. The Engineer/Designer is required to have a thorough understanding of the manufacturer warranties applicable on this project. The Engineer/Designer shall consider, account for, and advise DOC regarding any unique warranty situations that may arise from Owner-furnished equipment, Owner-installed equipment, or other situations that may conflict with warranty requirements.

A. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

Ensure that products listed under the PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.

The following paragraphs include products that do not indicate that they allow “or equal” substitutions. If the Engineer/Designer wishes to use other products, an alternative product request shall be submitted in writing to the DOC IT Infrastructure Specialist. This request shall follow the format and procedures of the Alternative Design Request identified in the TDDG, and include detailed literature from the manufacturer of the alternative product. If the alternative product is approved, the Engineer/Designer shall ensure that the specification is written with equal or greater detail to the following paragraphs.

The products listed throughout PART 2 - Products below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by the design are specified with equal or greater detail to the following paragraphs. The Engineer/Designer shall also verify that the most current part number of each specified product is listed in this section.

2.1 GENERAL

A. Materials shall consist of busbars, supports, bonding conductors and other incidentals and accessories as required.

2.2 MATERIALS

A. Grounding/Bonding:

1. Telecommunications Main Grounding Bus Bar (TMGB):

   a. Large (20” x 4” x ¼”), Pre-drilled: CPI 10622-020

   b. Small (10” x 4” x ¼”), Pre-drilled: CPI 10622-010

2. Telecommunications Grounding Bus Bar (TGB):

   a. Large (20” x 4” x ¼”), Pre-drilled: CPI 10622-020

   b. Small (10” x 4” x ¼”), Pre-drilled: CPI 10622-010

3. Telecommunications Bonding Backbone (TBB): Size a copper conductor per table under Section 3.2 *Installation.* Use a larger conductor if required per NEC. The conductor shall be green or marked with a distinctive green color.

4. Bonding Conductor for Telecommunications (BCT): Minimum size of the conductor shall be the same size as calculated for the TBB. Use a larger conductor if required per NEC. The conductor shall be green or marked with a distinctive green color stranded or solid copper.

5. Coupled Bonding Conductor (CBC): Minimum of #6 AWG conductor, insulated (green in color) stranded copper conductor.

6. Connectors:

   a. For BCT and TBB: Shall be a listed 2-hole irreversible compression type, or exothermic welded.

7. Telecommunications Ductbank Grounding Conductor: Minimum of #2 AWG bare copper conductor or larger conductor as required per NESC or as recommended by BICSI.

> Review and edit the following products/part numbers as applicable to this project. If firestopping material is specified in another section, the Engineer/Designer shall ensure that that section is listed in Part 1 - General above as a related section, and delete this paragraph in its entirety.

B. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:

1. Specified Tech. Inc.

> Review and edit the following products/part numbers as applicable to this project.

C. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:

   a. Brady: ID Pro Plus (or approved equal).

2. Labels:

   a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

3 PART 3 - EXECUTION

PART 3 - EXECUTION

> Ensure that products incorporated into the project under PART 3 paragraphs have corresponding Product information in PART 2 – Products, or in another specification Section if installed but not supplied under this Section.
>
> The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If it is desirable to use other products, the Engineer/Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and written with equal or greater detail to the following paragraphs.
>
> The products listed throughout PART 2 – Products and the installation requirements below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified in Part 2 with corresponding installation requirements specified in Part 3.

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Install the grounding and bonding system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 INSTALLATION

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Coordinate the installation of the telecommunications grounding and bonding system with the electrical power distribution system grounding infrastructure.

1. The telecommunications grounding and bonding infrastructure systems shall not make use of the building plumbing system.

2. If bonding/grounding connections to conductors are made below ground, use an exothermic weld.

B. Ground/Bonding:

1. TMGB: Provide a TMGB in the main telecommunications room of each building and as shown on the Construction Documents. Install TMGB and directly bond to the building's electrical service grounding system via the BCT and to associated TBB(s) within the building. Group protector, busbar bonding, and approved building grounding conductors toward one end of the TMGB and leave space for equipment grounding conductors to the opposite end.

a. Where an electrical power panel (panelboard) is located in the same room or space as the TMGB, that panelboard's alternating current equipment ground (ACEG) bus (when equipped) or the panelboard's enclosure shall be bonded to the TMGB.

b. The TMGB shall be as close to the panelboard as practicable and shall be installed to maintain clearances required by applicable electrical codes.

2. TGB: Provide TGB as shown on the Construction Documents and as required. Directly bond each TGB to it's associated TBB and to the nearest building structural steel or other permanent metallic system. Group protector, busbar bonding, and approved building grounding conductors

toward the left one end of the TGB and leave space for equipment grounding conductors to the opposite end.

a. Where an electrical power panel (panelboard) for telecommunications equipment is located within the same room or space as the TGB, that panelboard's alternating current equipment ground (ACEG) bus (when equipped) or the panelboard's enclosure shall be bonded to the TGB.

b. The TGB shall be as close to the panelboard as practicable and shall be installed to maintain clearances required by applicable electrical codes.

3. TBB(s), TBBIBC, and BCT Grounding Conductors: Provide TBB(s), TBBIBC(s), and BCT as shown on the Construction Documents and as required per TIA/EIA Standard J-STD-607-A to bond all non-current carrying metal telecommunications equipment and materials to the nearest TGB.

Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. Insulate grounding conductors from their support. Grounding conductors shall be continuous (without splices). Use TBB(s) to connect each TGB to the TMGB. Whenever two or more TBBs are used within a multi-story building, the TBBs shall be bonded together with a TBBIBC at the top floor and at a minimum of every third floor in between.

a. All connections shall be made using irreversible compression-type connectors or exothermic welding.

b. Any splicing shall be Owner-approved in writing, and only allowed under special circumstances. Where allowed, splice shall be made by using two-hole irrevisble compression-type connectors or exothermic welding, and shall be located in a designated telecommunications space.

c. Size TBB, TBBIBC, and BCT conductors as shown on the Construction Documents or per table below.

d. J-STD-607-A Figure 5.4.4.1:

TBB/TBBIBC/BCT Length (**Feet**)	Conductor Size (**AWG**)
Less than 13	6
13 thru 19	4
20 thru 25	3
26 thru 32	2
33 thru 40	1
41 thru 51	1/0
52 thru 66	2/0
Greater than 66	3/0

4. The Busbar (TMGB/TGB) designated for protectors must safely carry lightning and electrical power fault currents. It shall be positioned adjacent to the protectors.

5. Coupled Bonding Conductor (CBC): For unshielded riser cables or where ARMM cable shield continuity is not assured, install a <u>Coupled Bonding Conductor (CBC) with riser cable</u>. Run a #6 AWG copper ground riser conductor, tie-wrapped at regular intervals to the cable or cables in

each unshielded Backbone/Riser cable route, per SYSTIMAX® installation requirements. Ensure that only a minimal separation distance is allowed between the conductor and the riser cables. Bond the CBC in the same manner as a cable shield.

6. Ground conductor along length of outside plant telecommunications ductbank shall be bonded to grounding electrodes of MH/HH, grounding collar of all metallic conduits within the ductbank, and to building's electrical service ground.

   a. Ductbank ground conductor shall not be bonded to the TMGB or TGB.

   b. Per NEC 2002 800.12(C) *Entering Buildings: "Conduits or other metal raceways located ahead of the primary protector shall be grounded."*

7. Bond all horizontal metallic raceways for telecommunications cabling and components together, including all horizontal conduit ground bushings, and to the nearest TMGB/TGB.

8. Bond grounding strips installed below static dissipative vinyl composition floor tile to the nearest TMGB/TGB.

   a. Coordinate the location of the floor tile grounding strips with the Flooring contractor so they will be located along the same wall and within 3 feet of the TMGB/TGB.

   b. Bonding conductor shall be a minimum 6 AWG copper conductor and sized according to length from table listed above.

   c. Maintain bonding conductor close to wall at point of bond with floor grounding strip by using cable tie mounts securely attached to wall.

   d. Attach small metal D-rings to wall surrounding bonding connection to floor grounding strip for protection.

9. Bond all telecommunications primary protector grounds to the nearest TMGB/TGB.

10. Bond all telecommunications backbone cable shields to the nearest TMGB/TGB at both ends of the cable.

11. Ensure that all bonding breaks through paint to bare metallic surface of all painted metallic hardware.

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

C. Firestopping

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

2. Maintain the fire rating of all penetrated fire barriers. Fire stop and seal all penetrations made during construction.

   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

   b. Install firestops in strict accordance with manufacturer's detailed installation procedures.

c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.

d. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.

e. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

List additional Firestopping product installation requirements above as applicable to this project.

D. Labels:

1. Label TMGB(s) with "TMGB"

2. Label TGB(s) with "TGB".

3. Label TBB(s), BCT, TBBIBC(s), and static dissipative floor tile bonding conductors:

"WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

a. Attach labels to both ends of bonding conductors.

END OF SECTION

SECTION 16711 – INSIDE PLANT COMMUNICATIONS CIRCUITS

SECTION 16711 — INSIDE PLANT COMMUNICATIONS CIRCUITS

1 PART 1 - GENERAL

PART 1 - GENERAL

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS), Telecommunications Construction Guide Specifications (TCGS) Version 5.3, updated 4/30/2008 by C. Ryman.

This specification should also be used in Division 17 for LVE systems using UTP copper and/or fiber.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required for use with a specific project, but shall not create a new specification section based on the "intent" of the TCGS, or cut and paste content from TCGS sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated.** At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1.1 RELATED DOCUMENTS

Review and edit the following paragraph to ensure appropriate references are included.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

Review and edit the following list of generic type products and work for relevance to this project. This listing should not include procedures or processes, preparatory work, or final cleaning.

A. Provide all materials and labor for the installation of an inside plant telecommunication system fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standard. Work in this section includes, but is not limited to installation and termination of Inside Plant Communications cabling and components including administration equipment, raceway construction, cutting and patching, firestopping, and grounding and bonding for the specified Structured Cabling System (SCS - See Definition Below).

B. Related sections include but are not necessarily limited to the following:

> Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the contractor's responsibility for coordinating work.

1. Division 06 Section — "Rough Carpentry for IT Telecommunications Rooms"
2. Division 09 Section — "Resilient Flooring for IT Telecommunications Rooms"
3. Division 09 Section — "Fire-Resistant Paints for IT Telecommunications Rooms
4. Division 15 Section — "Sprinkler Systems for IT Telecommunications Rooms"
5. Division 16 Section — "Basic Electrical Materials and Methods"
6. Division 16 Section — "Raceway and Boxes for Communications Circuits"
7. Division 16 Section — "Grounding and Bonding for Telecommunications"
8. Division 16 Section — "Outside Plant Communications Circuits"

C. Products furnished (but not installed) under this section:

> Include this paragraph only if products will be furnished under this section but installed under other sections or by the Owner. DOC frequently has the Contractor furnish patch cords, but uses their IT staff to install. When installations are "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner- Installed Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

1. Furnish voice and data patch cords specified in Part 2 and Part 3 for installation by DOC personnel.

D. Products installed (but not furnished) under this section -

> Include this paragraph only if products will be installed under this section but furnished under other sections or by the Owner. When products are furnished "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner-Furnished Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.
>
> Consider including grounding and bonding conductors, busbars, and any other items that are installed under this section but not furnished under this section.
>
> Engineer/Designer shall coordinate with the A/E to ensure that the paint and plywood for the backboards are specified under Divisions 06 and 09 as indicated above, else include appropriately within this division.

1. Grounding and Bonding Conductors

2. Grounding Busbars and Collars

E. Provide Unit Prices for:

> Include this paragraph only if unit pricing will be required for a specific part of the project. Include statements on how to measure the quantity. For example, unit prices may be requested for duplex outlets, quadruplex outlets, etc. Specify technical information on the products and installation associated with the required unit pricing in the appropriate articles of PART 2 and PART 3.

1.3 REFERENCES

> Review and edit the following list of references. Check for completeness, currency and applicability to this project. Rarely should anything be removed from under the General or Communications categories. The Engineer/Designer shall verify with the DOC-CPDPM and/or the DOC-TDI Specialist assigned to the project whether the latest edition and/or addenda of each required reference is appropriate and specify the edition and addenda below accordingly.

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

   a. National Electrical Code (NEC)

   b. National Electrical Safety Code (NESC)

   c. Washington Industrial Safety and Health Act (WISHA)

   d. Occupational Safety and Health Act (OSHA)

   e. Revised Code of Washington (RCW)

   f. Washington Administrative Code (WAC)

   g. DOC Policy Directive: *Electrical Construction and Maintenance*, DOC 700.130

2. Communications:

   Unless specifically indicated otherwise in the Construction Documents, the latest Edition and all current Addenda's and approved Amendments for the following publications shall be considered Communications references. (This section of the Construction Documents is based on the Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008.)

   a. ANSI/TIA/EIA-455: *Fiber Optic Test Standards*

   b. ANSI/TIA/EIA-526 series: *Optical Fiber Systems Test Procedures*

   c. ANSI/TIA/EIA-568-B: *Commercial Building Telecommunications Cabling Standard*, including 568-B.2-10

d. ANSI/TIA/EIA-569-B: *Commercial Building Standard for Telecommunication Pathways and Spaces*

e. ANSI/TIA/EIA-606-A: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

f. ANSI-J-STD-607-A: *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

g. IEEE 802.3 (series): *Local Area Network Ethernet Standard,* including the IEEE 802.3z *Gigabit Ethernet Standard* and 802.3an Link Segment specifications

h. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*, including Class EA channel specifications amendment

i. BICSI*: BICSI Information Transport Systems Installation Manual (ITSIM)*

j. BICSI*: BICSI Telecommunications Distribution Methods Manual (TDMM)*

1.4 DEFINITIONS

Review and edit the following list of definitions for applicability to this project. Add and/or remove definitions for unusual terms that are not explained in the conditions of the Contract and that are used in ways not common to standard references.

NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:

Furnish - "Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations".

Install - "Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations".

Provide - "To furnish and install, complete and ready for the intended operation".

A. "BCT" shall mean *Bonding Conductor for Telecommunications*. The conductor that interconnects the telecommunications bonding infrastructure at the TMGB to the building's electrical service grounding electrode system.

B. "OSP-SCS" shall mean *Outside Plant - Structured Cabling System*. The OSP-SCS is defined as all required equipment and materials including, but not limited to, ANSI/TIA/EIA and ISO/IEC compliant copper and fiber optic cable (multimode and singlemode), connectors, splices, splice enclosures, grounding and bonding, and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

C. "SCS" shall mean *Structured Cabling System*. The SCS is defined as all required equipment and materials including (but not limited to) ANSI/TIA/EIA 568-B and ISO/IEC 11801 compliant copper station cable (Category 3, Category 6, Gigaspeed, etc.) and fiber optic cable (multimode and singlemode), patch cables, stations and station connectors, termination blocks, patch panels, racks/enclosures (such as EIA standard equipment racks, enclosures, and vertical and horizontal cable management hardware), pathway/raceway materials (such as conduit, sleeves, D-rings, surface raceway, ladder rack, cable tray, etc.), grounding and bonding, and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

D. "SERVICE SLACK" shall mean all horizontal and backbone copper and fiber cables shall be installed to provide an additional length of cable (service slack) near each end of the cable within the area where the cable terminations are made. The service slack is to accommodate future moves or changes to the locations of the cable termination equipment. Within a telecommunications or equipment room, the service slack shall be long enough to reach the longest, opposite side of the room plus the distance from ceiling to floor, or whichever is longer - a minimum of ten feet for horizontal cable or twenty-five feet for backbone cable. At the work area, a minimum of 4-6 inches of service slack is required within the telecommunications outlet box, and 12 inches stored within the ceiling area where conduit stub-ups end above the ceiling and the cable is not fully contained within conduit to the TR. For fiber optic cable, additional service slack is required – a minimum of ten feet stored within each fiber shelf or cabinet.

E. "TBB" shall mean *Telecommunications Bonding Backbone.* A conductor that interconnects all TGBs with the TMGB. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. The TBB originates at the TMGB and extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Whenever two or more TBBs are used within a building, the TBBs shall be bonded together with a TBBIBC. Size of TBB conductor is based on length from the TMGB to the electrical service grounding point.

F. "TGB" shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB's per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

G. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. There is typically one TMGB per building, located in the main telecommunications room of the building. This busbar is directly bonded to the electrical service grounding electrode system by the Bonding Conductor for Telecommunications (BCT) and bonded to building structural steel or other permanent metallic systems. The TMGB serves as the dedicated extension of the building's grounding system for the building's telecommunications infrastructure. A TMGB may serve in lieu of a TGB in a telecommunications room.

H. "UTP" shall mean *unshielded twisted pair* cable.

1.5 SYSTEM DESCRIPTION

> Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system.

A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA and ISO/IEC fully compliant communications Structured Cabling System (SCS) as hereinafter specified and/or shown on the Construction Documents and with TIA/EIA compliant grounding and bonding as specified in Division 16 *Grounding and Bonding for Telecommunications*. The system is intended to be capable of integrating voice, data, and video signals onto a common media. The data portion shall be tested for and be capable of Gigabit Ethernet operation as specified in IEEE 802.3z and 10GBase-T where Category 6A cable is specified. The GigaSPEED X10D solution shall meet or exceed IEEE 802.3an link segment specifications in addition to the TIA/EIA Category 6A channel specifications to 500 MHz and support 10GBase-T.

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

1.6 SUBMITTAL INFORMATION

> Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:
>
> "The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Construction Documents.
>
> Any deviations from the Construction Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.
>
> If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Construction Documents".

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

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

2. For those items noted as allowing "or equal," and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Quality Assurance/Control Submittals: Provide submittal information for review as follows:

1. Submit a cable routing and grouping plan as follows:

a. Where the cable routing, grouping, grounding and bonding is to be provided as shown on the Construction Documents, do not provide a cable routing and grouping plan. Submit written documentation stating that the cable routing and grouping will be provided as shown on the Construction Documents, that the Contractor has reviewed the routing and grouping on the Construction Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts between trades, and the routing and grouping meets applicable codes, regulations and standards.

b. Where changes in cable routing, grouping, grounding and bonding are proposed, submit complete floor plan(s) and/or detail drawing(s) showing the proposed routing, grouping, raceway sizes and locations, cabling, grounding and bonding in a manner equal to that of the Construction Documents. Ensure that any cabling changes are coordinated with comparable accommodating changes to the raceway routing and grouping. Specifically note each location where the proposed routing and grouping is different from the Construction Documents. Submit written documentation detailing the reason for each change request. Each change request must be approved in writing by the Engineer/Designer/Owner prior to proceeding with the change.

2. Submit wall field termination block and wire management elevations as follows:

    a. Where wall field termination blocks and wire management are to be provided as shown on the Construction Documents, do not submit elevations. Submit written documentation stating that the wall field termination blocks and wire management will be provided as shown on the Construction Documents, that the Contractor has reviewed the elevations on the Construction Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts between trades, and that the elevations meet applicable codes, regulations and standards.

    b. Where changes to the wall field termination blocks and wire management are proposed, submit wall field termination block and wire management elevations along with written documentation detailing the reason for the change. The change request must be approved in writing by the Engineer/Designer and Owner prior to proceeding with the change.

3. Submit a list of proposed test equipment for use in verifying the installation of the SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING and the SCS Manufacturer's recommended test parameters.

    a. Submit for each testing device:

        1) Manufacturer and product/model number.

        2) Documentation from the manufacturer showing date and outcome of the last re-calibration. Testing device shall have been re-calibrated within the last twelve (12) months or within the manufacturer's recommended calibration period, whichever is shorter, encompassing the period of time when the testing device will be used on this project.

        3) Documentation stating date, time, and employee name performing field calibration of test equipment within thirty (30) days of time when the testing device will be used on this project.

        4) Documentation from the manufacturer showing current software revision and the software's capabilities to successfully perform the current industry standard test for the Category of SCS cable being installed. Software revision shall be most current revision available for the testing device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.

        5) Failure to provide calibration data or where calibration data is not within the parameters specified above shall render all tests performed null and void and require re-testing of all cable within the project or work order at no expense to the Owner.

    b. Submit proposed copper and fiber cable test forms (see PART 3 – TESTING for more detail).

4. Submit a list of the personnel who will be assigned to the project, the type of work they will be performing per QUALITY ASSURANCE below, copies of the manufacturer's training certification for each, and copies of BICSI or equivalent SCS training certifications. If personnel changes are made during the project, submit the above information for any new personnel prior to their commencement of work on the project.

C. Closeout Submittals: Provide submittal information for review as follows:

> A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under other related communications sections (e.g. Raceway and Boxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications. The requirement that the Contractor provide an O&M Manual for Communications should be stated in this section or in Outside Plant Communications Circuits if applicable.

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description. This is a separate manual in addition to and independent of any general O&M Manual for the construction project. If the project includes Outside Plant Communications Circuits, incorporate into one manual.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

> Portions of the text below may be contained in other Sections (e.g. 16010 (or equivalent) - General Electrical). Coordinate text for accuracy and content.

a. Document changes to the system from that originally shown on the Construction Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

> Refer to the DOC Telecommunications Distribution Design Guide for format and content of the cable records described below.
>
> **Note that the Engineer/Designer is responsible for developing items 1-6 and 8 below and specifying in the Construction Documents.**

e. Provide a table/schedule showing the following information for each cable link in the project on the Record Drawings. Base the table/schedule on the schedule provided by the Engineer/Designer in the Project Manual. Items 1 through 6 and item 8 have already been completed by the Engineer/Designer and are included in the table/schedule. Complete items 7 and 9. Include the following items in the table/schedule:

1) End locations of cable (telecommunications room)

2) Link Type (campus, riser, horizontal)

3) Media type (fiber type & core size, Cat 6A, CAT 6, Cat 3, etc.)

4) Proposed usage (voice, data, lighting control, etc.)

5) Cable Identifier

6) As-designed maximum link length

7) Actual measured link length (from test results)

8) For fiber optic cabling, as-designed maximum link attenuation at design frequency (indicating frequency used for design calculations) including as-designed maximum splice loss and as-designed maximum connector loss

9) For fiber optic cabling, actual measured link attenuation as tested with test frequency (from test results)

10) For copper cabling, actual measured headroom (from test results)

1.7 SEQUENCING

> Include any requirements for coordinating work with potentially unusual or specifically required sequencing, such as having cable installed to test and commission other building automation systems (BAS).

A. Provide coordination with SYSTIMAX® to ensure that SYSTIMAX® inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any SYSTIMAX®-required modifications and have SYSTIMAX® re-inspect and certify the system prior to the scheduled use of the system by the Owner.

1. The Contractor is solely responsible for all costs associated with scheduling the SYSTIMAX® inspection, the inspection itself and any SYSTIMAX® required re-inspections, and for any modifications to the installation as required by SYSTIMAX®.

B. Schedule installation of cable and components that may be required for use by equipment and systems from other trades to ensure cabling connectivity for their testing and commissioning.

1.8 COORDINATION

A. Coordinate installation of cabling and components with other construction elements to ensure adequate headroom, working clearances, setback clearances, access, and building startup requirements.

1.9 QUALITY ASSURANCE

> The following are DOC requirements for Telecommunications Contractors and Telecommunications Contractor Employees. Engineer/Designer shall review and validate all documentation, references, and training certificates to ensure contractor compliance with these requirements. Review these requirements with the DOC-TDI Specialist and include as applicable to this project.
>
> For projects where the telecommunications cabling falls under the responsibility of the GC, consider establishing a deadline **prior to the bid date** for the General Contractors to have submitted prequalification documentation demonstrating that their telecommunications sub-contractor meets the qualification requirements. Also, consider publishing the list of pre-qualified telecommunications Contractors as an addendum prior to the bid deadline.

A. Telecommunications Contractor Qualifications: **Prior to bidding the project, shall submit**:

1. Documentation from the SCS manufacturer demonstrating the telecommunications Contractor is trained and certified by the Manufacturer to install, test, and maintain the SCS in the state of

Washington and is certified by the SCS Manufacturer to provide the SCS Manufacturer's Warranty in the state of Washington (see PART 1 - WARRANTY).

a. SYSTIMAX®: SYSTIMAX® SCS Installation Contractor (for copper and fiber).

2. Documentation indicating the telecommunications Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below.

3. Documentation demonstrating the telecommunications Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI who shall be assigned to the project throughout the duration of the project. The RCDD shall be a direct full time employee of the telecommunications Contractor (i.e. an RCDD consultant/sub-contractor to the telecommunications Contractor is not acceptable). The telecommunications Contractor shall document the specific activities the RCDD will provide on the project.

4. List of references for no less than five similar projects (in terms of size and construction cost) performed by the telecommunications Contractor under the telecommunications Contractor's current business name within the past three years. Detail the following for each project:

a. Project name and location.

b. Construction cost.

c. A brief description of the project, the components involved, and the SCS manufacturer used on the project.

d. Number of station drops.

e. Customer contact names, phone numbers, and addresses.

f. Names of telecommunications Contractor's RCDD, supervisor's/project foremen, installation & test technicians.

DOC generally includes the cabling under the responsibility of the GC which alleviates many problems. Include the paragraph listed at the bottom of this hidden text (or one similar) **"only"** if the cabling and components within this section of the project are to be constructed using a **Facility Contract** (FC) and a contractor selected under the State of Washington Department of Information Services (DIS) Master Contract.

Use of the DIS Master Contract may be discussed with the DOC project manager and the DOC-TDI Specialist prior to the completion of Design Development if events arise in the project that warrants using a FC.

When a FC is used along with the DIS Master Contract, this entire section is pulled out of the construction documents that go out to bid and is included in a separate construction document specifically written for the contractor from the DIS Master Contract. One or more pre-qualified Contractors from the DIS Master Contract shall be recommended by the DOC-TDI Specialist and approved by the DOC project manager. Review and edit the section numbers and titles below and coordinate content as applicable to this project.

"Documentation demonstrating that the Contractor has a current Master Contract with the State of Washington Department of Information Services (DIS) per the requirements in Section 01010, and shall be on the DOC pre-qualified DIS contractor list shown in Section 01010."

B. Telecommunications Contractor's employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS' manufacturer. Training and certifications by employee type are required as shown below:

1. Project Managers/Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing of all manufacturers' cabling and components to be installed as required by the manufacturer, <u>and</u> trained/certified on Structured Cabling Systems by BICSI (or an equivalent telecommunications training organization) at the *Technician* level. Requires current certification of:

    a. SYSTIMAX® SCS ND3321 "Design & Engineering" course.

    b. SYSTIMAX® SCS ND3341 "Installation & Maintenance" course.

2. Test Technicians: All (100%) shall be trained/certified for installation and testing of all manufacturers' cabling and components to be installed as required by manufacturer. Requires current certification of:

    a. Fluke Networks Certified Cabling Test Technician (CCTT) course or approved equal for other approved manufacturer's test equipment:

        1) For DTX (Copper and/or fiber): "CCTT for the DTX Series CableAnalyzer".

        2) For Optifiber OTDR: "CCTT for the OptiFiber Certifying OTDR".

3. Installation Technicians: All (100%) shall be trained/certified for installation of all manufacturers' cabling and components to be installed as required by the manufacturer <u>and</u> trained/certified on Structured Cabling Systems by BICSI (or an equivalent telecommunications training organization) at the *Installer Level 2*. Requires current certification of:

    a. SYSTIMAX® SCS ND3341 "Installation & Maintenance" course.

4. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. cleanup crew, no hands-on cable assistants, etc.) are not required to be manufacturer or BICSI trained and certified. Other personnel shall not be allowed to <u>directly</u> assist the installation technicians or test technicians.

C. Telecommunications Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:

1. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.

2. Firestopping Technician: All (100%) shall be trained/certified for installation.

D. Comply with NEC.

1.10 WARRANTY

> Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. The Engineer/Designer is required to have a thorough understanding of the manufacturer warranties applicable on this project. The Engineer/Designer shall consider, account for, and advise DOC regarding any unique warranty situations that may arise from Owner-furnished equipment, Owner-installed equipment, or other situations that may conflict with warranty requirements.

A. Contractor Warranty:

1. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

a. Provide all labor attributable to the fulfillment of this warranty at no cost to the Owner.

1) The Contractor Warranty period shall commence upon Owner acceptance of the work.

B. SCS Manufacturer Warranty:

1. Provide a SCS Manufacturer extended product, performance, application, and labor warranty that shall warrant all passive components used in the SCS. Additionally, this warranty shall cover components not manufactured by the SCS Manufacturer, but approved by the SCS Manufacturer for use in the SCS (i.e. "Approved Alternative Products"). The SCS Manufacturer warranty shall warrant:

a. That the products will be free from manufacturing defects in materials and workmanship.

b. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.

c. That the installation shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.

d. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.

2. Provide materials and labor attributable to the fulfillment of this warranty at no cost to the Owner.

3. The SCS Manufacturer Warranty shall be provided by the selected SCS Manufacturer and shall be:

a. SYSTIMAX® Structured Connectivity Solution Extended Product Warranty and Application Assurance Program (20 Years).

1) Provide a copy of the SYSTIMAX® Registration Document to the Owner at the time of submittal to SYSTIMAX®.

4. The SCS Manufacturer Warranty period shall commence upon a Warranty Certificate being issued by the manufacturer. The Warranty Certificate shall be issued no later than three months after Owner acceptance of the work.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

> Ensure that products listed under the PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.
>
> DOC has standardized on SYSTIMAX® for all new Structured Cabling Systems in DOC facilities. Products shall be specified accordingly. The Engineer/Designer shall ensure that the latest SYSTIMAX®a part numbers are used for specified products. Note that "Or-Equal" substitutions for core products available from SYSTIMAX® are not permitted.

> Any product substituted for a SYSTIMAX® warranted product other than those already listed within this document shall require the same or better 20 year product and performance warranty. If the substituted product is to be covered under the SYSTIMAX® warrantee, written authorization from the SYSTIMAX® Account representative must first be obtained and subsequently become part of the warranty documentation,
>
> Some of the following paragraphs include ancillary products (such as racks, cable supports, etc.) manufactured by companies other than SYSTIMAX®, but do not indicate that they allow "or equal" substitutions. If the Engineer/Designer wishes to use other products in lieu of non-SYSTIMAX® ancillary products, an alternative product request shall be submitted in writing to the DOC-TDI Specialist. This request shall follow the format and procedures of the Alternative Design Request identified in the TDDG, and include detailed literature from the manufacturer of the alternative product. If the alternative product is approved, the Engineer/Designer shall ensure that the specification for the alternative product is written with equal or greater detail to the following product specifications.
>
> The products listed throughout Part 2 - Products below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified with equal or greater detail to the following paragraphs. The Engineer/Designer shall also verify that the most current part number of each specified product is listed in this section. Cautiously remove all product information that does not apply to a specific project.
>
> Where one or more "x" is embedded within a product number listed in this section, the "x" portion typically is a place holder for quantity, color, length, etc. for the product. **It is the Engineer/Designer's responsibility (not the Contractor) to work with the Owner and Design Team to obtain the specific information for the project components and modify the product codes accordingly, replacing the "x" information within the Construction Documents.**

2.1 GENERAL

A. Unless specifically stated as "Or equal", equivalent items are not acceptable, provide items as specified.

B. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths of conduit and/or pathway to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.

C. SCS components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers unless the manufacturer of the SCS has listed (in writing) another manufacturer's component as an "Approved Alternative Product" and will warrant the "Approved Alternative Product" as part of the SCS Manufacturer Warranty (see PART 1 - WARRANTY).

1. Bid only one SCS Manufacturer and only bid a manufacturer for which the Contractor is certified. The SCS Manufacturer shall be the following. Substitution is not acceptable:

   a. SYSTIMAX®

2. Contractor shall verify SCS Manufacturer's Product Codes and Material Identifiers listed below prior to ordering.

> For prison new construction and total remodel of buildings, specify the CAT 6A X10D products. The CAT 6 XL products shall be used when adding drops to an existing building with the XL or older products.
>
> Review and edit the following products/part numbers as applicable to this project.

D. For a given manufacturer, all components shall be part of a single SCS product line – components shall not be intermixed between a manufacturer's SCS product lines. The SCS product line shall be engineered "end-to-end" – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

1. The SCS Product Line shall be the following, per manufacturer. Substitution is not acceptable:

a. SYSTIMAX®

1) For Category 6 Copper Distribution: SYSTIMAX® SCS GigaSPEED XL Solution

2) For Category 6A Copper Distribution: SYSTIMAX® SCS GigaSPEED X10D Solution

3) For Fiber Distribution: SYSTIMAX® SCS OptiSPEED, TeraSPEED, LazrSPEED

b. Superior Essex copper backbone cable (previously authorized by the SYSTIMAX® Regional Account Manager, Brian Goff).

> Engineer/Designer shall discuss rack/cabinet/runway color with the Regional IT Manager or designee for the installation site to determine if gray or black is desired. If adding to an existing TR, existing color should determine new product color. Product color should be uniform throughout the installation. If no recommendation from the Regional IT, the DOC TDI Specialist shall select the color.

E. Racks, rack cable distribution hardware, cable runways, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification or in the Construction Documents. Do not inter-mix equipment and components between different manufacturers.

1. Distribution Equipment:

a. Chatsworth Products, Inc. (CPI)

b. Wright Line

2. Racks and Cabinets:

a. Chatsworth Products, Inc. (CPI)

b. Amco

c. Great Lakes

d. Wright Line

e. Rittal Corporation

f. Hubbell

F. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Construction Documents that is required for a fully compliant, operational, tested, certified and warranted SCS system.

2.2 PATHWAYS AND CABLE SUPPORTS

> Engineer/Designer shall review and edit the following products/part numbers as applicable to this project. If section numbers and titles are referenced, verify for accuracy.

A. Installation and materials for the raceway and boxes including supports for wall mounted devices for the SCS shall be as specified under Division 16 Section — "Raceways and Boxes for Communications Circuits" except where noted below.

B. Surface Metal Raceway (SMR): UL listed under Section 5 with fittings including (but not limited to) mounting clips and straps, couplings, internal and external elbows, cover clips, bushings, end fittings, outlet boxes and other incidental and miscellaneous hardware required for a complete Surface Raceway system.

1. Wiremold w/Category 5/6 fittings.

a. Device Boxes: Shall be ANSI/TIA/EIA-569 compliant; with a <u>minimum inside depth of 2.5 inches</u> behind faceplate providing adequate depth for outlet jack and cable bend radii.

C. Telecommunications/Power Poles:

1. Wiremold, Steel Tele-Power pole, #30TP-4V (no substitutions including aluminum poles)

D. Backboards:

1. Plywood:

a. Shall be ¾ inch thick A-C grade or better plywood, 2.4m (8-ft) high unless otherwise noted. Plywood shall be void free, painted on both sides with fire-resistant paint. Plywood shall <u>not</u> be rated "fire-retardant."

2. Paint shall be light colored, non-conductive, manufactured by Flame Control Coatings, LLC, or Owner approved equal.

a. Flame Control No. 3003 Acrylic Primer.

b. Flame Control No. 20-20A Flat Latex Intumescent Fire Retardant Paint.

E. C-Rings:

1. Composite: CPI 12035

F. D-Rings:

1. Composite: CPI 12127, 10812

2. Metallic: CPI 10941, 10942, 10943

G. Cable Supports (J-Hooks, Straps): Complete with incidental materials and assemblies required for mounting. Note: Maximum quantities stated are for all categories of horizontal copper cable from CAT 3 through CAT 6, and are less than manufacturer's quoted CAT 6 ratings. <u>DOC has down-sized the maximum capacity as stated by the manufacturer. The number of cables supported shall not exceed the maximum numbers listed below.</u>

1. CADDY CableCat Wide Base Cable Supports (J-Hooks):

a. CAT12 (<u>maximum 8</u> CAT6 copper cables)

b. CAT21 (<u>maximum 25</u> CAT6 copper cables)

c. CAT32 (<u>maximum 40</u> CAT6 copper cables)

2. CADDY CableCat Adjustable Cable Supports (Straps/Bags):

a. CAT425 (maximum 96 CAT6 copper cables)

H. Cable Runway: Complete with fittings and mounting hardware including (but not limited to) butt and junction splice kits, corner brackets, cable runway radius drops for cross members and stringers, cable runway radius bends, protective end caps, retaining posts, support brackets, foot kits, vertical wall brackets, wall angles, grounding hardware and other incidental and miscellaneous hardware required for a complete ladder rack system. Ladder rack components shall be manufactured by the selected Rack/Distribution Equipment manufacturer.

1. Unless otherwise indicated, all cable runway and incidental equipment color shall be of the same color at a DOC location:

a. Gray

b. Black

> Designer shall specify on the Construction Documents to transition to the “Alternate Space Cable Runway” above 19” racks/frames with vertical cabling sections for appropriate alignment of radius drops into vertical cabling sections.

2. Cable Runway:

a. For CPI: Universal Cable Runway 10250-xxx

b. For CPI: Alternate Space Cable Runway 31472-xxx

3. Cable Runway Radius Bends:

a. For CPI Vertical: Cable Runway Radius Bend 1072x-xxx

b. For CPI Horizontal: Cable Runway E-Bend 10822-xxx

4. Cable Runway Corner Bracket:

a. For CPI: 11959-xxx

5. Cable Retaining Posts:

a. For CPI: 10596-x08

6. Cable Runway Radius Drops (Cross Member & Stringer):

a. For CPI: 1210x-xxx

7. Protective End Caps for Runway:

a. For CPI: 10642-001

8. Rack/cable runway Grounding Strap kit:

a. For CPI: 40164-001 Qty-1

b. For CPI: 40164-025 Qty-25

> Verify the size of innerduct required for the project and modify paragraph below accordingly.

I. Innerduct:

1. Intrabuilding Flexible Textile: UL Listed, rated for indoor installation.
    a. Riser Product: MaxCell Innerduct (or approved equal)
    b. Plenum Product: MaxCell Innerduct (or approved equal)
2. Intrabuilding Corrugated: bright orange, UL Listed, rated for indoor installation with UL Listed pull tape.
    a. 1” Diameter - riser rated
    b. 1-1/4” Diameter - riser rated
    c. 1” Diameter - plenum rated
    d. 1-1/4” Diameter - plenum rated

J. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb., UL Listed

K. Cable Manager and Wire Ties: Hook and loop style cable straps. Use of standard “hard notch-style” plastic wire ties is not acceptable.

1. Siemon VCM-xxxx-xxx (or approved equal)
2. Mille-Tie (or approved equal)

L. Pulling Compound or Lubricant: “Only non-water based, non-damaging to indoor-rated cable sheathing type.”

> List additional raceway products above as applicable to this project.

2.3 FIRESTOPPING

> Review and edit the following products/part numbers as applicable to this project. If firestopping material is specified in another section, the Engineer/Designer shall ensure that that section is listed in Part 1 - General above as a related section, and delete this paragraph in its entirety.

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

1. Specified Tech. Inc. (or approved equal).

> List additional firestopping products above as applicable to this project.

2.4 EQUIPMENT RACKS/ENCLOSURES

> The Engineer/Designer shall work closely with the DOC-TDI Specialist to design the rack layouts utilizing the DOC rack bay-face templates. DOC developed a rack design that positions the horizontal cable patch panels in a specific relationship to the LAN switches and voice cable patch panels that minimizes choke points for patch cables.

Note that certain TRs require installation of rack-mounted file servers. The two-post racks can not accommodate the larger servers and the hole patterns are not acceptable. The 4-Post Server Frames shall be used where servers are required. Where two or more racks are required, the two-post racks can be used for non-server type equipment. **Note that servers now require two-person installation into racks/cabinets – ensure clear working space available on each side of server for each person to support when installing into rack/cabinet!!!**

Review and edit the following products/part numbers as applicable to this project. The Engineer/Designer shall confer with the DOC Regional IT staff to determine if racks or cabinets are required, identify all of the equipment planned for the rack/cabinets, then work with the DOC-TDI Specialist to determine the types of racks/cabinets and quantities of each needed for each TR and ER, and how each should be configured for shelves, doors, etc. Note that most ERs require cabinets of specific manufacturer and type that may not be specified below.

Check with the DOC-TDI Specialist for samples of the Owner's rack designs that incorporate the following:
1. For single rack design, horizontal cable panels shall be located in the middle of the rack with LAN switch(s) and voice patch panels on opposing ends. Example: switches above and horizontal cable panels below.
2. For two rack design, horizontal cable panels shall be located on a rack separate from the voice patch panels. The LAN switch(s) shall be located on the same rack as the horizontal panels.
3. Where more than two racks, racks with LAN switch(s) shall be on one side and racks with voice patch panels shall be on the opposite side of rack(s) with horizontal cable panels.

A. Unless otherwise indicated, equipment racks/enclosures and incidental equipment color shall be:

1. Clear aluminum

B. Unless otherwise indicated, equipment rack/enclosure/wall-mounted brackets and incidental materials and equipment shall be provided by the selected Rack/Distribution Equipment manufacturer. Do not inter-mix products from different manufacturers.

The Engineer/Designer shall take care to coordinate the locations of floor-mounted power outlets with the space between the base plates of adjoining racks to avoid superimposing the base plates over the power outlets.

C. Provide each equipment rack, equipment frame, cabinet, and wall-mount bracket (set) with the following:

1. 2-Channel Free Standing Equipment Racks – "**not for installation of servers**:" EIA-standard 19-inch wide racks with universal alternating hole pattern, weight capacity of 1,000 lbs, complete with top angles, self-supporting bases, and mounting holes on both sides of the rails.

a. Racks:

1) For CPI: 7'0" high Universal Rack 463-5-3-x-03 (or owner approved equal)

2) For Leased offices where ceiling height is an issue for 7 foot racks:

a) For CPI: 6’6” high Universal Rack 463-5-3-x-02 (or owner approved equal)

b) For CPI: 6’0” high Universal Rack 463-5-3-x-01 (or owner approved equal)

The Engineer/Designer shall determine both the quantity and length of all patch cords required for all Owner equipment and telecommunications components within the racks/cabinets and also for the work area outlets. The length of the patch cords for the racks/cabinets shall be determined by the Engineer/Designer based on optimum routing; cords of excessive length shall not be specified.

The vertical and horizontal cable managers specified for the racks/cabinets shall be of the size and quantity to accommodate all of the anticipated patch cords. Vertical cable managers shall be sized by using cable quantities “at a minimum of 15% below” the manufacturer’s “50% fill level” table for each product.

1. For 2-post racks, dual-sided vertical cable managers should always be specified.
2. For 4-post racks, depending on what is placed in the rack, dual-sided vertical cable managers may also be needed (like for horizontal cables into rear of patch panels).
3. Narrow vertical cable managers, like CPI’s “VCS”, should not be used.
4. A double-sided vertical cable manager should typically be specified for each side of a rack. An exception allowing only one vertical cable manager on one side of a single rack may be allowed where the horizontal cable count will never go beyond 96.
5. Where racks are side by side, a vertical cable manager shall be in-between each rack and on each end rack. Example: two racks shall typically have three vertical cable managers.
6. Patch cords should never route across the center line of equipment or panels. Specify horizontal jumper trays to transition cords across racks.
7. Where the horizontal cable count is above 192, the deeper and wider (10 or 12 inch wide) vertical cable managers shall be specified.
8. Horizontal cable managers shall be placed both above and below each small LAN switch (typically 12- 48 port switch).
9. Core switches (blade types like Cisco 65xx models) should be mounted in racks using vertical cable managers with extended fingers or extended finger brackets (like CPI 12891-70x) shall be specified to support the switch end of the patch cords.

b. Vertical Cable Management for 7-foot high rack channels:

1) For CPI:

a) 6 Inch Wide:

i. Double-Sided 12.75” Deep, Vertical Cabling Section (VCS): 11729-503

ii. Single-Sided 6.38” Deep, Vertical Cabling Section (VCS): 11374-503

iii. Double-Sided 24.5” Deep, Evolution g2: 35521-703

iv. Single-Sided 13.2” Deep, Evolution g1: 35511-703

b) 10 Inch Wide:

i. Double-Sided 24.5” Deep, Evolution g2: 35523-703

ii. Single-Sided 13.2” Deep, Evolution g1: 35513-703

c) 12 Inch Wide:

i. Double-Sided 24.5” Deep, Evolution g2: 35524-703

ii. Single-Sided 13.2” Deep, Evolution g1: 35514-703

c. Guard rail:

1) For CPI: 400-56-x-19 (7 inches deep)

d. Cable Support Bars: 5” deep:

1) AMP 557548-1 (or approved equal)

e. Vertical Wire Managers:

1) For routing ARMM tie cables along the outside of the rear rail of equipment racks to SYSTIMAX® 1100PSCAT5E rack-mounted voice patch panels:

a) For CPI: Vertical Wire Management Loop 13079-001

2. <u>4-Channel</u> Free Standing Server Frames: EIA-standard 7-foot high x 19-inch wide x 29-inch deep, “**designed specifically for rack-mounted servers”** (channels with alternating square hole pattern for cage nuts to adapt to M6, 10-32, or 12-24 server mounting screws), weight capacity of 1,000 lbs, complete with two top angles, two base angles, two horizontal braces, self-supporting bases, top and bottom extension pans, top pan shall have cable access ports.

a. Server Frames:

1) For CPI:

a) Adjustable ServerRack 1521x-xxx

b) QuadraRack® Server Frame 15053-x03

2) Amco

3) Great Lakes

Designer shall obtain cage nut thread size from DOC Regional IT staff – based on type(s) of servers to be installed, and modify text below accordingly

b. Cage Nuts for server frame:

1) For CPI QuadraRack®, Size @ M-6: 12637-001

2) For CPI QuadraRack®, Size @ 10-32: 12638-001

3) For CPI QuadraRack®, Size @ 12-24: 12639-001

c. Single-sided 6-inch wide, 7-foot high cable channels for vertical cable management:

1) For CPI:

a) Single-sided Wide Vertical Cabling Section: 11374-x03

d. Guard rail:

1) For CPI: 40056-x19 (7 inches deep)

e. Cable Support Bars: 5” deep:

1) AMP (or equal) 557548-1

3. Wall-mount Swing Gate Equipment Racks: Open EIA-standard 19-inch wide, hinged, wall-mount swing gate rack with universal alternating hole pattern.

   a. Swing gate racks:

      1) For all buildings requiring wall mount racks, racks shall be a minimum of 35 inches high (20U), minimum 24 inches deep:

         a) For CPI: Standard Swing Gate Wall Rack 11791-x25

            i. For CPI – Include: HD Swing Gate Kit 12795-x01

      2) Each rack shall be provided with:

         a) Jumper rings/loops for vertical cable management:

            i. For CPI: 1307 (or approved equal)

         b) Cable Support Bars: 5" deep:

            i. AMP 557548 (or approved equal)

4. Wall-mount Cabinets: EIA-standard 19-inch wide (interior rack dimension), dual locking hinge (for front and back access), wall-mount cabinets with universal alternating hole pattern. Complete with fan/filter kit for cooling, with mounting holes on both sides of the rails, and a metallic, lockable door.

   a. For CPI:

      1) CUBE-iT PLUS® Wall-Mount Cabinet:

         a) 18 RMU, 24" W x 36" H x 30" D: 11996-236

         b) 26 RMU, 24" W x 38" H x 30" D: 11996-248

      2) Fan & Filter Kit for CUBE-iT PLUS® Cabinet:

         a) 100 CFM Fan: 12804-701

         b) Fan filter kit: 12805-x01

         c) Box of 6 filters: 12806-001

   b. Or Owner approved equal.

Engineer/Designer shall work directly with the DOC Regional IT staff and IT management to determine if power distribution units, power strips, and/or surge protectors are needed and if so, determine the correct size and model.
*-Consideration shall be given to placing a **"stand-by"** surge protector in the rack to be used to bring equipment back online using direct AC power in the event of a UPS unit or battery failure. It may take several weeks to obtain a replacement UPS or battery.

TDI Design Criteria for UPS, Power Strips and Surge Protector:
-Specify a UPS with sufficient outlet receptacles for direct plug-in of all equipment mounted on the rack.
-UPS shall plug directly into a dedicated technical outlet.
-If UPS has two power supplies, then each should plug directly into a separate dedicated technical outlet.

-Per APC recommendations, power strips and surge protectors should not be used; only a PDU should be connected to a UPS to supply additional outlets; use of any non-APC components with an APC UPS could void the APC Equipment Protection Policy (EPP).
-If a PDU is desired, consider specifying a metered unit.
-If for any reason additional outlets are required beyond those available on the UPS, a larger UPS or second UPS should be acquired.
-Any power strips or surge protectors allowed shall be mounted towards the bottom of racks above any rack-mounted UPS; they shall not be mounted within or out from the vertical cable managers where the highest potential exists for EMI into the patch cords.
-Based on the selected components, the Engineer/Designer shall identify any affect to the electrical outlet requirements dedicated for the rack and convey that information to the Architect for coordination in the electrical specifications including the power panel.

5. 120 VAC / 15 Ampere Surge Protector:

   a. Horizontal mount for 19” Equipment Racks: Complete strip (19” in length) with mounting hardware to install toward the bottom rack RU’s.

      1) For APC 9-outlets: NET9RMBLK

      2) For Tripp Lite 12-outlets: IBAR12

6. 120 VAC / 20 Ampere Power Distribution Unit (PDU) basic units, not metered:

   a. Horizontal mount for 19” Equipment Racks:

      1) For APC, Switched, 1RU, (8)5-20R outlets, L5-20P (locking) 12’ cord: AP7901

      2) For Wright Line, 1RU, (9)5-20R outlets, 5-20P 9’ cord: PD192011

      3) For Tripp-Lite, 1RU, (13)5-20R outlets, 5-20P 15’ cord: PDU1220

Coordinate with DOC personnel to determine if shelves, drawers or other rack accessories are desired/required.

7. Grounding kit and #6 AWG insulated copper conductor grounded to the nearest TGB.

   a. For CPI: CPI grounding kit

8. Incidental materials required for proper construction, mounting and securing.

List additional Equipment Racks/Enclosure products above as applicable to this project.

2.5 GROUNDING AND BONDING

Review and edit the following products/part numbers as applicable to this project.

A. As specified under Division 16 Section – “Grounding and Bonding for Telecommunications.”

List additional Grounding and Bonding products above as applicable to this project.

2.6 PATCH PANELS

For prison new construction and total remodel of buildings, specify the CAT 6A X10D products. The CAT 6 XL products shall be used when adding drops to an existing building with the XL or older products.

Review and edit the following products/part numbers as applicable to this project.

A. Copper Patch Panels: Complete with pre-manufactured cable management for supporting station cable behind the patch panel, cable strain relief wire management for complete support of patch cables in front, and with incidental materials necessary for mounting. Unless otherwise indicated, copper patch panels shall be manufactured by the selected SCS Manufacturer.

1. For Horizontal Distribution at Gigaspeed 1000BASE-T: Shall exceed Category 6 transmission requirements for connecting hardware as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801.

a. For SYSTIMAX®:

1) CAT 6 XL RJ-45 (wired for T568B):

a) 24 Port – PATCHMAX GS3 GigaSPEED XL (2 RU): PM-GS3-24 (700173735)

b) 48 Port – PATCHMAX GS3 GigaSPEED XL (3 RU): PM-GS3-48 (700173743)

2. For Horizontal Distribution at Gigaspeed 10GBASE-T: Shall meet or exceed Category 6A transmission requirements for connecting hardware as specified in TIA/EIA-568-B.2-10 and ISO 11801 Class EA channel specifications amendment to 500 MHz.

a. For SYSTIMAX®:

1) CAT 6A X10D RJ-45 (wired for T568B):

a) 24 Port – PatchMAX GS5 GigaSPEED X10D (2 RU): PM-GS5-24 (760060913)

b) 48 Port – PatchMAX GS5 GigaSPEED X10D (3 RU): PM-GS5-48 (760060921)

3. For Administrative Voice Cross-Connection to Horizontal Distribution Panels:

a. For SYSTIMAX®:

1) For CAT 5e (wired for T568B):

a) 24 Port – modular jack panel (1 RU): 1100PSCAT5E-24 (108208919)

b) 48 Port – modular jack panel (2 RU): 1100PSCAT5E-48 (108208935)

2) For CAT 5 modular with 25 pair female 525 connectors on the back (wired for T568B):

a) 4 x Telco to 24 x RJ45 – modular jack panel: 2500CAT5PS-24B (108236142)

b) 8 x Telco to 48 x RJ45 – modular jack panel: 2500CAT5PS-48B (108236159)

B. Fiber Patch Panels: Pre-assembled enclosures with connector panels, blank connector panels (for unused connector panel slots), and cable strain relief wire management – minimum of one per patch panel, complete with fiber connectors and fiber optic receptacle adapters (see CONNECTORS below), and with incidental materials necessary for mounting. Fiber patch panels shall be manufactured by the selected SCS Manufacturer:

1. For Backbone Distribution:

   a. For SYSTIMAX®:

      1) Rack mounted patch panels (2U to 4U, 6 to 72 duplex ports):

         a) For low density applications:

            i. 600G2 Fiber Optic Modular Shelf - Slide Version

               (1) 1-RU (24 SC connections) 600G2-1U-MOD-SD (760028324)

               (2) 2-RU (48 SC connections) 600G2-2U-MOD-SD (760032086)

         b) For high density applications:

            i. 1000G2 Fiber Optic Modular Shelf

               (1) 4-RU (72 SC connections) 1000G2-4U-MOD-SD (760023200)

> DOC prefers to not use wall-mounted patch panels. Use of them shall first be approved by the DOC-TDI Specialist.

      2) Wall-mounted patch panels (6 to 24 duplex ports), (<u>allowed only where shown on Construction Documents</u>, requires D-181707 Fusion Splice Adapter Kits (105289664) for splices & pigtails).

         a) 12 connector Lightguide Interconnection Unit 100A3 LIU (106896947)

         b) 24 connector aluminum Lightguide Interconnection Unit 200A LIU (105535926)

            i. Connectors: Duplex SC (see CONNECTORS below)

            ii. Connector panels: Duplex SC (high-density)

            iii. Connector panels: Duplex LC (high-density)

      3) G2 Modules (MODG2-xxx-xx-xx-x):

         a) Shall be with pre-assembled and factory-terminated pigtails and reflect correct industry color for type of installed fiber.

> The Engineer/Designer shall refer to hidden text notes earlier under racks above Vertical Cable Management regarding rack design and cable management.

C. Patch Panel Horizontal Wire Management:

   a. For CPI:

      1) Patch Panel Wire Management Bar (12176-501)

      2) Large Horizontal Ring Panel, 6” deep ring, 2 RU (11564-519)

      3) Slip-On Cover for above Ring Panel (11764-519)

      4) Horizontal Wire Management Panel for VCS, 1.5” Offset, 1 RU (13070-519)

      5) Horizontal Wire Management Panel for VCS, 1.5” Offset, 2 RU (13075-519)

      6) Clip-On Cable Cover for above panels, 1 RU (12663-501)

7) Clip-On Cable Cover for above panels, 2 RU (12663-502)

8) Universal Horizontal Cable Manager, 5.14” deep, 2 RU (30130-719)

9) Universal Horizontal Cable Manager, 6.44” deep, 2 RU (30330-719)

10) Upper Jumper Tray, 3.5” deep, 2 RU (12183-519)

11) Upper Jumper Tray, 6” deep, 2 RU (13183-519)

12) Lower Jumper Tray, 3.5” deep, 2 RU (12185-519)

13) Lower Jumper Tray, 3.5” deep, double, 3 RU (12187-519)

14) Transition Plate (12186-501)

Any additional Patch Panel products beyond those listed above will require approval by the DOC-TDI Specialist.

2.7 OUTLETS & CONNECTORS

Review and edit the following products/part numbers as applicable to this project.

A. Copper Outlets (modular jacks): 8-position/8-conductor, insulation displacement connection (IDC), non-keyed, and shall accept modular 8-position/8-conductor plugs, complete with multicolored identification labels/icons for identification, and with a universally color-coded wiring pattern for both T568A and T568B. Copper connectors shall be manufactured by the selected SCS Manufacturer.

1. Horizontal Distribution:

Include connector information for each type of connector to be used on the project. Review the type of inmate phone system termination and coordinate with the correct connector type (green in color) if any.

For prison new construction and total remodel of buildings, specify the CAT 6A X10D products. The CAT 6 XL products shall be used when adding drops to an existing building with the XL or older products.

Engineer/Designer shall determine through Owner/Design Team as to the color of the modular outlet to be specified.

a. Category 3 (for Inmate Phone System): None required.

b. For Gigaspeed 1000BASE-T, shall exceed Category 6 transmission requirements for connecting hardware as specified in most current ANSI/TIA/EIA 568-B and ISO/IEC 11801. Shall be part of the UL LAN Certification and Follow-up Program:

1) For SYSTIMAX®:

a) GigaSPEED XL MGS400 Series (*color*) Product: MGS400-xxx-x (700206xxx) and mandatory Cap with Strain Relief for MGS Outlet (760056069)

c. For Gigaspeed 10GBASE-T, shall meet or exceed Category 6A transmission requirements for connecting hardware as specified in TIA/EIA-568-B.2-10 and ISO 11801 Class EA channel specifications amendment to 500 MHz. Shall be part of the UL LAN Certification and Follow-up Program:

1) For SYSTIMAX®:

a) GigaSPEED X10D MGS500 Series (*color*) Product: MGS500-xxx (760023xxx) and mandatory Cap with Strain Relief for MGS Outlet (760056069)

B. Fiber Pigtails: Use for fusion splicing to Indoor Riser or Outdoor Plant fibers for termination in a fiber distribution shelf or LIU.

1. For SYSTIMAX®:

a. For Single mode fiber:

1) For SC connector: BS1SC-UC-5 (700011083)

2) For LC connector: BS1LC-UC-5 (700010945)

b. For 62.5 um Multimode fiber:

1) For SC connector: BL1SC-UC-5 (700003353)

2) For LC connector: BL1LC-UC-5 (700006760)

c. For 50.0 um LazrSPEED Multimode fiber:

1) For SC connector: TZ1SC-UC-5 (760006429)

2) For LC connector: TZ1LC-UC-5 (760000653)

C. Fiber Connectors: Requires special DOC approval – allowed only where shown on Construction Documents. Complete with fiber optic receptacle adapters where required for mounting.

1. For SYSTIMAX® Horizontal Distribution:

a. For 62.5 um Multimode fiber, beige:

1) For SC using 3.0 mm cordage: P6200A-Z-125 (700007040)

2) For LC: P1001A-Z-125 (700007008)

2. For SYSTIMAX® Backbone Distribution:

a. For Multimode fiber, beige:

1) For SC: P6201A-Z-125 (700007024)

2) For LC: P1001A-Z-125 (700007008)

b. For Singlemode fiber 8.0/125 µm, blue:

1) For SC: P6001A-Z-125 (700006976)

2) For LC: P1101A-Z-125 (700011372)

List additional Connector products above as applicable to this project.

2.8 COPPER TERMINATION BLOCKS

Review and edit the following products/part numbers as applicable to this project.

A. Copper Termination Blocks: UL listed and exceed ANSI/TIA/EIA 568-B Gigaspeed specifications for performance. Include connecting blocks, designation strips, and labels for each 25-pair strip. Label colors per ANSI/TIA/EIA standards. Termination blocks shall be manufactured by the selected SCS Manufacturer:

1. 110 Blocks:

a. For SYSTIMAX®:

1) With Legs:

a) 100-pr: 110AW2-100 (107059891)

b) 300-pr: 110AW2-300 (107059917)

2) Without Legs:

a) 100-pr: 110DW2-100 (107059909)

b) 300-pr: 110DW2-300 (107059925)

b. Designation strips: 188UT1-50

c. Labels: 110xxx-4500L

d. IDC Connecting Blocks

1) For Horizontal Distribution: 4-pair markings, 110C-4

2) For Backbone Distribution: 5-pair markings, 110C-5

2. For Mounting on Backboards:

a. For SYSTIMAX®:

1) 110 Jumper Trough w/legs: 110A3 (107831133)

2) 110 Retainer Clip: 88A2 (107267452)

3) 110 Backboard w/legs: 188B2 (104405113)

4) 110 Distribution Ring: 18A (104049382)

3. For Mounting on Racks:

a. For SYSTIMAX®:

1) 110 Jumper Trough w/o legs: 110B3 (107831141)

2) 110 Backboard w/o legs: 188B1 (102689569)

3) 19-inch frame 110 Mounting Brackets :

a) 50/100-PR (3U): 110RD2-100-19 (107535593)

b) 200-PR (4U): 110RD2-200-19 (107535585)

c) 600-PR (12U): 110RD2-600-19 (108430779)

List additional Copper Termination Block products above as applicable to this project.

2.9 STATIONS

Review and edit the following products/part numbers asapplicable to this project.

A. Faceplates: Complete with port identification labels and blank inserts/fillers for covering unused connector openings:

1. Stations to be used for wall-mount telephones: Brushed stainless steel with stainless steel mounting lugs suitable for supporting wall-mount telephones:

a. SYSTIMAX®

b. HUBBLE, SUTTLE, or approved equal.

2. Inmate phone stations: None.

Security Faceplates - all faceplates at prison facilities shall be security style:

a. SYSTIMAX®

b. For HUBBLE: SWP8 (single gang) or SWP82 (double gang) and associated mounting strap

3. All other stations: Brushed stainless steel:

a. For SYSTIMAX®: MxxSP Series.

4. Security Screws: Torx Tamper-Resistant Head or approved equal.

a. All faceplates at prison facilities shall be fastened using security screws.

B. Faceplate Mounting Brackets: Suitable for mounting faceplates over wall cutouts (i.e. flush-mount faceplates with no in-wall outlet box). Not acceptable for wall mounted devices including wall phones. Wall mounted devices shall attach “only” to an outlet box or similar mounting device which is secured to a solid building component.

1. For CADDY:

a. Single gang faceplates: CADDY MP1P

b. Double gang faceplates: CADDY MPAL2

List additional Station products above as applicable to this project.

2.10 CABLE

Review and edit the following products/part numbers as applicable to this project.

A. General: Cables shall be manufactured by the selected SCS Manufacturer.

B. Copper Cable:

1. For Horizontal Distribution: 4-pair, UTP, 24 AWG, with solid copper conductors.

a. Category 3:

1) For SYSTIMAX®:

a) Plenum: 2010

b) Non-plenum: 1010

The Engineer/Designer shall work with the Owner to select a cable sheath color that is unique for each specific Category of cable within the facility. A different color shall be used for CAT 3, CAT 5, CAT 5e, CAT 6, and CAT 6A. 4CAT 6A shall be different color from CAT 6.

Note that the Outside Diameter of 1091/2091 is greater than 1081/2081 cable, which is greater than 1071/2071, which is greater than 1061/2061 due to the strength member. Calculate fill and size raceways accordingly.

For prison new construction and total remodel of buildings, specify the CAT 6A X10D 91-series cable and all components including patch cords.

The XL 1081/2081 cable shall be used when adding drops to an existing building with the 81 or older series cable.

For “most” leased offices, the 1071/2071 shall be used for lower costs unless there is a stated need for higher bandwidth.

Take note on conduit fill due to the larger outside diameter of the X10D 91-series cable!

b. For Gigaspeed 1000BASE-T, shall exceed Category 6 transmission requirements for connecting hardware as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801.

1) For SYSTIMAX®:

a) Plenum – unless otherwise noted on the Construction Documents:

i. Product:

(1) GigaSPEED XL – 2081

b) Non-plenum – unless otherwise noted on the Construction Documents:

i. Product:

(1) GigaSPEED XL – 1081

c. For Gigaspeed 10GBASE-T, shall meet or exceed Category 6A transmission requirements for connecting hardware as specified in TIA/EIA-568-B.2-10 and ISO 11801 Class EA channel specifications amendment to 500 MHz.

1) For SYSTIMAX®:

a) Plenum – unless otherwise noted on the Construction Documents:

i. Product:

(1) GigaSPEED X10D – 2091

b) Non-plenum – unless otherwise noted on the Construction Documents:

i. Product:

(1) GigaSPEED X10D – 1091

DOC does not generally allow the use of OSP rated cable in the horizontal data environment. If a design solution (approved by DOC-TDI Specialist) requires the use of OSP rated Category 6, then include the following paragraph. The Entrance Protector for this application is specified in the Outside Plant Communications Circuits section.

d. OSP Rated Category 6: Outdoor rated, shall exceed Category 6 transmission requirements as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801:

1) For SYSTIMAX®:

a) OSP: Non-plenum Category 6 Outdoor Cable – 1571

Product: SYSTIMAX® 1571 004ABK (760008888)

2. For Indoor Backbone/Riser Distribution:

a. Copper Backbone Cable: Shielded, 24-AWG solid copper conductor, and insulated with color coded PVC, UL Verified to ANSI/TIA/EIA 568-B for Category 3 performance. The selected SCS Cable Manufacturer shall manufacture the cable or specify another cable manufacturer:

1) For SYSTIMAX®:

a) Manufactured by Superior Essex (no substitutions):

i. ARMM Riser Cable 02-xxx-03 (xxx is pair count)

b. For Termination Block Connections (back-side): Unshielded, non-plenum multi-pair copper cable.

c. Multi-pair Copper Cable: 24-AWG, solid copper conductor, and insulated with color coded PVC, UL Verified to ANSI/TIA/EIA 568-B for Category 3 performance. Cable shall be manufactured by the selected SCS Manufacturer:

1) For SYSTIMAX®:

a) Non-plenum Category 3 Product: 1010

b) Plenum Category 3 Product: 2010

c) Low Smoke Zero Halogen Product: 3010

Engineer/Designer shall discuss with the DOC TDI Specialist which MMF shall be deployed on each project. Where new construction occurs at an existing campus that has 62.5 um fiber deployed, then 62.5 um MMF typically needs to be deployed within new buildings because numerous low voltage BAS systems utilize the MMF and daisy-chain through patch panels, rather than active electronics, which requires a uniformly sized MMF throughout the campus and buildings. For construction of a totally new prison campus or stand-alone buildings, 50 um MMF shall be used.

C. Fiber Cable:

1. For Riser Distribution:

a. For Multimode: Graded index, loose tube cable.

1) For 62.5/125 µm: Extended/high grade with a maximum attenuation of 3.0 dB/km @ 850 nm and 1.0 dB/km @ 1300 nm, and a minimum cable OFL bandwidth of 220 MHz/km @ 850 nm and 500 MHz/km @ 1300 nm, 1 Gbps Ethernet distance of 300 m @ 850 nm and 550 m @ 1300 nm. Cable shall be manufactured by the selected SCS Manufacturer:

    a) For SYSTIMAX®: OptiSPEED

        i. Plenum Product: 5201-002A-MPSL thru 5301-144A-MPSL

        ii. Riser Non-plenum Product: 5200-002A-MROR thru 5300-072A-MRSL

2) For 50.0/125 µm: A maximum attenuation of 3.0 dB/km @ 850 nm and 1.0 dB/km @ 1300 nm, and a minimum cable OFL bandwidth of 1500 MHz/km @ 850 nm and 500 MHz/km @ 1300 nm, and laser bandwidth of 2,000 MHz/km @ 850 nm and 500 MHz/Km, 1 Gbps Ethernet distance of 1,000 m @ 850 nm and 600 m @ 1300 nm, 10 Gbps Ethernet distance of 300 m @ 850 nm. Cable shall be manufactured by the selected SCS Manufacturer:

    a) For SYSTIMAX®: LazrSPEED 300

        i. Plenum Product: 5201-002A-ZPAQ thru 5301-144A-ZPAQ

        ii. Riser Non-plenum Product: 5200-002A-ZRAQ thru 5300-144A-ZRAQ

b. For Singlemode: Loose tube zero water peak with a maximum attenuation of 0.34 dB/km @ 1310 nm and 0.31 dB/km @ 1385 nm and 0.22 dB/km @ 1550 nm. Cable shall be manufactured by the selected SCS Manufacturer and shall be:

1) For SYSTIMAX®: TeraSPEED

    a) Plenum Product: 5201-002A-WPYL thru 5301-144A-WPYL

    b) Riser Non-Plenum Product: 5200-002A-WRYL thru 5300-144A-WRYL

c. For Hybrid/Composite: Multimode and singlemode characteristics and specifications shall conform to the above requirements. Cable shall be manufactured by the selected SCS Manufacturer and shall be:

1) For SYSTIMAX®: TeraSPEED/OptiSPEED (62.5/125 µm)

    a) Plenum Product: 5201-02/02A-W/MPSL thru 5301-36/36A-W/MPSL

    b) Riser Non-Plenum Product: 5200-02/02A-W/MRSL thru 5300-48/48A-W/MRSL

2) For SYSTIMAX®: TeraSPEED/LazrSPEED 300 (50.0/125 µm)

    a) Plenum Product: 5201-02/02A-W/ZPAQ thru 5301-36/36A-W/ZPAQ

    b) Riser Non-Plenum Product: 5200-02/02A-W/ZRAQ thru 5300-36/36A-W/ZRAQ

List additional Cable products above as applicable to this project.

2.11 CABLE ASSEMBLIES (PATCH CORDS) AND CROSS-CONNECTS

Review and edit the following products/part numbers as applicable to this project.

A. Hook and Loop Style Cable Managers: Reusable (Velcro based) hook-&-loop style, adjustable tension, roll or spool dispensed. **Plastic wire ties are not acceptable & shall not be used except as specifically directed**.

1. SIEMON VCM-xxxx-xxx (or approved equal)

2. Mille-Tie (or approved equal)

Patch cables will generally be furnished by the Contractor and delivered to DOC IT personnel at the facility for installation. DOC personnel shall determine lengths of patch cables and colors. Note that patch cable color for inmate LANs shall be green, no other patch cables shall be green in color.

B. Copper Patch Cables: Pre-manufactured (factory-terminated), stranded unshielded twisted pair (UTP), with 8-pin modular plugs and/or termination block-style patch plugs. Patch cables shall be manufactured by the selected SCS Manufacturer.

1. For Horizontal Distribution:

a. Gigaspeed 1000BASE-T Category 6 transmission shall exceed requirements as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801. Gigaspeed 10GBASE-T Category 6A transmission shall meet or exceed TIA/EIA-568-B.2-10 and ISO 11801 Class EA channel specifications amendment to 500 MHz. Modular plugs shall be complete with snagless boots.

1) SYSTIMAX® 4-pair Modular-to-modular plugs (8-pin to 8-pin):

a) 1000BASE-T GigaSPEED XL, Product: GS8E

b) 10GBASE-T GigaSPEED X10D, Product: GS10E

C. Fiber Patch Cables: Pre-manufactured (factory-terminated) with a UL rating of OFNR. Fiber patch cables shall be manufactured by the selected SCS Manufacturer.

1. For Backbone Distribution:

a. For Multimode 62.5/125 µm: SYSTIMAX® OptiSPEED

1) For SC-to-SC, duplex, 3.0 mm cordage: FPC-M-SC-SC-3-2-R-F-xxx (feet: 4,5,10,15,20,25), longer lengths available in 1.6 mm cordage.

2) For SC-to-MTRJ, duplex, 1.6 mm cordage: FPC-M-SC-MJ-3-2-R-F-xxx (feet: 4, 6, 8, 10, 15, 20, 25)

3) For LC-to-SC, duplex, 1.6 mm cordage: FPC-M-LC-SC-3-2-R-F-xxx (feet: 4, 6, 15)

4) For LC-to-LC, duplex, 1.6 mm cordage: FPC-M-LC-LC-3-2-R-F-xxx (feet: 2, 4, 5, 6, 8, 10, 15, 20, 25, 30, 35, 40, 50, 55, 70,100, & custom)

5) For LC-to-MTRJ, duplex, 1.6 mm cordage: FPC-M-LC-MJ-3-2-R-F-xxx (feet: 4, 6, 8, 10, 15, 30)

b. For Multimode 50.0/125 µm: SYSTIMAX® LazrSPEED

1) For SC-to-SC, duplex, 3.0 mm cordage: FPC-X-SC-SC-3-2-R-F-xxx (feet: 4, 6, 10, 20, 30, 40, 50, & custom)

2) For SC-to-SC, duplex, 1.6 mm cordage: FPC-X-SC-SC-3-2-R-F-xxx (feet: 4, 6, 10, 20, 30, 40, 50, 85, 105, & custom)

3) For LC-to-MTRJ, duplex, 1.6 mm cordage: FPC-X-LC-MJ-3-2-R-F-xx (feet: 4, 6, 10, 20, 30, 40, 50, & custom)

4) For LC-to-SC, duplex, 1.6 mm cordage: FPC-X-LC-SC-3-2-R-F-xxx (feet: 4, 6, 10, 20, 30, 40, 50, & custom)

5) For LC-to-LC, duplex, 1.6 mm cordage: FPC-X-LC-LC-3-2-R-F-xxx (feet: 4, 6, 10, 20, 30, 40, 50, 85, 105, and custom)

c. For Singlemode 8.0/125 µm: SYSTIMAX® TeraSPEED

1) For SC-to-SC, duplex, 3.0 mm cordage: FPC-W-SC-SC-3-2-R-F-xxx (feet: 5, 10)

2) For SC-to-SC, duplex, 1.6 mm cordage: FPC-W-SC-SC-2-2-R-F-xxx

3) For LC-to-SC, duplex, 1.6 mm cordage: FPC-W-LC-SC-2-2-R-F-xxx (feet: 10, 20)

4) For LC-to-LC, duplex, 1.6 mm cordage: FPC-W-LC-LC-2-2-R-F-xxx (feet: 4, 5, 6, 8, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100)

D. Copper Jumper Wire: Category 3 (for cross connects), manufactured by the selected SCS Manufacturer.

List additional Cable products above as applicable to this project.

2.12 COPPER TERMINATION TOOL:

A. For SYSTIMAX®:

1. Impact Tool (Handle & Blade): 8762D Kit (406477794)

2. Impact Tool (Handle only): D-914 Impact Tool (407484971)

a. Replacement Blade:

1) SYSTIMAX® M110 Blade (407728427)

2) ANIXTER (Harris Corp. EverSharp): Anixter #227857, Harris #10176-500

2.13 LABELS

Review and edit the following products/part numbers as applicable to this project. Any additional labels or changes to size or formatting shall be reviewed and approved by the DOC TDI Specialist.

A. Labels and Tags:

1. Identifiers shall follow the format and definitions per ANSI/TIA/EIA 606-A Class 3 administration and as identified in the Construction Documents. Labels shall be permanent (i.e. not subject to

fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

a. Labels for Station Cable:

1) Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

b. Labels for Marker Tags shall be a minimum size of 2.0” W x 1.0” H:

1) Panduit:

a) Clear L3PL3CL

b) White L3PL3WH

c. Marker Tags for Conduit and Cable shall be a minimum size of 3.5” W x 2.0” H, constructed of rigid vinyl with a clear over-laminate protection (self-laminating), with slots for installing as a wrap and/or flag with nylon cable ties with a minimum loop tensile strength of 40 pounds. Labels applied to tags shall be typed and created by a label maker or an approved equivalent software-based label making system (see above). Handwritten labels are not acceptable.

1) Tags:

a) Panduit: Self-Laminating Cable Marker Rigid (Non-Adhesive) Tag #PST-FOBLNK (no substitutions)

2) Nylon Cable Ties (minimum 40 LB loop tensile strength):

a) Panduit: PAN-TY #PLTxI-C (or approved equal)

2. Hand-carried label maker:

a. Brady: ID Pro Plus, IDXPERT, HandiMark, TLS2200 (or approved equal).

3. Signs: Permanent plastic or metal engraved, not subject to fading or erasure, waterproof and solvent resistant, permanently affixed.

3 PART 3 - EXECUTION

PART 3 - EXECUTION

Ensure that products incorporated into the project under PART 3 paragraphs have corresponding Product information in PART 2 – Products, or in another specification Section if installed but not supplied under this Section.

DOC has standardized on SYSTIMAX® Communication for all new Structured Cabling Systems in DOC facilities. Installation requirements shall be specified accordingly.

The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If other products are approved, the Engineer/Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and written with equal or greater detail to the following paragraphs.

The products listed throughout PART 2 – Products and the installation requirements below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by the design are specified in Part 2 with corresponding installation requirements specified in Part 3.

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

1. In the event of damage to DOC telecommunications infrastructure, Contractor shall immediately stop any work that could potentially further the damage and contact the Owner:

- For Capital Projects, Owner shall be the DOC Capital Programs Project Manager
- For all other projects, Owner shall be the DOC Regional IT Manager

a. The DOC Owner shall immediately provide information of the damage to the DOC Regional IT Manager and/or the DOC Telecommunications Distribution Infrastructure (TDI) Specialist assigned to support the facility, and the facility manager.

b. Only the DOC TDI Specialist working in concert with DOC IT, Plant, and Capital Programs managers shall determine the repair and/or replacement strategy. Contractor shall not make this determination, make any temporary repairs or replace any telecommunications infrastructure unless directed to do so in writing by the DOC TDI Specialist.

c. All damaged telecommunications infrastructure shall be restored to within the scope of the original design, installation, operational, and warranty parameters (or better) by a contractor of Owners choosing. Only a certified SYSTIMAX® Value Added Reseller (VAR) shall work on the telecommunications cabling. Restoration shall include, but not be limited to all repair and/or replacement work and materials, testing, and re-certification of the infrastructure for full compliance to Owner's TDI Standards and SYSTIMAX® SCS and/or other manufacturer's warranty requirements.

F. Remove surplus material and debris from the job site and dispose of legally and per Contract Document requirements.

G. Owner and Engineer/Designer Inspections: Contractor shall coordinate with Owner and Engineer/Designer to schedule in advance, dates for observations as indicated below. Owner and Engineer/Designer will determine if onsite observations are required for all work listed below or portions thereof.

1. Contractor shall provide one week advance notice to Owner and Engineer/Designer when work listed below is scheduled.

2. Contractor shall provide a minimum of 2 days advance notice to Owner and Engineer/Designer of dates when work listed below will be ready for observation.

3. Work requiring observation by Owner and Engineer/Designer:

   a. Placement of racks and cabinets, rack cable distribution hardware, cable runways. Observations shall occur during initial placement and finished placement prior to installing cables and equipment.

   b. Placement of backboards (see Division 09). Observations shall occur after painting of plywood but prior to placement on walls and prior to attachment of any hardware or cable supports.

   c. Pulling cable through conduit. Observations shall occur during initial pulling and periodically throughout the installation project.

   d. Installation of cable terminations onto Work Area outlets and at patch panels. Observations shall occur during initial terminations and periodically throughout the installation process.

   e. Testing of cables. Observations shall occur, at a minimum, during initial cable testing.

   f. Demolishing existing telecommunications cable. Observations shall occur during initial cable removal and periodically throughout the demolition process.

   g. On-site visits by SYSTIMAX® inspectors for inspecting and certification of the cabling system. Owner and Engineer/Designer shall be notified of scheduled visit dates.

3.2 DEMOLITION

> The Engineer/Designer shall coordinate with local DOC IT Manager and DOC Plant Manager to determine whether DOC wishes to retain certain demolished material or wishes to have it hauled away. Review any demolition requirements for this project with the DOC project manager and edit the following paragraph or create a similar paragraph as applicable.

A. Demolish existing telecommunications equipment, cable, materials, and incidentals no longer in use after installation of and cutover to the new SCS.

   1. When removing cable(s) from conduit where other cables are left in place, do not exceed the maximum pulling tension of any cable left within the conduit (this shall be the cable left in the conduit with the lowest maximum pulling tension). This shall typically be 25 pounds/ft. maximum pulling tension.

   2. Properly and legally dispose of all materials demolished by the Contractor per Contract Document requirements.

B. When demolishing existing surface plastic/metal raceway, patch and/or paint wall to match existing undisturbed wall finish after raceway is removed.

3.3 RACEWAY

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Surface Raceway: Provide for all surface mounted stations as shown in the Construction Documents.

1. Size surface raceway according to the quantity of cable to be routed through it according to ANSI/TIA/EIA-569 cable capacity standards, plus an additional 100% for future expansion. Size fittings/bends to accommodate Category 6 and fiber optic bend radii as specified in ANSI/TIA/EIA-569.

2. Match surface raceway finish as close as possible to the finish of the wall it is to be mounted on but do not paint surface raceway. Surface raceway shall be:

   a. Installed per Article 352 of the NEC. Surface raceway shall be installed as mechanically and electrically continuous and bonded in accordance with NEC and ANSI/TIA/EIA 607 codes and standards.

   b. Installed according to ANSI/TIA/EIA standards for fiber optic and Category 5/6 bend radii. Bend points shall have a minimum two inch radius control.

   c. Securely supported using screws or other anchor-type devices (tape or glue is not an acceptable support medium) at intervals not exceeding 5 feet and with no less than two supports per straight raceway section. Surface raceway shall be supported in accordance with the manufacturer's installation requirements.

   d. Completely installed including insulating bushings and inserts where required by manufacturer's installation requirements.

   e. Installed parallel and perpendicular to surfaces or exposed structural members, and following surface contours where possible.

   f. Close any unused raceway openings.

B. Backboards: Backboards of non-treated A-C Plywood and painted with fire retardant paint shall be provided per Division 06 and 09 as shown on Construction Documents. Backboards shall be capable of supporting attached equipment.

C. Sleeves: Provide sleeves where required for cable pass-thru through building structures and/or fire rated barriers. Provide roto-hammering or core drilling where required for sleeve installation. Seal between sleeve and building structure and/or barrier or provide firestop material for fire-rated structure/barriers.

1. Size sleeves:

   a. As noted in the Construction Documents.

   b. Where not noted, size sleeves a minimum of 2 inches in diameter or by the type and quantity of cable to be routed through the sleeve per ANSI/TIA/EIA 569 cable capacity standards plus an additional 100% for future expansion - whichever is greater.

   > The Engineer/Designer shall include cable runway radius bends on the drawings to support cables where they pass through sleeves then transition in elevation.

2. Where cable passing through sleeves transitions in elevation, additional means of support shall be constructed to prevent distortion to the outer jacket of bottom-layer cables:

   a. Provide cable runway radius bends attached to the wall at the immediate bottom edge of sleeve for cable transition to a higher or lower elevation. For lower elevation, requires (90-degree runway outside bend -to- vertical cable runway section -to- 90-degree runway inside bend).

b. If a cable runway radius bend or other appropriate means is not immediately adjacent to the outside bottom edge of sleeves and distortion to the outer jacket of bottom-layer cables is still possible, a cushion edge support, such as a slit innerduct attached to the end of the sleeve or other appropriate means shall be constructed.

D. C-Rings: Provide C-Rings mounted on walls or backboards at 6 inch intervals and as shown in the Construction Documents. C-Rings shall not be used as a direct support for horizontal voice or data cables in ceiling spaces (see Cable Supports) or as a substitute for a ladder rack.

E. D-Rings: Provide D-Rings as necessary to route exposed cables on backboards in telecommunications rooms and as shown in the Construction Documents. D-Rings may be affixed to wall structures or other supports, but not attached to a ceiling support system. D-rings shall not be used as a direct support for horizontal voice or data cables in ceiling spaces (see Cable Supports) or as a substitute for a ladder rack. Mount D-rings at a minimum of 12 inch intervals and as shown in the Construction Documents.

F. Cable Supports (J-Hooks, Bags): Provide cable supports for routing cable in non-exposed open access environments as shown in the Construction Documents. Cable supports may be affixed to wall/ceiling structures or other supports, but not attached to a ceiling support system. Mount cable supports at **4 foot intervals** unless otherwise specified in the Construction Documents.

1. Determine the quantity and size of cable supports according to the type, size, and quantity of cable to be routed through the support plus an additional 25% for future expansion.

2. Do not use cable supports for more cables than the DOC down-sized rating capacity as stated in Part 2 *Products*. Provide alternative supports (bags) or additional pathway(s) where the total cable count exceeds the largest size cable support per the DOC rating capacity.

3. Do not use cable supports to directly support fiber optic cable without additional pathway, such as innerduct or conduit.

G. Cable Runway: Install cable runway per manufacturer's instructions with flat (rung) side up (side rail protrusions shall point downward toward floor). Size and install as shown in the Construction Documents, to include:

1. Provide cable runway to route cable from entrance points of room to racks/cabinets within telecommunications/equipment rooms, pass-thru locations, all elevation changes of cabling, and in locations shown in the Construction Documents. Cut ends of cable runway square. Ream cut ends to remove burrs and sharp edges. Cap open ends of runway with manufacturer's recommended protective end caps.

2. Where cable runway direction routes into a 90-degree change, an L-shape, or around a wall corner, transition runway to a Cable Runway E-Bend.

3. Where cable runway intersects into a T or X-shape, Cable Runway Corner Brackets shall be installed.

4. Cable runway (regular and/or alternate space styles) shall be installed above equipment racks and cabinets at an elevation sufficiently high enough to provide clearance above racks/cabinets for installation of Cable Radius Drops and allow cables to be installed in compliance to the *"ISP Telecommunications Clearances for EMI Reduction"* table in Section 3.11 of this document.

   a. A minimum headroom access of twelve (12) inches shall be maintained above cable runways.

   b. A combination of alternate space and/or regular space Cable Runway sections may be required to properly align the Cable Radius Drop modules.

5. Cable runway shall not be secured directly to floor standing equipment racks/cabinets.

    a. Any exceptions granted shall only be approved by Owner in writing and shall require:

        1. Runway mounting plate shall attach to the rack so the top rack management unit (RMU) is useable.

        2. Runway shall be elevated above top of rack/cabinet to allow full unobstructed installation of runway radius drops over the rack/cabinet.

6. Provide Cable Runway Radius Bend or Radius Drops wherever cable changes elevation, transitions from through-wall sleeves, drops from one section of runway to another lower section of runway or into racks/cabinets or vertical cable management locations.

7. Install cable radius drops above racks/cabinets in positions that allow cable to flow over radius drop directly into vertical cable management locations between or into racks/cabinets. Transitioning to an *"alternative space cable runway"* may be necessary to achieve appropriate cable runway rung spacing.

    a. A combination of alternate space and/or regular space Cable Runway sections may be required to properly align the Cable Radius Drop modules.

8. Provide Cable Retaining Posts for all sides of cable runway not directly adjacent to a wall. Affix posts at 2 foot centers and at corners and/or junctions.

9. Provide a continuous bond from the TGB across all cable runways, including all runway sections, with Cable Runway Grounding kits. Each rack/cabinet shall be individually bonded to the TGB. Do not bond racks/cabinets to the cable runway due to potential seismic events.

H. Innerduct: Provide bright orange UL Listed innerduct as pathway for fiber optic cables and as shown in the Construction Documents. Provide UL Listed flexible textile innerduct as shown in the Construction Documents for other cables.

    1. Innerduct installed in plenum-rated environments shall be plenum-rated. All other innerduct shall be riser-rated.

I. Pull Strings: Provide a pull string in existing conduits and innerducts that are to remain vacant after existing cable is demolished and in existing and new conduits and innerducts that have new cable installed under this project.

List additional Raceway product installation requirements above as applicable to this project.

3.4 FIRESTOPPING

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

B. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.

    1. Provide firestopping material for through and membrane penetrations of fire-rated barriers.

    2. Install firestops in strict accordance with manufacturer's detailed installation procedures.

3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply sealing material in a manner acceptable to the local fire and building authorities.

4. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.

5. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

C. Label each penetration upon firestop installation completion using label compliant with most-current ANSI/TIA/EIA-606-A format. After labeling, take digital photo of each penetration including label within photo, and submit to both Owner and Engineer/Designer.

> List additional Firestopping product installation requirements above as applicable to this project
> .

3.5 EQUIPMENT RACKS/ENCLOSURES

> See the DOC Telecommunications Distribution Design Guide for information on required drawing content, including telecommunications room Plan Views discussed below. Verify with DOC facility IT personnel whether vented shelves are to be provided for Owner installation.
>
> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.
>
> Provide special attention to vertical cable managers within cabinets, specifying appropriate manufacturer's materials to provide adequate cable management.

A. Provide EIA racks/cabinets and all associated hardware according to locations, elevations, and plan views as shown in the Construction Documents and furnish shelves directly to the Owner (not installed in the rack) for future Owner installation.

1. Where shelves are furnished, provide earthquake tie-down straps and mounting hardware.

2. The CPI Universal Rack Model 46353-x03 is permitted for use in both Telecommunications Rooms and Equipment Rooms.

B. For Floor Mount Racks/Cabinets:

1. Install as shown on the Construction Documents.

2. <u>Per Telcordia-GR-63-CORE, the framework base of racks and cabinets shall be attached to the floor without auxiliary support or bracing from the building walls or ceilings. Do not secure racks/cabinets to cable runways due to potential seismic events.</u>

3. Bolt rack/cabinet to floor using ½ inch or larger Grade 8 bolts. For raised floors, equipment racks/cabinets shall be securely anchored to the sub-floor. For concrete floors and sub-floors, concrete floor expansion anchors shall be used at an embedment depth of 3.5 inches. Expansion anchors shall be suitable for earthquake (dynamic) applications, as specified by the manufacturer.

C. Free Standing Equipment Racks (2-Channels):

1. Provide six (6) cable support bars per rack to be used for additional cable support and routing control in the rear of the rack.

2. Provide one Double-Sided Vertical Cabling Section per each side of each rack. Where multiple side by side racks are provided, provide one Double-Sided Vertical Cabling Section between each rack.

D. Free Standing Equipment Frames (4-Channels) and Cabinets:

1. Provide six (6) cable support bars per frame/cabinet to be used to provide additional cable support and routing control in the rear of the frame/cabinet.

2. Provide four Single-Sided Vertical Cabling Sections per 4-post frame, positioned on the left front, right front, left rear, and right rear of each frame channel. Where multiple side by side 4-post frames are provided, provide two Single-Sided Vertical Cabling Sections between each frame, one in front and one at the rear.

3. Cabinets shall have four internal Vertical Cabling Sections equal to 4-post frames; else provide Vertical Cabling Sections external to cabinets as identified for 4-post frames above.

E. Wall Mount Swing Gate Equipment Racks: Provide racks, sized and located as shown on the Construction Documents.

1. Provide Jumper rings/loops mounted at 8” intervals along each vertical rack rail.

2. Mount Wall-Mounted racks on unistrut rails in order to provide the 24” deep wall-mount rack with a minimum 26” depth.

3. Provide up to six (6) cable support bars per rack to be used to provide additional cable support and routing control in the rear of the rack.

F. Wall-Mount Rack Enclosures/Cabinets: Provide in sizes and locations as shown on the Construction Documents.

G. Hinged Wall-Mounted Brackets: Provide in sizes and locations as shown on the Construction Documents.

H. Flush Mounted Wall Brackets: Provide in sizes and locations as shown on the Construction Documents.

> List additional Equipment Rack/Enclosure product installation requirements above as applicable to this project.

3.6 GROUNDING AND BONDING

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

> Verify and edit referenced section titles.

1. Provide a minimum of one wall-mountable telecommunications ground bus bar per telecommunications room and as shown on the Construction Documents.

2. Bonding conductor shall be installed to bond all non-current carrying metal telecommunications equipment and materials to the nearest TMGB or TGB (as provided under Division 16 Section — "Grounding for Communications Circuits and Raceway").

   a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

   b. Provide a continuous bond from the TGB across all cable runways, including all runway section butts with Cable Runway Grounding kits.

   c. Each rack/cabinet shall be individually bonded to the TGB. Do not bond racks/cabinets to cable runways.

> List additional Grounding and Bonding product installation requirements above as applicable to this project.

3.7 PATCH PANELS

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Provide patch panels and horizontal wire management according to locations, elevations, and plan views as shown on the Construction Documents.

1. Copper: Size and install rack-mountable patch panels as shown on the Construction Documents. Use copper patch panels to terminate copper station cables. Install horizontal patch cable management supports below each patch panel without integrated cable supports or as shown on Construction Documents.

2. Fiber: Size and install rack-mountable patch panels as shown on the Construction Documents. Use fiber patch panels to terminate multimode and/or singlemode fiber riser and OSP backbone cables. Except for PATCHMAX GS3 panels, separate fiber patch panel rows shall be used to terminate different fiber optic cabling types (multimode, multimode of different types, and singlemode) where practical. Install horizontal patch cable management supports below each patch panel without integrated cable supports or as shown on Construction Documents.

> Additional Patch Panel product installation requirements shall be added to the above list as applicable to this project.

3.8 CONNECTORS

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Copper Outlets (modular jacks):

1. For Horizontal Distribution:

   a. Provide outlets and install using T568B wiring pattern.

b. Mount outlets at 90-degrees (i.e. straight, not angled) at the patch panel.

c. Mount outlets at 45-degree angle at the work area behind the faceplate.

> Additional Connector product installation requirements shall be added to the above list as applicable to this project.

3.9 COPPER TERMINATION BLOCKS

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Provide termination blocks and (jumper troughs) with or without legs based on the following mounting conditions:

1. Mounting on Backboards:

a. Provide termination blocks, jumper troughs, and backboards with legs, and retainer clips as shown on the Construction Documents.

b. Locate jumper troughs above and below each termination block in a column.

c. Locate a backboard in place of jumper troughs in the vertical middle of each column of 600 pair or more.

d. Provide a 2-inch gap between the leg-base of multiple columns of termination blocks. Mount 2-inch distribution rings vertically along the 2-inch gap between the termination block columns.

2. Mounting on Racks: Provide termination blocks and jumper troughs without legs. Use rack mount brackets to mount termination blocks on EIA standard 19” floor and wall-mount racks.

B. Route cable horizontally along base of backboard until it reaches the termination block column on which it is to terminate and then route vertically to the termination block.

C. Punch down cable sequentially across the termination strips.

D. Punch down cable using only the selected SCS Manufacturer approved impact tool set to “high” and approved blade (110M).

> List additional Copper Termination Block product installation requirements above as applicable to this project.

3.10 STATIONS

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Faceplates: Shall provide a snug and sure fit for connectors – loose connectors are not acceptable.

1. Provide faceplates for stations in the locations and gang counts shown on the Construction Documents. In Secured Areas, provide Security Faceplates with associated mounting straps. Faceplates shall completely conceal outlet boxes, reducer plates, etc.

2. Unless otherwise noted in the Construction Documents, mount voice ports on top or left and mount data ports on bottom or right.

3. Flush-mount connectors on faceplates.

> Coordinate with DOC facility personnel to determine the location of secured areas. Consider identifying these locations to the Contractors during the pre-bid walk through.

4. Provide Security Screws for faceplates.

> List additional Station product installation requirements above as applicable to this project.

3.11 CABLE

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. General (applicable to all cable types): Provide non-plenum (CM/CMR, OFNR) rated cable for locations where cable is to be installed in conduit. For cable not installed in conduit, provide plenum (CMP, OFNP) rated cable if cable is installed in a plenum air space environment, non-plenum rated otherwise. Cabling shall bear plenum or non-plenum markings for the environment in which it is installed.

1. For Horizontal Distribution: Provide station cable in types, sizes, and quantities as defined by the Symbol Schedule and as shown on the Construction Documents. Install cable between the station and its associated telecommunications room. Provide one cable per each connector at each station. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.

    a. For 10GBASE-T cable, install cable using only 10GBASE-T components and terminations, including patch cords.

    b. For 1000BASE-T cable, termination of 1000Base-T cable to a CAT-5e patch panel allowed only when a few cables are added.

2. For Intrabuilding Backbone Distribution: Provide intrabuilding backbone cable in types, sizes, and quantities as shown on the Construction Documents. Install intrabuilding backbone cables between telecommunications rooms within the same building. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.

3. Contractor shall install cables in compliance with ANSI/TIA/EIA Standards, BICSI practices, and manufacturer's design and installation guidelines, which shall include, but not be limited to: bending radius, pulling tension, other mechanical stresses, pulling speed, bundle sizing, cable supports, cable depth within trays, service slack, dressing at outlets and panels, terminations, etc.

4. Install cable in a continuous (non-spliced) manner unless otherwise indicated.

5. Do not distort the outer jacket of the cable. Where this occurs, Contractor shall replace cable at no cost to Owner.

6. Adhere to the bending radius and pull strength requirements as detailed in the ANSI/TIA/EIA standards and the manufacturer's installation recommendations during cable handling and installation.

a. Pull all cables simultaneously where more than one cable is being installed in the same raceway.

b. Use pulling compound or lubricant where necessary. Use non-water-based compounds <u>that will not damage conductor, insulation, or outside cable sheath of indoor rated cable</u>.

c. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cabling installation.

7. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.

8. Secure cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors), or any other violation of the NEC is not acceptable. Install hook and loop cable managers in conformance with the SCS manufacturer's installation recommendations. Do not over-tighten cable managers or cause any cross-sectional deformation of cabling. Use of hard notch plastic wire ties is not acceptable.

   a. <u>Horizontal cable bundles should be no more than 24 cables and shall not exceed a quantity of 48 cables</u>.

9. Cable in telecommunications/power poles:

   a. Telecommunications cable shall only be routed into telecommunications/power poles having a continuous solid steel barrier forming two separate vertical channels for the electrical conductor and telecommunications cable. Poles with a barrier other than solid steel are not acceptable, including aluminum.

   b. Single channel telecommunications poles are allowed only if dedicated for telecommunications cabling and no electrical conductors are installed.

   c. Route telecommunications cable into and through a separate vertical channel from the electrical conductors. Under no conditions shall the telecommunications cable share the same channel with the electrical conductors.

   d. Each vertical channel of the Wiremold Steel Tele-Power pole is 1.5" deep. The metallic separation barrier stops short before the bottom of the pole, just before the telecommunications outlet port, allowing full use of the 3" depth inside the pole for the cable bend radius.

10. Cable in conduit:

   a. The quantity of cable placed in conduit shall not exceed a 40% fill limitation per TIA Standards. The table listed below represents a 40% fill for EMT conduit with the current types of SYSTIMAX® cables used by Owner. To determine the 40% fill limitation for cable types not listed below or other types of conduit, contractor shall contact the Engineer/Designer before proceeding.

EMT Raceway		4-Pair UTP Systimax Cables, OD (in.)										
		CAT 3		CAT 5e		CAT6				OSP	CAT6A	
Trade		1010	2010	1061	2061	1071E	2071E	1081	2081	1571	1091	2091
		0.170	0.180	0.215	0.196	0.232	0.226	0.250	0.233	0.250	0.315	0.310
Size	I.D. (in.)	Max # of Cables per Conduit (@ 40% fill)										
3/4"	0.824	9	8	5	7	5	5	4	5	4	2	2
1"	1.049	15	13	9	11	8	8	7	8	7	4	4
1 1/4"	1.380	26	23	16	19	14	14	12	14	12	7	7
1 1/2"	1.610	35	32	22	26	19	20	16	19	16	10	10
2"	2.067	59	52	36	44	31	33	27	31	27	17	17
2 1/2"	2.731	103	92	64	77	55	58	47	54	47	30	31
3"	3.356	155	139	97	117	83	88	72	82	72	45	46
3 1/2"	3.834	203	181	127	153	109	115	94	108	94	59	61
4"	4.334	259	231	162	195	139	147	120	138	120	75	78

11. Cable using J-hooks/Bags:

    a. Provide spacing of J-hooks/bags at 4 feet intervals with visible cable sag between supports per SYSTIMAX installation requirements.

    b. Provide one additional J-hook/bag within 2 feet of cable routing direction change, such as a 90 degree turn from north to east.

    c. The quantity of cables placed onto J-hooks/bags shall not exceed the DOC down-sized rating capacity as stated in *Part 2 Products*.

12. Cable at the backboards:

    a. Lay and dress cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.

    b. Route cable as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

    c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Use hook and loop cable managers to bundle similarly routed and similar cables together and attach to approved vertical support components (D-rings “only” for vertical support) and approved J-hooks or bags for horizontal support, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

    d. See COPPER TERMINATION BLOCKS above for details on routing copper cabling to termination blocks.

13. Cable in the telecommunications rooms:

    a. For telecommunications rooms with horizontal cable runways, lay cable neatly in the runway in even bundles and loosely secure cabling to the runway at regular intervals with hook and loop cable managers.

    b. All cables routed “down” from the horizontal runway shall be supported with a cable runway radius drop or cable runway radius bend.

14. Cable terminating on patch panels located on racks/cabinets (except CAT 3 Tie Cables to racks):

a. Route cables in telecommunications rooms to patch panels on racks/cabinets by routing across horizontal cable runway above the top of rack/cabinet, then down a cable runway cross member radius drop, through a vertical cable runway to the patch panel. Leave sufficient cable slack to accommodate movement between rack/cabinet and cable runway during a seismic event.

15. <u>CAT 3 tie cables terminating on patch panels located on racks:</u>

a. CAT 3 or ARMM cables connected to wall-mounted 110 blocks shall route across horizontal cable runway above the top of racks, then down a cable runway stringer radius drop, parallel along the outside of the rear rack C-channel, affixed to Vertical Wire Management Loops attached to the rear rack C-channel.

b. For multiple CAT 3/ARMM cables to patch panels on the same rack, alternate cable routing to the left and right rear rack rails.

c. Attach CAT 3/ARMM cables to vertical wire management loops using cable straps.

16. <u>The vertical weight of cables shall be sufficiently and appropriately supported so that cross-sectional deformation of cabling does not occur.</u>

B. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

1. For horizontal distribution: Provide station cable in the locations shown on the Construction Documents.

a. A maximum of four (4) horizontal cables are permitted to be installed within a 4 11/16" x 4 11/16" (or smaller) outlet/device box.

b. Provide Category 3 cable for inmate telephone system stations and for administrative telephones "only" where specified by Owner for leased facilities. Provide Category 6 cable for all other stations.

c. Where cable is routed into or through modular furniture, cable shall have a separate path from electrical cable separated by a metallic barrier. The metallic barrier separation shall be maintained as indicated in the table below titled *"ISP Telecommunications Clearances for EMI Reduction."*

Exclude the following statement if OSP Rated CAT 6 is not required on the project.

d. Provide OSP rated Category 6 cable only in locations shown on the Construction Documents.

1) Where OSP rated Category 6 cable is required by code and not shown on Construction Documents, submit RFI to Architect for Owner review.

2. Provide **<u>service slack</u>** at both ends of horizontal distribution cables typically located in Equipment Rooms (ER), Telecommunications Rooms (TR), Work Areas (WA), and at Building Entrance Protectors (BEPs).

a. There shall be sufficient cable service slack at the ER or TR to accommodate:

1) Relocation of cabling termination equipment to the farthest away position from the cables point of entry into the ER/TR, including floor to ceiling height, or a minimum service slack of no less than 10 feet, whichever is greater.

2) The service slack for copper cable shall not be coiled, but properly formed per ANSI/TIA/EIA Standards, BICSI practices, and manufacturer's recommendations.

b. Installations where cable is exposed above the ceiling plate at the WA, leave 12 inches of service slack in the ceiling area above the WA, properly supported.

c. Installations where cable is not exposed above the ceiling plate at the WA outlet (typically where the cable run is entirely within conduit), the TR location shall have one additional foot of cable length added to the TR-end service slack to compensate for the lack of service slack in the ceiling area above the WA location.

d. Where horizontal cable connects to a BEP, leave a minimum of 12 inch service slack on the wall area adjacent to the BEP.

e. Do not store cable service slack inside pull boxes or junction boxes.

f. Cable service slack behind the WA jack shall be 4-6 inches.

1) The cable slack shall be properly stored in the outlet box by following the BICSI and SYSTIMAX® Installation Guidelines that specify the following:

a) "Prior to engaging the jack to the faceplate, coil the cable service slack into the outlet box. Install the jack to the faceplate after the cable service slack has been coiled into the outlet box."

b) Coil the service slack for storage into the outlet box in a direction that minimizes the angle where the cable meets the rear of the outlet jack.

2) Insert the outlet jack into the faceplate at a 45-degree angled position in lieu of the 90-degree straight position to help reduce strain on the outer cable jacket of the service slack.

g. Cable service slack that has been placed inside the outlet box that shows lack of proper coiling technique, has been deformed, or is evident of having exceeded the minimum bend radius, shall be replaced by Contractor at no expense to the Owner.

3. The cable pairs shall be pulled tight into the jack so the cable jacket/sheath ends at the immediate back of the jack with no more than 1/16 inch gap from the rear of the jack. The Contractor shall re-terminate, at no cost to the Owner, installations where the gap exceeds 1/16 inch. Where cable re-terminations result in less than 4-6 inches of service slack in the outlet box, Contractor shall replace existing cable at no expense to the Owner.

4. Route cable to comply with ANSI/TIA/EIA-569 rules for avoiding potential EMI sources and as indicated in the following table:

ISP Telecommunications Clearances for EMI Reduction

	Telecommunications Infrastructure			
Sources of Electromagnetic Interference	**Crossconnect Locations** *Unshielded*	Shielded	**Horizontal Cabling** *Unshielded*	Shielded
Power Circuits Not in Metallic Raceway				
Less than 220 V_{rms}	2”	2”	2”	2”
Greater than 220 V_{rms} but ≤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 ≤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 ≤ 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 ≤ 480 V_{rms}	10 ft	4 ft	4 ft	2 ft
Greater than 480 V_{rms}	20 ft	20 ft	10 ft	5 ft

5. For intrabuilding backbone distribution: Install intrabuilding backbone cable in the locations shown on the Construction Documents.

   a. Use unshielded, non-plenum multi-pair copper cable for connecting the back side of termination blocks to entrance protectors, telephone systems, and voice grade active electronics.

   b. For shielded cable, bond both ends of the metallic shield (or metallic strength) member to the nearest TGB (as furnished under Division 16 Section — “Grounding and Bonding for Telecommunications”).

   c. For unshielded riser cables or if ARMM cable shield continuity is not assured: Install riser cable with a Coupled Bonding Conductor (CBC). Run a #6 AWG copper ground riser conductor, tie-wrapped at regular intervals to the cable or cables in each unshielded Backbone/Riser cable route, per SYSTIMAX® installation requirements. Ensure that only a minimal separation distance is allowed between the conductor and the riser cables. Bond the CBC in the same manner as a cable shield.

d. Provide sufficient service slack at both ends of the backbone cable to accommodate:

1) Relocation of cabling termination equipment to the farthest away position from the cables point of entry into the area of the termination (typically the ER/TR), including floor to ceiling height, <u>or a minimum service slack of no less than 25 feet</u>, whichever is greater.

2) The service slack for copper cable shall not be coiled, but properly formed per ANSI/TIA/EIA Standards, BICSI practices, and manufacturer's requirements.

C. Fiber Cable:

1. Terminate all fiber strands within a fiber cable. The installation of "dark fiber" is not acceptable.

2. <u>All horizontal and backbone fiber optic cable shall be installed within innerduct.</u>

3. Fiber optic cable shall be supported per cable manufacturer's recommendations. Direct support of fiber optic cable or fiber optic patch cords by J-Hooks is not acceptable.

4. Fiber optic patch cords shall be continuously supported by horizontal and vertical cable managers within and between each rack and cabinet.

   a. Where patch cords route along horizontal cable runways or span any distance with no support, the patch cord shall be installed within a compliant UL Listed innerduct.

5. Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.

   1) Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.

   2) Demonstrate that the test results are in harmony with the factory test results as shipped with the reel.

6. Where shielded cable is called for in the Construction Documents or used, bond both ends of the metallic shield (or metallic strength) member to the nearest TGB (as furnished under Division 16 Section - "Grounding for Communications Circuits and Raceway").

7. Provide cable service slack of the same lengths and in the same manner as indicated above for *Copper Cable* and *intrabuilding backbone distribution*.

   a. Additional fiber cable service slack shall be provided inside the fiber patch panel cabinet/shelf of a minimum of 3 m (10 ft).

   b. Terminate all fiber strands in the fiber cabinet/shelf using a fusion splice onto a fiber pigtail with a factory-terminated connector of the type specified under Section 2 *Products*.

> List additional Cable product installation requirements above as applicable to this project.

3.12 CABLE ASSEMBLIES (PATCH CORDS) AND CROSS-CONNECTS

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

Patch cables will generally be furnished by the Contractor and delivered to DOC IT personnel at the facility for installation. Include specific requirements for patch cables on the project, including quantity, color and length. DOC personnel shall determine lengths of patch cables and colors. Note that patch cable color for inmate LANs shall be green, no other patch cables shall be green in color.

Note: <u>Where the combined length of two copper patch cords of a channel exceeds 10 m (33 feet), the length of the horizontal link portion of the channel shall be reduced accordingly from the maximum (90 m/295 feet) per ANSI/TIA/EIA-568-B.1. Lengths differing from the 568 Standard, even when based on a formula stipulated by the cabling manufacturer, shall only be allowed when the DOC Infrastructure Specialist has approved the length in writing.</u>

A. Furnish copper patch cables for modular copper connections. Deliver patch cables to Owner in the sizes, colors and quantities below:

1. Blue (for Administrative LAN & other administrative network connections):
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)
2. Gray (for Administrative telephone connections):
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)
3. Green (for Inmate LAN, network, and telephone connections):
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)
4. Red (for Radio-related & fire alarm connections):
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)
5. Yellow (for Building Automation Systems & Security Electronics connections):
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)

B. Furnish fiber patch cables for fiber connections. Deliver patch cables to Owner in the fiber type, lengths, and quantities below:

1. MMF OptiSPEED 62.5/125 µm:
   a. Length (e.g. 3m) - (<u>Qty</u>)
   b. Length (e.g. 1m) - (<u>Qty</u>)
2. MMF LazrSPEED 50.0/125 µm:

a. Length (e.g. 3m) - (Qty)

b. Length (e.g. 1m) - (Qty)

3. SMF TeraSPEED 8.0/125 µm:

a. Length (e.g. 3m) - (Qty)

b. Length (e.g. 1m) - (Qty)

C. Furnish one (1) spool of Category 3 jumper wire per each telecommunications/equipment room for cross connects and deliver unopened to Owner.

D. Furnish hook and loop style cable managers for managing patch cords in the telecommunications rooms. Provide in colors, sizes and quantities as indicated below.

> Include specific requirements for cable managers on the project, including quantity, color and size. Review and edit the information below as required for this project.

1. Furnish eight (8) cable managers, each 6 inches in length, for every two fiber cables installed.

> List additional Patch Cable/Cross Connect requirements above as applicable to this project.

3.13 LABELING AND ADMINISTRATION

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. General: Labeling and administration of ISP communications components shall follow the format and definitions of Owner's telecommunications administration plan based on the format of ANSI/TIA/EIA-606-A Class 3 Standard and as defined in the Construction Documents.

B. Color Coding: Apply industry standard color coded labels to cable termination hardware. Always apply the same color label at both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the backboard behind the termination equipment, may be the color of a cover on the termination equipment, or may be the actual color of the insert label on the termination equipment. Use the following color code:

1. Orange: Identification of the telecommunication service provider (telephone company) network demarcation point.

2. Green: Identification of customer extension of the network demarcation.

3. White: Identification of first-level backbone cables in the building containing the main cross-connect (MC) and a horizontal cross-connect (HC), or between the MC and an intermediary cross-connect (IC).

4. Gray: Identification of the second-level backbone (tie) cables in the building between HCs, cables between MCs, or between an IC and a HC.

5. Blue: Identification of the horizontal distribution (station) cables between the HC and telecommunications outlet (TO). A blue color coded label is only required at the telecommunications room end of the cable, not at the station end of the cable.

6. Brown: Identification of inter-building backbone cables.

7. Yellow: Identification of inmate phone termination fields, auxiliary circuits, alarms, maintenance, security, bridging blocks, and other miscellaneous circuits.

8. Red: Identification of key telephone systems.

C. Telecommunications Rooms or Racks/Cabinets in areas without a separate TR room:

1. In non-secured areas, affix a permanent sign to the door of each telecommunications room or rack/cabinet per Construction Document prints. Where telecommunications room names are required in other labels, use the telecommunication room name shown on the Construction Documents.

    a. For racks/cabinets, affix sign centered across top cross-member of outside front and to the left of the rack/cabinet identifier.

2. In secured areas, affix a permanent sign to the inside of the space, such as above the entrance door or to the inside of a cabinet door per Construction Document prints. Do not affix a sign to the outside of the telecommunications room entrance door or cabinet door.

D. Racks/Cabinets: Label racks and cabinets as shown on the Construction Documents. Affix "large print" label centered across top cross-member on outside of rack/cabinet on both the front and rear sides.

E. Grounding/Bonding Conductors:

1. Label Location: Affix at each end of the conductor as follows:

    a. "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR -- DO NOT REMOVE OR DISCONNECT! If disconnected, report to facility management immediately!"

F. Cables:

1. Label Location: Affix at each end of the cable.

2. Station Cables: Label station cables with the same label as the station connector (see STATION CONNECTORS (PORTS) below) that terminates the cable at the station location within 4-6" of termination point. Include a clear vinyl adhesive wrapping applied over the label in order to permanently affix the label to the cable. Using transparent tape to affix labels to cables is not acceptable.

3. Intrabuilding Backbone Cables:

    a. Label Format: *fs1/fs2-UUU.n*

    b. *fs1/fs2*: The two telecommunication spaces (TR or ER) where the cable ends are terminated.

    c. *UUU*: Specify the following depending on the cable type:

        1) "ACA" for Administrative voice copper cable

        2) "ICA" for Inmate voice copper cable

        3) "BCA" for Building Automation Systems (BAS) copper control cable

        4) "FCA" for Fiber optic cable

        5) "XLG" for Coaxial cable leg

d. *n*: The unique cable identifying number from the Construction Documents.

e. Example - The Administrative copper backbone cable running between telecommunications rooms “1A’ and “4A” identified as cable #12: **1A/4A-ACA.12**

4. Identify and label all backbone cables at each end of cable within 24” of telecommunications room entrance and again within 24” of termination point or as specified by Drawings. Use Marker Tags for backbone cables larger than 1 inch diameter and where multiple cables bundled together would make direct stick-on labels difficult to read.

a. Label/Tag shall reflect the cable identifier information above or as specified per the Construction Documents.

b. Provide new labels/tags to existing cables where indicated on the Construction Documents.

G. Termination Blocks:

1. General:

a. Label termination block ports/pairs sequentially beginning on the first row of each termination block column. Begin with “001” for the first port/pair.

b. Label termination strip pairs sequentially (left to right).

2. For Horizontal Distribution: Label termination blocks used for voice horizontal distribution with a single label affixed above the entire termination block column which reads “Adm Voice Stations”. Label termination blocks used for inmate phone system horizontal distribution with a single label affixed above the entire termination block column that reads “Inmate Stations”.

3. For Backbone Distribution: Label termination blocks used for backbone distribution with a single label affixed above the entire termination block wall field which reads “Backbone”. Additionally, label each termination block column within the termination block wall field as follows:

a. Label columns in the form “TR”, where “TR” is the telecommunications room where the backbone cable originates (see TELECOMMUNICATIONS ROOMS above). Use a new column for each telecommunications room. Do not intermix cables from multiple telecommunications rooms in a single termination block column.

1) Example: If a termination block column on the fourth floor terminates backbone cabling from the first floor telecommunications room, then the column on the fourth floor would have the label “1A” and the termination block column on the first floor would have the label “4A.”

H. Patch Panels:

1. For Horizontal Distribution:

a. General: Label patch panels as shown on the Construction Documents.

b. Panels: Label patch panels on the outside with a minimum of ½ inch high lettering that clearly indicates the patch panel number.

c. Ports: Ports are typically pre-labeled by the manufacturer with sequential numbers (i.e. 1 to 96). For ports which are not pre-labeled, label port in the form “##” where “##” is the sequential port number within the panel. Each patch panel shall start at port number “01”.

1) 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.

I. Station Connectors (Ports):

1. Connected to Patch Panels in the Telecommunications Room:

Refer to the Telecommunications Distribution Design Guide for information on the Port Designation labels shown on the Construction Documents.

a. Label connectors in the form “TR-PP#-##” where “TR” is the telecommunications room where the station cable terminates (see TELECOMMUNICATIONS ROOMS above), “PP#” is the sequential patch panel number within the telecommunications or equipment room at which the station cable terminates (see, PATCH PANELS above) and “##” is the port number within the patch panel where the station cable terminates. Cross reference connector labels with the Port Designation label on the Construction Documents.

1) Example: If a faceplate has two copper cables terminated in the second telecommunications room on the fourth floor, in the third patch panel, in ports 5 and 6, then the connectors would have the labels “4B-PP3-05” and “4B-PP3-06” respectively.

2) Example: If a faceplate has a duplex fiber cable terminated in the first telecommunications room on the third floor, in the first patch panel, in port 4, then the connector would have the label “3A-PP1-04”.

2. Connected to Termination Blocks in the Telecommunications Room:

Refer to the Telecommunications Distribution Design Guide for information on the Port Designation labels shown on the Construction Documents.

a. Label connectors in the form “TR-110-###” where “TR” is the telecommunications room identifier at which the station cable terminates (see TELECOMMUNICATIONS ROOMS above), “110” represents the 110 termination block, and “###” is the sequential termination block port number, within a given termination block column, where the station cable terminates. Cross reference connector labels with the Port Designation label on the Construction Documents.

1) Example: If a faceplate has two copper cables terminated in the second telecommunications room on the fourth floor on termination block ports 5 and 6, then the connectors would be labeled “4B-110-005” and “4B-110-006” respectively.

J. Conduits Labels:

1. Identify and label/tag all conduits at each end or where specified by Drawings. Attach Marker Tags to conduits larger than 2 inch diameter and where multiple conduits bundled together would make direct stick-on labels difficult to read.

2. Verify the accuracy of existing conduit labels based on the information identified below, and correct as necessary.

3. If conduits are without labels, label each conduit end (existing or new) in a clear manner, with the information specified below.

4. Labeling information shall include:

a. Identify the location of the other end of the conduit (i.e. room name, telecommunications room identifier, pull box identifier, outlet identifier, (use the label of the first port of the outlet as the outlet identifier)).

b. Identify the conduit length.

K. Pull Strings: Label each pull string in a clear manner by designating the location of the other end of the pull string (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

L. Firestopping:

1. Refer to labeling requirement under the Firestopping section.

2. Labels shall be compliant with the most-current ANSI/TIA/EIA-606-A format.

List additional Labeling requirements above as applicable to this project.

3.14 TESTING

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. It is Imperative for the Contractor to properly setup and configure the test equipment to ensure that proper testing is conducted based on the type of cable installed, the manufacturer's recommended test criteria, and the test requirements within this specification. Examples of problem test results include incorrect NPV for the type of cable sheath, testing for channel instead of link, etc. Testing performed by Contractor with an improper setup or configuration or improperly calibrated test equipment will not be accepted and all tests shall be re-done at no additional expense to Owner.

1. Contractor should consider providing a sampling of the tests for review by the A/E's RCDD.

B. All cable provided to the Owner shall be tested prior to acceptance. Where spare cable is provided to Owner, cable shall be tested upon delivery at no additional expense to Owner, and shall meet manufacturer's test criteria. Where spare cable is provided to Owner from ends of reels or other sources, or has incurred handling or been in subsequent transit since initial testing upon delivery, or in any way is suspect for potential damage since initial testing upon delivery, cable shall be re-tested at no additional expense to the Owner, and shall meet manufacturer's test criteria.

C. Provide electronic copies of original cable test machine results in both electronic format and in printed format as approved by the Owner and Engineer/Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the details of the test criteria, testing date, cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide complete test records and results to both the Owner and Engineer/Designer for review and acceptance within two weeks of Substantial Completion.

1. Copy original test machine test files to a CD directly from the machine tester.

a. For Fluke: Shall be Fluke Linkware.

2. Print test records in color for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic form (on CDROM) to both the Owner and Engineer/Designer for review. Handwritten test results will not be accepted.

a. Test records shall be in sequence by cable identifier within each building.

b. For additions of only several cables, electronic form can be via e-mail attachment when approved by Owner.

D. Test the SCS after installation for compliance to all applicable standards as follows:

1. Copper:

a. Where a higher rated category cable is installed onto a lower rated category patch panel, perform two tests - one at each rating category.

b. For Horizontal Distribution: Test all pairs of each copper station cable for conformance to ANSI/TIA/EIA 568-B.2-1 and 568-B.2-2 (or latest editions) Category 6 or TIA/EIA-568-B.2-10 for augmented Category 6A standards. To the extent possible, perform tests with building electrical systems fully powered on (i.e. Lights, HVAC, etc.).

1) Test each end-to-end permanent link (from the connector at the station (work area) to the connector or termination in the telecommunications room) utilizing sweep tests for Installed Length, Insertion Loss (IL), Near End Crosstalk (NEXT), Power Sum Near End Crosstalk (PSNEXT), Attenuation to Crosstalk Ratio (ACR) - Near End (ACRN), Power Sum Attenuation to Crosstalk Ratio (PSACR) - Near End (PSACR-N), Far End Cross Talk (FEXT), Equal Level Far End Crosstalk (ELFEXT) or Attenuation to Crosstalk Ration - Far End (ACRF), Power Sum Equal Level Far End Crosstalk (PSELFEXT) or Power Sum Attenuation to Crosstalk Ration - Far End (PSACRF), Return Loss (RL), Wire Map, Propagation Delay, Delay Skew, continuity, shorts, polarity, and presence of AC voltage. Test each cable in both directions at 250 MHz for Category 6 cable and 500 MHz for Category 6A cable.

a) Conduct a sampling test on 10GBASE-T CAT 6A for Alien Crosstalk on cable bundles:

i. Power Sum Alien NEXT (PSANEXT)

ii. Power Sum Alien Attenuation to Crosstalk Ratio from the Far-end (PSAACRF)

2) <u>NOTE: Owner requires cable tests using test parameters higher than minimum pass criteria for Category 6 cables</u>. Contractor shall set up tester for "Custom" test criteria to revise "PASS/FAIL" results accordingly.

a) SYSTIMAX® <u>**71-series** cables receiving less than **5 dB Headroom**</u> and <u>**81-series** cables receiving less than **6 dB Headroom**</u> on <u>Permanent Link tests</u> shall be re-examined for installation compliance at both ends of termination and along accessible horizontal pathway.

i. If corrective action by the Contractor fails to increase dB Headroom to the levels indicated above, both the Owner and Engineer/Designer shall be contacted to examine the cable installation and termination practices of the Contractor. At the Owner's request, the SYSTIMAX® Regional Account Manager may be called in to review the cable installation and termination practices of the Contractor.

ii. If the SYSTIMAX® Regional Account Manager approves the cable installation and termination practices employed by the Contractor, the cables in question shall be re-tested using the SYSTIMAX® <u>Channel tests</u>. The cables shall receive a PASS on all SYSTIMAX® guaranteed Channel test criteria, else the Failed cables shall be removed, destroyed, and re-installed with the testing procedure re-started with the Permanent Link test indicated above.

3) Use a TIA/EIA Level IV testing instrument, certified re-calibration within the last twelve months by the manufacturer or more frequent if recommended by manufacturer, field re-calibration occurring at the start of testing, with the most current manufacturer's software revision, capable of storing and printing test records for each cable within the system and equipped with the current and appropriate "SYSTIMAX® Gigaspeed test adapters".

a) Testing Device: Fluke DTX-1800 with latest software and hardware releases for SYSTIMAX® GigaSpeed CAT-6 XL and/or CAT-6A X10D horizontal distribution cables.

i. For CAT 6 link testing, use CAT 6 Permanent Link Adapters only.

ii. For CAT 6A link testing, use CAT 6A Permanent Link Adapters only.

b) Permanent Link Adapters shall be re-calibrated with the DTX-PLCAL module within the last six months.

4) Tests shall also confirm/guarantee compliance to SYSTIMAX® Ethernet GigaSPEED 1000B-T (1000 Mb/s IEEE 802.3ab) and 1000B-TX (1000 Mb/s ANSI/TIA/EIA-854) applications based on the data contained in the SYSTIMAX® Performance Verification of GigaSPEED XL Installations February 2nd, 2004 or latest edition.

a) CAT 6A cable tests shall confirm/guarantee compliance to IEEE 802.3an Ethernet 10GBase-T link segment specifications and standard TIA/EIA-568-B.2-10.

5) Test results shall be test machine-produced in Fluke (most-recent version) cable test management software format:

a) LinkWare (most-current version)

c. For Intra-building Backbone Distribution: Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 3 standards.

1) Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

2) Test entire channel, from termination block to termination block.

3) Use a TIA/EIA Level IV testing instrument, certified re-calibration within the last twelve months by the manufacturer or more frequent if recommended by the manufacturer, field re-calibration occurring within thirty (30) days, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.

a) Fluke DTX-1800 with latest software and hardware releases for SYSTIMAX®, or approved equal.

2. Fiber: Test fiber optic cable on the reel upon delivery to the job site prior to installation, and again after installation.

a. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:

1) For Horizontal Distribution:

a) SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

2) For Backbone Distribution:

a) SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

b) A mated connection interface (connector-to-connector mating of two fiber ends) is defined as a single connection for the purposes of the above formula.

c) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).

b. Test all strands using a power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B, or latest ANSI/TIA/EIA Standards and the SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

1) Tests all strands bi-directional end-to-end.

2) Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.

3) Provide test measurements as follows:

a) For Multimode Cable: Test at both 850 and 1300 nm.

i. Multimode fiber tests shall be conducted using an LED light source.

b) For Singlemode Cable: Test at both 1310 and 1550 nm.

c. Test results shall conform to:

1) The criteria specified in ANSI/TIA/EIA-568B (latest edition).

2) The Contractor’s calculated loss budget above.

3) The criteria specified in IEEE 802.3z (Gigabit Ethernet).

4) Both the optional and recommended criteria specified in SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

5) Tests shall confirm/guarantee compliance to SYSTIMAX® and IEEE 802.3 Ethernet GigaSPEED performance for maximum end-to-end dB loss.

E. Identify cables and equipment that do not pass to the Owner and Engineer/Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials <u>at no additional expense to the Owner</u>. Provide new test results to the Owner and Engineer/Designer in the same manner as above.

1. In addition to the above, if it is determined that the cable is at fault, remove the damaged cable and replace it with a new cable. Cable "repairs" are not acceptable. The procedure for removing the cable shall be as follows:

    a. Prior to removal of damaged cable and installation of new cable:

        1) Inform the Owner and Engineer/Designer of the schedule for the removal and installation.

        2) Test the new cable on the reel per paragraph B, above.

        3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.

        4) Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

    b. Remove the damaged cable and provide new cable.

    c. After the removal of the damaged cable and installation of the new cable:

        1) Test the new cable per the paragraph titled TESTING.

        2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.

            a) If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.

        3) Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

    d. If a cable(s) residing in the same conduit or innerduct is damaged by the Contractor during installation of other cable, Contractor shall replace damaged cable(s) at no additional expense to owner.

        1) Replacement cables shall be subject to the testing procedures of the paragraph titled *TESTING*.

> List additional Testing requirements above as applicable to this project.

3.15 FOLLOW UP

> Review any contractor follow-up requirements with the DOC project manager and clearly state these requirements in the following paragraph(s). The 40 hours of assistance listed below should probably only be included when a PBX installation is part of the contract since the SYSTIMAX ® warranty should cover most other follow-up requirements.

A. For the first four weeks that the system is in full operation, provide technical assistance for trouble shooting, training, and problem solving by phone and (within 24 hours of notice) on site. Provide up to 40 hours of assistance (in addition to any warranty-related work), including phone, travel, and on site time during this period.

END OF SECTION

SECTION 16715 – OUTSIDE PLANT COMMUNICATIONS CIRCUITS

SECTION 16715 — OUTSIDE PLANT COMMUNICATIONS CIRCUITS

1 PART 1 - GENERAL

PART 1 - GENERAL

Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Telecommunications Construction Guide Specifications (TCGS) Version 5.3, updated 4/30/2008 by C. Ryman.

This specification should also be used in Division 17 for LVE systems using 22-24 AWG OSP copper or OSP fiber.

This specification section has references, products, procedures, processes, and work descriptions/summaries that are common to many Washington State Department of Corrections telecommunications projects. This information is provided in specification format to serve as a guide to the Engineer/Designer in producing a CSI-compliant specification that will meet the unique requirements of DOC Telecommunications projects. However, this document is not intended to be a Master Specification. The information included in this section is not intended to be all-inclusive for any given project.

The Engineer/Designer may edit this section (adding and/or removing content where required) for use with a specific project, but shall not create a new specification section based on the "intent" of the TCGS, or cut and paste content from the TCGS sections into other existing specification sections. **Edits to the section shall be performed with WORD "Revision Tracking" features activated.** At the various project design milestones when the documents are submitted to DOC for review, the TCGS specifications shall be printed showing the revision markings.

Text in shaded boxes (such as this text) is included to aid the Engineer/Designer in understanding areas of this Guide Specification that may require modification for a particular project. Although this text is generally written in declarative form, the Engineer/Designer shall consider it guidance only. The Engineer/Designer shall not assume that the content of this specification section is suitable or sufficient for any given project in its current form and shall remain responsible for developing a thorough and complete specification that meets the requirements of the project being designed.

1.1 RELATED DOCUMENTS

Review and edit the following paragraph to ensure appropriate references are included.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

Review and edit the following list of generic type products and work for relevance to this project. This listing should not include procedures or processes, preparatory work, or final cleaning.

A. Provide all materials and labor for the installation of a customer-owned outside plant telecommunication system fully compliant to the ANSI/TIA/EIA Commercial Building Telecommunications Standard. Work in this section includes, but is not limited to installation and termination of Customer-Owned Outside Plant Communications cabling and components including administration equipment, cutting and patching, firestopping, and grounding and bonding for the specified Outside Plant Structured Cabling System (OSP-SCS - See Definition Below).

B. Related sections include but are not necessarily limited to the following:

Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate. Include sections that furnish products which are installed under this section (coordinate with paragraphs below). This paragraph should be used sparingly to avoid assuming the contractor's responsibility for coordinating work.

1. Division 16 Section — "Basic Electrical Materials and Methods"
2. Division 16 Section — "Outside Plant Communications Site Work"
3. Division 16 Section — "Raceway and Boxes for Communications Circuits"
4. Division 16 Section — "Grounding and Bonding for Telecommunications"
5. Division 16 Section — "Inside Plant Communications Circuits"

C. Products furnished (but not installed) under this section:

Include this paragraph only if products will be furnished under this section but installed under other sections or by the Owner. When installations are "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner- Installed Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

D. Products installed (but not furnished) under this section -

Include this paragraph only if products will be installed under this section but furnished under other sections or by the Owner. When products are furnished "By Owner" consider referencing the installation to Division 1 Section 01010 (or equivalent) - Summary of Work (Owner-Furnished Items). If this paragraph is required for the project, the Engineer/Designer must take care to clearly define any product warranty issues associated with the split responsibility.

Consider including grounding and bonding conductors and any other items that are installed under this section but not furnished under this section.

1. Grounding and bonding Conductors

E. Provide Unit Prices for:

Include this paragraph only if unit pricing will be required for a specific part of the project. Include statements on how to measure the quantity. For example, unit prices may be requested for cable, patch panels, etc. Specify technical information on the products and installation associated with the required unit pricing in the appropriate articles of PART 2 and PART 3.

1.3 REFERENCES

Review and edit the following list of references. Check for completeness, currency and applicability to this project. Rarely should anything be removed from under the General or Communications categories. The Engineer/Designer shall verify with the DOC-CPDPM and/or the DOC-TDI Specialist assigned to the project whether the latest edition and/or addenda of each required reference is appropriate and specify the edition and addenda below accordingly.

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:

a. National Electrical Code (NEC)

b. National Electrical Safety Code (NESC)

c. Washington Industrial Safety and Health Act (WISHA)

d. Occupational Safety and Health Act (OSHA)

e. Revised Code of Washington (RCW)

f. Washington Administrative Code (WAC)

g. DOC Policy Directive: *Electrical Construction and Maintenance*, DOC 700.130

2. Communications:

Unless specifically indicated otherwise in the Construction Documents, the latest Edition and all current Addenda's and approved Amendments for the following publications shall be considered Communications references. (This section of the Construction Documents is based on the Washington State Department of Corrections (WSDOC) Telecommunications Distribution Infrastructure Standards (TDIS) Version 5.3, 4/30/2008)

a. ANSI/TIA/EIA-455: *Fiber Optic Test Standards*

b. ANSI/TIA/EIA-526 series: *Optical Fiber Systems Test Procedures*

c. ANSI/TIA/EIA-568-B: *Commercial Building Telecommunications Cabling Standard*

d. ANSI/TIA/EIA-569-B: *Commercial Building Standard for Telecommunication Pathways and Spaces*

e. ANSI/TIA/EIA-606-A: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

f. ANSI-J-STD-607-A: *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

g. ANSI/TIA/EIA-758: *Customer-Owned Outside Plant Telecommunications Cabling Standard*

h. IEEE 802.3 (series): *Local Area Network Ethernet Standard,* including the IEEE 802.3z *Gigabit Ethernet Standard*

i. ISO/IEC IS 11801: Generic Cabling for Customer Premises

j. BICSI*: BICSI Information Transport Systems Manual (ITSIM)*

k. BICSI*: BICSI Telecommunications Distribution Methods Manual (TDMM)*

l. BICSI*: BICSI Customer-Owned Outside Plant Design Manual (CO-OSP)*

1.4 DEFINITIONS

> Review and edit the following list of definitions for applicability to this project. Add and/or remove definitions for unusual terms that are not explained in the conditions of the Contract and that are used in ways not common to standard references.
>
> NOTE: Furnish, provide and install are used repeatedly throughout this specification. The Engineer/Designer shall ensure that these terms are identified in the appropriate section of the project manual. The definitions of these terms shall be similar to the following:
>
> Furnish - “Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations”.
>
> Install - “Operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations”.
>
> Provide - “To furnish and install, complete and ready for the intended operation”.

A. “BCT” shall mean *Bonding Conductor for Telecommunications*. The conductor that interconnects the telecommunications bonding infrastructure at the TMGB to the building’s electrical service grounding electrode system.

B. “HH” shall mean Handhole. A structure similar to a small maintenance hole through which communications cable can be pulled, but not large enough for a splice case or for a person to fully enter to perform work. DOC typically does not allow installation of new HHs or installation of telecommunications cable into/through existing HHs. Do not use an existing HH unless specifically identified for use on construction document drawings.

C. “MH” shall mean *Maintenance Hole.* A vault located in the ground or earth as part of an underground conduit system and used to facilitate placing, connecting, and maintaining communications cables as well as placing associated equipment. It is expected that a person will enter the MH to perform work.

D. “OSP-SCS” shall mean *Outside Plant - Structured Cabling System*. The OSP-SCS is defined as all required equipment and materials including, but not limited to, ANSI/TIA/EIA compliant copper and fiber optic cable (multimode and singlemode), connectors, splices, splice enclosures, grounding and bonding, and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

E. “SERVICE SLACK” shall mean all horizontal and backbone copper and fiber cables shall be installed to provide an additional length of cable (service slack) near each end of the cable within the area where the cable terminations are made. The service slack is to accommodate future moves or changes to the locations of the cable termination equipment. Within a telecommunications or equipment room, the service slack shall be long enough to reach the longest, opposite side of the room plus the distance from ceiling to floor, or whichever is longer - a minimum of ten feet for horizontal cable or twenty-five feet for backbone cable. For fiber optic cable, additional service slack is required – a minimum of ten feet stored within each fiber shelf or cabinet.

F. “TBB” shall mean *Telecommunications Bonding Backbone.* A conductor that interconnects all TGBs with the TMGB. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. The TBB originates at the TMGB and extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Whenever two or more TBBs are used within a building, the TBBs shall be bonded together with a TBBIBC. Size of TBB conductor is based on length from the TMGB to the electrical service grounding point.

G. "TGB" shall mean *Telecommunications Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. A TGB is the common point of grounding connection for telecommunications systems and equipment in the area served by telecommunications room or equipment room. There is typically one or more TGB's per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.

H. "TMGB" shall mean *Telecommunications Main Grounding Busbar.* A predrilled UL Listed copper busbar provided with holes for use with standard sized lugs. There is typically one TMGB per building, located in the main telecommunications room of the building. This busbar is directly bonded to the electrical service grounding electrode system by the Bonding Conductor for Telecommunications (BCT) and bonded to building structural steel or other permanent metallic systems. The TMGB serves as the dedicated extension of the building's grounding system for the building's telecommunications infrastructure. A TMGB may serve in lieu of a TGB in a telecommunications room.

1.5 SYSTEM DESCRIPTION

> Review and edit the following statement(s) for applicability to this project, restricted to describing performance, design requirements and functional tolerances of a complete system.

A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA and ISO/IEC fully compliant communications Outside Plant Structured Cabling System (OSP-SCS) as hereinafter specified and/or shown on the Construction Documents and with fully compliant TIA/EIA grounding and bonding as specified in Division 16 section *Grounding and Bonding for Telecommunications*. The system is intended to be capable of integrating voice, data, and video signals onto a common media. The data portion shall be tested for and be capable of Gigabit Ethernet operation as specified in IEEE 802.3z.

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

1.6 SUBMITTAL INFORMATION

> Review and edit the following list of submittals as applicable to this project. Note that the submittals listed below are specific to this section only. Division 1, Section 01300 (or equivalent) – Submittals should include general administrative requirements (e.g. schedule, number of copies, distribution, etc.). Either Section 01300 or this section should include a statement similar to the following:
>
> "The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Contract Documents.
>
> Any deviations from the Construction Documents or specified product data shall be clearly noted, and must be approved by the Engineer/Designer prior to start of construction. The Engineer/Designer shall obtain approval from DOC through the Alternative Design Request (ADR) process prior to approving a Contractor-submitted deviation.
>
> If the deviation is not approved by the Engineer/Designer it remains the Contractor's responsibility to provide what is required in the Construction Documents".

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

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

2. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.

3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Quality Assurance/Control Submittals: Provide submittal information for review as follows:

1. Submit a cable routing and grouping plan as follows:

   a. Where the cable routing, grouping, grounding, and bonding is to be provided as shown on the Construction Documents, do not provide a cable routing and grouping plan. Submit written documentation stating that the cable routing and grouping will be provided as shown on the Construction Documents, that the Contractor has reviewed the routing and grouping on the Construction Documents with applicable Subcontractors and suppliers and agrees it does not create conflicts between trades, and that the routing and grouping meets applicable codes, regulations and standards.

   b. Where changes in cable routing, grouping, grounding and bonding are proposed, submit complete floor plan(s) and/or detail drawing(s) showing the proposed routing, grouping, raceway sizes and locations, cabling, grounding and bonding in a manner equal to that of the Construction Documents. Ensure that any cabling changes are coordinated with comparable accommodating changes to the raceway routing and grouping. Specifically note each location where the proposed routing and grouping is different from the Construction Documents. Submit written documentation detailing the reason for each change request. Each change request must be approved in writing by the Engineer/Designer and Owner prior to proceeding with the change.

2. Submit wall field termination block and wire management elevations as follows:

   a. Where wall field termination blocks and wire management are to be provided as shown on the Construction Documents, do not submit elevations. Submit written documentation stating that the wall field termination blocks and wire management will be provided as shown on the Construction Documents, that the Contractor has reviewed the elevations on the Construction Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts between trades, and that the elevations meet applicable codes, regulations and standards.

   b. Where changes to the wall field termination blocks and wire management are proposed, or where elevations have not been included on the Construction Documents, submit wall field termination block and wire management elevations along with written documentation detailing the reason for the change. The change request must be approved in writing by the Engineer/Designer and Owner prior to proceeding with the change.

3. Submit a list of proposed test equipment for use in verifying the installation of the SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING and the SCS Manufacturer’s recommended test parameters.

a. Submit for each testing device:

1) Manufacturer and product/model number.

2) Documentation from the manufacturer showing date and outcome of the last re-calibration. Testing device shall have been re-calibrated within the last twelve (12) months or within the manufacturer's recommended calibration period, whichever is shorter, encompassing the period of time when the testing device will be used on this project.

3) Documentation stating date, time, and employee name performing field calibration of test equipment within thirty (30) days of time when the testing device will be used on this project.

4) Documentation from the manufacturer showing current software revision and the software's capabilities to successfully perform the current industry standard test for the Category of SCS cable being installed. Software revision shall be most current revision available for the testing device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.

5) Failure to provide calibration data or where calibration data is not within the parameters specified above shall render all tests performed null and void and require re-testing of all cable within the project or work order at no expense to the Owner.

b. Submit proposed copper and fiber cable test forms (see PART 3 – TESTING for more detail).

4. Submit a list of the personnel who will be assigned to the project, the type of work they will be performing per QUALITY ASSURANCE below, copies of the manufacturer's training certification for each, and copies of BICSI or equivalent SCS training certifications. If personnel changes are made during the project, submit the above information for any new personnel prior to them beginning work on the project.

C. Closeout Submittals: Provide submittal information for review as follows:

> A telecommunications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for each project. O&M information submitted under other related communications sections (e.g. Raceway and Boxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications. The requirement that the Contractor provide an O&M Manual for Communications should be stated in this section or in Inside Plant Communications Circuits if applicable.

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description. This is a separate manual in addition to and independent of any general O&M Manual for the construction project. If the project includes Inside Plant Communications Circuits, incorporate into one manual.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

> Portions of the text below may be contained in other Sections (e.g. 16010 (or equivalent) - General Electrical). Coordinate text for accuracy and content.

a. Document changes to the system from that originally shown on the Construction Documents and clearly identify system component labels and identifiers on Record Drawings.

b. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).

d. Show identifiers for major infrastructure components on Record Drawings.

Refer to the DOC Telecommunications Distribution Design Guide for format and content of the cable records described below.

Note that the Engineer/Designer is responsible for developing items 1-6 and 8 below and specifying in the Construction Documents.

e. Provide a table/schedule showing the following information for each cable link in the project on the Record Drawings. Base the table/schedule on the schedule provided by the Engineer/Designer in the Project Manual. Items 1 through 6 and item 8 have already been completed by the Engineer/Designer and are included in the table/schedule. Complete items 7 and 9. Include the following items in the table/schedule:

1) End locations of cable (telecommunications room)

2) Link Type (campus, riser, horizontal)

3) Media type (fiber type and core size, Cat 6A, CAT 6, Cat 3, etc.)

4) Proposed usage (voice, data, lighting control, etc.)

5) Cable Identifier

6) As-designed maximum link length

7) Actual measured link length (from test results)

8) For fiber optic cabling, as-designed maximum link attenuation at design frequency (indicating frequency used for design calculations) including as-designed maximum splice loss and as-designed maximum connector loss

9) For fiber optic cabling, actual measured link attenuation as tested with test frequency (from test results)

10) For copper cabling, actual measured headroom (from test results)

1.7 SEQUENCING

Include any requirements for coordinating work with potentially unusual or specifically required sequencing, such as having cable installed to test and commission other building automation systems (BAS).

A. Provide coordination with SYSTIMAX® to ensure that SYSTIMAX® inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any SYSTIMAX®-required modifications and have SYSTIMAX® re-inspect and certify the system prior to the scheduled use of the system by the Owner.

1. The Contractor is solely responsible for all costs associated with scheduling the SYSTIMAX® inspection, the inspection itself and any SYSTIMAX® required re-inspections, and for any modifications to the installation as required by SYSTIMAX®.

B. Schedule installation of cable and components that may be required for use by equipment and systems from other trades to ensure cabling connectivity for their testing and commissioning.

1.8 COORDINATION

A. Coordinate installation of cabling and components with other construction elements to ensure adequate headroom, working clearances, setback clearances, access, and building startup requirements.

1.9 QUALITY ASSURANCE

> The following are DOC requirements for Telecommunications Contractors and Telecommunications Contractor Employees. Review these requirements with the DOC-TDI Specialist and include as applicable to this project.
>
> For projects where the telecommunications cabling falls under the responsibility of the GC, consider establishing a deadline **prior to the bid date** for the General Contractors to have submitted prequalification documentation demonstrating that their telecommunications sub-contractor meets the qualification requirements. Also, consider publishing the list of pre-qualified telecommunications Contractors as an addendum prior to the bid deadline.

A. Telecommunications Contractor Qualifications: **Prior to bidding the project, submit:**

1. Documentation from the OSP-SCS manufacturer demonstrating the telecommunications Contractor is trained and certified by the Manufacturer to install, test, and maintain the SCS in the state of Washington and is certified by the OSP-SCS Manufacturer to provide the OSP-SCS Manufacturer's Warranty in the state of Washington (see PART 1 - WARRANTY).

   a. SYSTIMAX®: SYSTIMAX SCS Installation Contractor (for copper and fiber).

2. Documentation indicating the telecommunications Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below.

3. Documentation demonstrating the telecommunications Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI who shall be assigned to the project throughout the duration of the project. The RCDD shall be a direct full time employee of the telecommunications Contractor (i.e. an RCDD consultant/sub-contractor to the telecommunications Contractor is not acceptable). The telecommunications Contractor shall document the specific activities the RCDD will provide on the project.

4. List of references for no less than five similar projects (in terms of size and construction cost) performed by the telecommunications Contractor under the telecommunications Contractor's current business name within the past three years. Detail the following for each project:

   a. Project name and location

   b. Construction cost

   c. A brief description of the project, the components involved, and the OSP-SCS manufacturer used on the project

   d. Number of station drops

e. Number of buildings and quantity of backbone cable installed by type

f. Customer contact names, phone numbers, and addresses

g. Names of telecommunications Contractor's RCDD, supervisors/project foremen, installation & test technicians

> DOC generally includes the cabling under the responsibility of the GC which alleviates many problems. Include the paragraph listed at the bottom of this hidden text (or one similar) **"only"** if the cabling and components within this section of the project are to be constructed using a **Facility Contract** (FC) and a contractor selected under the State of Washington Department of Information Services (DIS) Master Contract.
>
> Use of the DIS Master Contract may be discussed with the DOC project manager and the DOC-TDI Specialist prior to the completion of Design Development if events arise in the project that warrants using a FC.
>
> When a FC is used along with the DIS Master Contract, this entire section is pulled out of the construction documents that go out to bid and is included in a separate construction document specifically written for the contractor from the DIS Master Contract. One or more pre-qualified Contractors from the DIS Master Contract shall be recommended by the DOC-TDI Specialist and approved by the DOC project manager. Review and edit the section numbers and titles below and coordinate content as applicable to this project.
>
> "Documentation demonstrating that the Contractor has a current Master Contract with the State of Washington Department of Information Services (DIS) per the requirements in Section 01010, and shall be on the DOC pre-qualified DIS contractor list shown in Section 01010."

B. Telecommunications Contractor's employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS' manufacturer. Training and certifications by employee type are required as shown below:

1. Project Managers/Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing of all manufacturers' cabling and components to be installed as required by the manufacturer, and trained/certified on Structured Cabling Systems by BICSI (or an equivalent telecommunications training organization) at the *Technician Level*. Requires current certification of:

a. SYSTIMAX® SCS ND3321 "Design & Engineering" course

b. SYSTIMAX® SCS ND3341 "Installation & Maintenance" course

2. Test Technicians: All (100%) shall be trained/certified for installation and testing of all manufacturers' cabling and components to be installed as required by the manufacturer. Requires current certification of:

a. Fluke Networks Certified Cabling Test Technician (CCTT) course or approved equal for other approved manufacturer's test equipment:

1) For DTX (Copper and/or fiber): "CCTT for the DTX Series CableAnalyzer".

2) For Optifiber OTDR: "CCTT for the OptiFiber Certifying OTDR".

3. Installation Technicians: All (100%) shall be trained/certified for installation of all manufacturers' cabling and components to be installed as required by the manufacturer and trained/certified on

Structured Cabling Systems by BICSI (or an equivalent telecommunications training organization) at the *Installer Level 2*. Requires current certification of:

a. SYSTIMAX® SCS ND3341 "Installation & Maintenance" course

4. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. cleanup crew, no hands-on cable assistants, etc.) are not required to be manufacturer or BICSI trained and certified. Other personnel shall not be allowed to directly assist the installation technicians or test technicians.

C. Telecommunications Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:

1. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.

2. Firestopping Technician: All (100%) shall be trained/certified for installation.

D. Comply with NEC.

E. Comply with NESC.

1.10 WARRANTY

Coordinate this paragraph with the conditions of the contract and Division 1 requirements to ensure that no statements are made that will limit or void those conditions. The Engineer/Designer is required to have a thorough understanding of the manufacturer warranties applicable on this project. The Engineer/Designer shall consider, account for, and advise DOC regarding any unique warranty situations that may arise from Owner-furnished equipment, Owner-installed equipment, or other situations that may conflict with warranty requirements.

A. Contractor Warranty:

1. Provide a Contractor-endorsed two-year service warranty against defects in materials and workmanship.

a. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.

1) The Contractor Warranty period shall commence upon Owner acceptance of the work.

B. OSP-SCS Manufacturer Warranty:

1. Provide an OSP-SCS Manufacturer extended product, performance, application, and labor warranty that shall warrant all passive components used in the OSP-SCS. Additionally, this warranty shall cover components not manufactured by the OSP-SCS Manufacturer, but approved by the OSP-SCS Manufacturer for use in the OSP-SCS (i.e. "Approved Alternative Products"). The OSP-SCS Manufacturer warranty shall warrant:

a. That the products will be free from manufacturing defects in materials and workmanship.

b. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-B and ISO/IEC 11801 Standards.

c. That the installation shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.

d. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.

2. Provide materials and labor attributable to the fulfillment of this warranty at no cost to the Owner.

3. The OSP-SCS Manufacturer Warranty shall be provided by the selected OSP-SCS Manufacturer and shall be:

a. SYSTIMAX® Structured Connectivity Solution Extended Product Warranty and Application Assurance Program (20 Years).

1) Provide a copy of the SYSTIMAX® Registration Document to the Owner at the time of submittal to SYSTIMAX®.

4. The OSP-SCS Manufacturer Warranty period shall commence upon a Warranty Certificate being issued by the manufacturer. The Warranty Certificate shall be issued no later than three months after Owner acceptance of the work.

2 PART 2 - PRODUCTS

PART 2 - PRODUCTS

Ensure that products listed under the PART 2 – Products paragraphs have corresponding installation instructions in PART 3 – Execution, or in another specification section if furnished but not installed under this section.

DOC has standardized on SYSTIMAX® for all new Structured Cabling Systems in DOC facilities. Products shall be specified accordingly. The Engineer/Designer shall ensure that the latest SYSTIMAX® part numbers are used for specified products. Note that “Or-Equal” substitutions for core products available from SYSTIMAX® are not permitted.

Any product substituted for a SYSTIMAX® warranted product other than those already listed within this document shall require the same or better 20 year product and performance warranty. If the substituted product is to be covered under the SYSTIMAX® warrantee, written authorization from the SYSTIMAX® Account representative must first be obtained and subsequently become part of the warranty documentation.

Some of the following paragraphs include ancillary products manufactured by companies other than SYSTIMAX®, but do not indicate that they allow “or equal” substitutions. If the Engineer/Designer wishes to use other products in lieu of non-SYSTIMAX® ancillary products, an alternative product request shall be submitted in writing to the DOC-TDI Specialist. This request shall follow the format and procedures of the Alternative Design Request identified in the TDDG, and include detailed literature from the manufacturer of the alternative product. If the alternative product is approved, the Engineer/Designer shall ensure that the specification for the alternative product is written with equal or greater detail to the following product specifications.

The products listed throughout PART 2 – Products below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified with equal or greater detail to the following paragraphs. The Engineer/Designer shall also verify that the most current part number of each specified product is listed in this section. Cautiously remove all product information that does not apply to a specific project.

Where one or more “x” is embedded within a product number listed in this section, the “x” portion typically is a place holder for quantity, color, length, etc. for the product. **It is the Engineer/Designer’s responsibility (not the Contractor) to work with the Owner and Design Team to obtain the specific information for the project components and modify the product codes accordingly, replacing the “x” information within the Construction Documents.**

2.1 GENERAL

A. Unless specifically stated as “Or equal”, equivalent items are not acceptable, provide items as specified.

B. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths and condition of conduit and/or pathway (including maintenance holes and handholes) to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.

C. OSP-SCS components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers unless the manufacturer of the OSP-SCS has listed (in writing) another manufacturer’s component as an “Approved Alternative Product” and will warrant the “Approved Alternative Product” as part of the OSP-SCS Manufacturer Warranty (see PART 1 - WARRANTY).

1. Bid only one OSP-SCS Manufacturer and only bid a manufacturer for which the Contractor is certified. The OSP-SCS Manufacturer shall be the following. Substitution is not acceptable:

    a. SYSTIMAX®

2. Contractor shall verify SCS Manufacturer’s Product Codes and Material Identifiers listed below prior to ordering.

D. For a given manufacturer, all components shall be part of a single OSP-SCS product line – components shall not be intermixed between a manufacturer’s OSP-SCS product lines. The OSP-SCS product line shall be engineered “end-to-end” – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

1. The OSP-SCS Product Line shall be the following, per manufacturer. Substitution is not acceptable:

    a. For SYSTIMAX®:

        1) For Category 6 Copper Distribution: SYSTIMAX® SCS GigaSPEED XL Solution

        2) For Category 6A Copper Distribution: SYSTIMAX® SCS GigaSPEED X10D Solution

        3) For Fiber Distribution: SYSTIMAX® SCS OptiSPEED, TeraSPEED, LazrSPEED

        4) For Category 3 filled ASP ANMW Copper Backbone:

            a) Manufactured by Superior Essex (no substitutions)

E. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Construction Documents that is required for a fully compliant, operational, tested, certified and warranted OSP-SCS system.

2.2 RACEWAY

Engineer/Designer shall review and edit the following products/part numbers as applicable to this project. If section numbers and titles are referenced, verify for accuracy.

A. As specified under Division 16 Section – “Outside Plant Communications Site Work”, Division 16 Section – “Raceway and Boxes for Communications Circuits” and Division 16 Section – “Inside Plant Communications Circuits” except where noted below.

1. Innerduct:

a. Outside Plant: Flexible textile innerduct with pull tapes.

Product: MaxCell Innerduct (or approved equal)

b. Outside Plant: Corrugated, bright orange, with pull tape and rated for outdoor duct installation.

1) 1” Diameter

2) 1-1/4” Diameter

c. Intrabuilding: Corrugated, white, with pull tape, UL Listed for indoor installation.

1) 1” Diameter - riser rated, UL Listed

2) 1-1/4” Diameter - riser rated, UL Listed

3) 1” Diameter - plenum rated, UL Listed

4) 1-1/4” Diameter - plenum rated, UL Listed

B. Pull Rope: Plastic or nylon with a minimum test rating of 200 lb.

1. For Intrabuilding: Shall be UL Listed.

C. Pulling Compound or Lubricant: Polywater or approved equal.

2.3 FIRESTOPPING

Review and edit the following products/part numbers as applicable to this project. If section numbers and titles are referenced below, verify for accuracy.

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

1. Specified Tech. Inc. (or approved equal).

2.4 GROUNDING AND BONDING

Review and edit the following products/part numbers as applicable to this project.

A. As specified under Division 16 Section – “*Grounding and Bonding for Telecommunications*”

2.5 EQUIPMENT RACKS/ENCLOSURES

Review and edit the following products/part numbers asapplicable to this project. If section numbers and titles are referenced below, verify for accuracy.

A. As specified in Division 16 Section – "Inside Plant Communications Circuits."

2.6 TERMINATION EQUIPMENT

Review and edit the following products/part numbers as applicable to this project. If section numbers and titles are referenced below, verify for accuracy.

A. Voice Backbone Copper Building Entrance Protectors (BEPs). Complete with lockable covers and plug-in protector modules for each pair terminated on the chassis. Protector modules shall provide over-voltage and sneak current protection. BEPs and protectors shall be manufactured by the selected OSP-SCS Manufacturer:

1. For SYSTIMAX®:

a. Protectors: 489A Building Entrance Protector

1) Mounting brackets: SYSTIMAX® 249A Mounting Bracket

2) Protector units/modules: SYSTIMAX® 4B1-EW (includes heat coils for sneak current protection)

3) Associated lock wrench

DOC does not generally allow the use of OSP rated 4-pair copper cable in the horizontal data environment, or in the OSP backbone environment. If a design solution (ADR approved by DOC-TDI Specialist requires the use of OSP rated Category 6, then include the following paragraph. Note that a voice circuit connected to a PoE or Data protector will fail.

B. OSP Copper 4-pair CAT 6 Station Entrance Protectors. Protectors shall be manufactured by the selected OSP-SCS Manufacturer:

1. For SYSTIMAX®:

a. Protectors: SYSTIMAX® Category 6 OSP Protector

Product: CAT-6 OSP 16 Volt Protector – Data (760028373)

Product: CAT-6 OSP 64 Volt Protector – PoE (760033951)

Product: CAT-6 OSP 235 Volt Protector – Analog Voice (760031708)

2.7 CABLE

Verify whether Outdoor or Indoor/Outdoor cable will be required for the project. Consult the DOC TDI Specialist as well as maintaining compliance with the NEC 50-ft rule. Note that the type of cables shall be specified in the CD - DOC does not want the choice left up to the Contractor!!!

Engineer/Designer shall discuss with the DOC TDI Specialist which MMF shall be deployed on each project. Where new construction occurs at an existing campus that has 62.5 um fiber deployed, then 62.5 um MMF typically needs to be deployed to new buildings because numerous low voltage BAS systems utilize the MMF and daisy-chain through patch panels, rather than active electronics, which requires a uniformly sized MMF throughout the campus and buildings. For construction of a totally new prison campus or stand-alone buildings, 50 um MMF shall be used.

A. Outdoor Cable: Rated for outdoor use, duct installation, and/or direct burial installation as dictated by the application.

1. Fiber Optic Cable: All-dielectric, meeting or exceeding ANSI/TIA/EIA and industry standards including Bellcore GR-20-CORE specifications. Cables and fan-out kits shall be manufactured by the selected OSP-SCS Manufacturer:

a. Multimode Fiber - 62.5 Micron: All-dielectric, MDPE jacket, gel filled, buffer tubes, dry water blocking cable core, multimode graded index, 62.5/125 multimode, with a maximum attenuation of 3.4 dB/km at 850 nm and 1.0 dB/km at 1300 nm and bandwidth of 200 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

1) For SYSTIMAX®:

a) Outdoor rated: SYSTIMAX® Outdoor Loose Tube OptiSPEED Dielectric

i. Product: 5024-xxxA-MXBK (760002xxx)

Example 24 strand: 5024-024A-MXBK (760002725)

b) Indoor/Outdoor rated: SYSTIMAX® OptiSPEED Loose Tube (check cable & installation requirements with Local Authority):

i. Riser Rated Product: 5124-xxxA-MRBK (70019xxx)

Example 24 strand: 5124-024A-MRBK (700191455)

ii. Plenum Rated Product: 5125-xxxA-MPBK (7600xxxxx)

Example 24 strand: 5125-024A-MPBK (760016642)

b. Multimode Fiber – 50.0 Micron: All-dielectric, MDPE jacket, gel filled, buffer tubes, dry blocking cable core.

1) For SYSTIMAX®:

a) Outdoor rated: SYSTIMAX® Outdoor Loose Tube LazrSPEED 300 Dielectric

i. Product: 5024-xxxA-ZXBK (760002xxxx)

b) Example 24 strand: 5024-024A-ZXBK (760002824)Indoor/Outdoor rated: SYSTIMAX® LazrSPEED 300 Loose Tube (check cable & installation requirements with Local Authority):

i. Plenum Rated Product: 5125-xxxA-ZPBK (7600xxxxx)

Example 24 strand: 5125-024A-ZPBK (760016824)

c. Singlemode 8.0 Micron: All-dielectric Loose Tube with a maximum attenuation of 0.4 dB/km at 1300 nm and 0.3 dB/km at 1550 nm.

1) For SYSTIMAX®:

a) Outdoor rated: SYSTIMAX® Outdoor Loose Tube TeraSPEED Dielectric

i. Product: 5024-xxxA-WXBK (7600xxxxx)

Example 12 strand: 5024-012A-WXBK (760002592)

b) Indoor/Outdoor rated: SYSTIMAX® TeraSPEED Loose Tube (check cable & installation requirements with Local Authority)

i. Riser Rated Product: 5124-xxxA-WRBK (760004xxx)

Example 12 strand: 5124-012A-WRBK (760004101)

ii. Plenum Rated Product: 5125-xxxA-WPBK (7600xxxxx)

Example 12 strand: 5125-012A-WPBK (760016568)

DOC prefers to have separate cables for SMF and MMF, except where pathway space is an issue. If composite is needed, the Designer/Engineer shall discuss whether the DOC-preferred Loose Tube or the Central Tube Composite Outdoor fiber should be specified below.

d. Hybrid/Composite: Shall conform to the multimode and singlemode characteristics above.

1) For SYSTIMAX® (SMF TeraSPEED 8.0 Micron & MMF LazrSPEED 300 50.0 Micron, Dielectric):

a) Outdoor rated: SYSTIMAX® TeraSPEED/LazrSPEED 300 Dielectric Composite Outdoor Loose Tube

Example 12/12: 5024-12/12A-W/ZXBK (760008722)

2) For SYSTIMAX® (SMF TeraSPEED 8.0 Micron & MMF OptiSPEED 62.5 Micron):

a) Outdoor rated: SYSTIMAX® TeraSPEED/OptiSPEED Dielectric Composite Outdoor Loose Tube

Example 24/12: 5024-24/12A-W/MXBK (760039354)

Note that OSP copper backbone and riser cables are no longer manufactured by SYSTIMAX®. SYSTIMAX® has directed DOC to specify Superior Essex cable which they will include within their SYSTIMAX® 20 year warranty.

2. Copper Cable:

a. For Backbone Category-3: Shielded, with 24-AWG solid copper conductors insulated with color coded PVC. UL Verified to ANSI/TIA/EIA 568-B for Category 3 performance. Insulated with filled foam skin-DEPIC and conform to RUS 7 CFR 1755.890 (REA PE-89). Cable shall be manufactured by or listed as an “approved alternative product” by the selected OSP-SCS Manufacturer:

1) For SYSTIMAX®:

a) Outdoor rated: Superior Essex ANMW ASP Filled Core Cable

Product: 22-xxx-83 (22-097-83 thru 22-125-83)

b) Indoor *“Riser”* rated: Superior Essex ARMM Riser Cable

Product: 02-xxx-03 (02-097-03 thru 02-125-03)

b. For Inter-building 4-pair Category-6:

1) For SYSTIMAX®:

a) Outdoor rated: SYSTIMAX® 1571 Category 6 Cable

Product: 1571 004ABK (760008888)

c. For Termination Block Connections (back-side): Unshielded, non-plenum multi-pair copper cable, 24-AWG, solid copper conductor, insulated with color coded PVC. UL Verified to ANSI/TIA/EIA 568-B for Category 3 performance. Cable shall be manufactured by the selected OSP-SCS Manufacturer:

1) For SYSTIMAX®: Category 3 1010 MultiPair Cable

Product: 10100xxAGY

2) For SYSTIMAX®: Category 3 1010 4-Pair Cable

Product: 1010004xxx 4/24

2.8 LABELING AND ADMINISTRATION

Review and edit the following products/part numbers as applicable to this project.

A. Labels and Tags

1. Shall follow the format and definitions of DOC's administration plan based on the ANSI/TIA/EIA 606-A Class 3 and as identified in the Construction Documents.

2. Labels shall be permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

a. Labels applied directly to small 4-pair cable (or equal diameter cable), not for Marker Tags:

1) Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

b. Labels for Marker Tags shall be a minimum size of 2.0" W x 1.0" H:

1) Panduit:

a) Clear L3PL3CL

b) White L3PL3WH

3. Hand-carried label maker:

a. Brady: ID Pro Plus, IDXPERT, HandiMark, TLS2200 (or approved equal).

4. Marker Tags for Conduit and Cable shall be a minimum size of 3.5" W x 2.0" H, constructed of rigid vinyl with a clear over-laminate protection (self-laminating), with slots for installing as a wrap and/or flag with nylon cable ties with a minimum loop tensile strength of 40 pounds. Labels applied to tags shall be typed and created by a label maker or an approved equivalent software-based label making system (see above). Handwritten labels are not acceptable.

a. Tags:

1) Panduit: Self-Laminating Cable Marker Rigid (Non-Adhesive) Tag #PST-FOBLNK (no substitutions)

b. Nylon Cable Ties (min. 40 LB loop tensile strength):

1) Panduit: PAN-TY #PLTxI-C (or approved equal)

5. Signs: Permanent plastic or metal engraved, not subject to fading or erasure, waterproof and solvent resistant, permanently affixed.

3 PART 3 - EXECUTION

PART 3 - EXECUTION

3.1 GENERAL

> Ensure that products incorporated into the project under PART 3 paragraphs have corresponding Product information in PART 2 – Products, or in another specification Section if installed but not supplied under this Section.
>
> DOC has standardized on SYSTIMAX® for all new Structured Cabling Systems in DOC facilities. Installation requirements shall be specified accordingly.
>
> The following paragraphs include installation requirements written specifically for the Products listed in Part 2 above. If other products are approved, the Engineer/Designer shall ensure that appropriate Part 3 installation requirements are added/removed or modified as applicable and written with equal or greater detail to the following paragraphs.
>
> The products listed throughout PART 2 – Products and the installation requirements below are not all-inclusive for any given project. The Engineer/Designer shall ensure that products required by their design are specified in Part 2 with corresponding installation requirements specified in Part 3.

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

1. In the event of damage to DOC telecommunications infrastructure, Contractor shall immediately stop any work that could potentially further the damage and contact the Owner:

   - For Capital Projects, Owner shall be the DOC Capital Programs Project Manager
   - For all other projects, Owner shall be the DOC Regional IT Manager

a. The DOC Owner shall immediately provide information of the damage to the DOC Regional IT Manager and/or the DOC Telecommunications Distribution Infrastructure (TDI) Specialist assigned to support the facility, and the facility manager.

b. Only the DOC TDI Specialist working in concert with DOC IT, Plant, and Capital Programs managers shall determine the repair and/or replacement strategy. Contractor shall not make this determination, make any temporary repairs or replace any telecommunications infrastructure unless directed to do so in writing by the DOC TDI Specialist.

c. All damaged telecommunications infrastructure shall be restored to within the scope of the original design, installation, operational, and warranty parameters (or better) by a contractor of Owners choosing. Only a certified SYSTIMAX® Value Added Reseller (VAR) shall work on the telecommunications cabling. Restoration shall include, but not be limited to all repair and/or replacement work and materials, testing, and re-certification of the infrastructure for full compliance to Owner's TDI Standards and SYSTIMAX® SCS and/or other manufacturer's warranty requirements.

F. Store all materials so as to be protected from the elements. Pathway materials (conduit, fittings, maintenance holes, etc.) are permitted to be stored outdoors if stacked on boards to avoid direct contact with the ground. The Contractor shall be responsible for any deteriorating effects on the materials due to improper storage (or outdoor storage) prior to installation including damage caused by prevailing weather conditions.

G. Remove surplus material and debris from the job site and dispose of legally and per Contract Document requirements.

H. <u>Owner and Engineer/Designer Inspections</u>: Contractor shall coordinate with Owner and Engineer/Designer to schedule in advance, dates for observations as indicated below. Owner and Engineer/Designer will determine if onsite observations are required for all work listed below or portions thereof.

1. Contractor shall provide one week advance notice to Owner and Engineer/Designer when work listed below is scheduled.

2. Contractor shall provide a minimum of 2 days advance notice to Owner and Engineer/Designer of dates when work listed below will be ready for observation.

3. Work requiring observation by Owner and Engineer/Designer:

a. Pulling of cable. Observations shall occur during initial pulling and periodically throughout the installation process and include forming and placement of cable service slack.

b. Installation of cable terminations onto patch panels. Observations shall occur during initial terminations and periodically throughout the installation process.

c. Testing of cables. Observations shall occur, at a minimum, during initial cable testing.

d. Demolishing existing telecommunications cable. Observations shall occur during initial cable removal and periodically throughout the demolition process.

e. On-site visits by SYSTIMAX® inspectors for inspecting and certification of the cabling system. Owner and Engineer/Designer shall be notified of scheduled visit dates.

3.2 DEMOLITION

> The Engineer/Designer shall coordinate with local DOC IT Manager and DOC Plant Manager to determine whether DOC wishes to retain certain demolished material or wishes to have it hauled away. Review any demolition requirements for this project with the DOC project manager and edit the following paragraph or create a similar paragraph as applicable.

A. Demolish existing telecommunications equipment, cable, materials, and incidentals no longer in use after installation of the new OSP-SCS.

1. When removing cable(s) from conduit where other cables are left in place, do not exceed the maximum pulling tension of any cable left within the conduit (this shall be the cable with the lowest maximum pulling tension).

2. Mandrel, clean, install pull rope, and cap outside plant conduits left empty after demolition of outside plant cables.

a. Clean each conduit with a wire brush, swab, and prove out with a minimum 16 inch long test mandrel that is ¼ inch smaller than the inside diameter of the duct. Clean conduit a minimum of two times in the same direction. Swab with clean rags until the rag comes out of the conduit clean and dry. Swab away from buildings for duct sections connected to buildings.

3. Properly and legally dispose of all materials demolished by the Contractor per Contract Document requirements.

B. Coordinate the demolition schedule with the Owner. Do not proceed with demolition prior to approval from the Owner.

3.3 RACEWAY

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Provide and install as specified under Division 16 Section – "Outside Plant Communications Site Work", Division 16 Section – Raceway and Boxes for Communications Circuits, and Division 16 Section – "Inside Plant Communications Circuits" except where noted below:

B. Outside Plant Innerduct:

1. Provide in quantities and sizes as required and as shown on the Construction Documents.

2. Provide sufficient innerduct slack to allow for innerduct shrinkage after stretching during installation.

3. Avoid excessive pulling tension. Replace corrugated innerduct showing evidence of excessive pulling tension at no cost to the Owner.

4. Rack and secure innerduct inside maintenance holes and handholes. If existing maintenance holes and handholes have insufficient racking to support new cabling, provide racking.

5. Cap innerduct immediately after placement in order to prevent debris from entering. Uncap only when cable is to be installed.

C. Inside Plant Innerduct

1. Provide innerduct for outside plant fiber optic cables from termination points within buildings to outside conduit entrances and in the sizes and locations shown on the Construction Documents. Provide plenum-rated innerduct within plenum rated spaces.

List additional Raceway product installation requirements above as applicable to this project.

3.4 FIRESTOPPING

Review and edit the list of sections below for relevance to this project and include only those that are directly related to this section. Ensure that the referenced sections are included in the project manual and that titles are accurate.

A. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

B. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.

1. Provide firestopping material for through and membrane penetrations of fire-rated barriers.
2. Install firestops in strict accordance with manufacturer's detailed installation procedures.
3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.
4. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.
5. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

C. Label each penetration upon Firestop installation completion using label compliant with the most-current ANSI/TIA/EIA-606-A format. After labeling, take digital photo of each penetration including label within photo and submit to both Owner and Engineer/Designer.

List additional firestop product installation requirements above as applicable to this project.

3.5 TERMINATION EQUIPMENT

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Copper Building Entrance Protectors (BEPs): Provide BEPs in sizes and quantities as shown on the Construction Documents and as required for protection of building-to-building copper circuits. Provide protector's in sufficient quantity to protect each pair of each cable plus an additional 10% for future use. Install BEPs per manufacturer's instructions. Route outside plant copper cables through a BEP.

1. Connect each BEPs protector ground lug to the nearest TGB with a #6 AWG copper grounding conductor.

B. OSP Copper Data Station Entrance Protectors: Provide Protectors in quantities as shown on the Construction Documents and as required for protection of OSP copper data circuits. Install Protectors per manufacturer's instructions. Route outside plant copper cables through a Protector.

1. Connect each Protector's ground lug to the nearest TGB with a #10 AWG copper grounding conductor.

List additional termination equipment product installation requirements above as applicable to this project.

3.6 GROUNDING AND BONDING

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. All grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

Verify and edit referenced section titles.

B. Bond non-current carrying metal telecommunications equipment and materials to the nearest TGB (if within a building – as specified under Division 16 Section - "Grounding for Communications Circuits and Raceway") or the nearest grounding conductor if in the outside plant.

1. Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

List additional grounding/bonding product installation requirements above as applicable to this project.

3.7 CONNECTORS/SPLICES

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Fiber Splices (Pigtails): Provide fusion-type fiber splices for connector pigtails (at the patch panels). Fiber splices are not permissible anywhere else in the system. Protect each fusion splice in a splice tray or similar protective device that is designed to mount within the fiber patch panel. Protect bare/stripped optical fiber strands with a heat shrink or silicon adhesive sleeve to prevent exposure to moisture.

List additional connector/splice product installation requirements above as applicable to this project.

3.8 CABLE

A. For each conduit in which innerduct or cable is to be installed:

1. Test Mandrels: Clean each conduit with a wire brush and swab with clean rags a minimum of two times in the same direction until the rag comes out of the conduit clean and dry. Swab away from buildings for duct sections connected to buildings. Prove out each conduit with a minimum 16 inch long test mandrel that is ¼ inch smaller than the inside diameter of the duct.

B. General (applicable to all cable types):

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Test cable on the reel upon delivery to the job site, prior to installation. Re-test the cable on the reel prior to installation if the reel has been stored for any significant period of time, moved multiple times, or if there is any question as to possible cable damage. "End of reel" cable provided to Owner for spare or future use shall be tested prior to Owner's acceptance at no additional expense to the Owner. If "end of reel" cable is transferred to a smaller reel for

delivery to Owner, on reel testing shall be performed after the cable transfer onto the smaller reel.

a. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation or acceptance of spare cable.

b. Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.

c. Demonstrate that the test results are similar to the factory test results as shipped with the reel.

d. Do not install cables or provide spare cable to Owner that fails the on-reel test or are significantly different from the factory test results. Replace any cables that fail the on-reel test at no additional expense to the Owner.

2. Contractor shall install cables in compliance with ANSI/TIA/EIA Standards, BICSI practices, and manufacturer's design and installation guidelines. Contractor shall adhere to the requirements detailed in the manufacturer's recommendations and ANSI/TIA/EIA Standards relating to bending radius, pulling tension, other mechanical stresses, and pulling speed.

a. Monitor pulling tension on runs of 300 feet or longer. Acceptable monitoring devices are:

1) Winch with a calibrated maximum tension

2) Breakaway link (swivel)

3) In-line tensiometer

3. A new pull rope shall be installed in each pathway along with the cable where the remaining fill ratio is less than forty percent (40%). Leave a minimum of 10 feet of pull rope looped and tied off at each end of the conduit.

4. Where conduit fill will result in less than 40% after installation of cable, innerduct shall be installed in the conduit to allow for subsequent cable installation.

5. Set up cable reels on the same sides of maintenance holes and hand holes as the conduit sections in which cables are to be placed. Level and align reels with conduit sections to prevent twisting of cables during installation into conduits. Pull cables into conduits from tops of reels in long smooth bends. Do not pull cables into conduits from bottoms of reels. Use a cable feeder guide (shoe) of suitable dimensions between the cable reel and the face of the duct to protect the cable and to guide it into the duct. Carefully inspect the cables for sheath defects as the cables are payed off the reel. If defects are found during the pulling operation or if the cable on the reel binds, twists, or does not pay off freely, stop the pulling operation immediately and notify the Owner's representative.

6. Cables of 1-¼ inch diameter or larger shall be equipped with factory installed pulling eyes, or install a core hitch on site. Use pulling grips for cables smaller than 1-¼ inches in diameter. Do not pound grips into the cable sheath to prevent the grips from slipping. Use a ball-bearing based swivel between the pulling-eyes or grips and the pulling strand.

7. Once pulling begins, and tension is applied to the cable, continue the pull at a steady rate. If it is necessary to stop the pull at any point, the tension shall not be released unless it is necessary to do so.

8. Do not splice cables unless specifically noted on the Construction Documents.

9. For new ductbank, install cables in the lowest available conduit in a duct bank, working up as additional cables are installed. For existing ductbanks, do not place cables in ducts other than those indicated on the Construction Documents.

10. Where cables are pulled through maintenance holes or handholes, select the same duct at both sides of maintenance holes or handholes unless specifically noted on the Construction Documents. Avoid changes in duct selections, especially in elevations, to ensure that no damage occurs to the cable sheaths and that pulling tensions are kept as low as possible.

    a. Where the specified outgoing duct is not useable, or the ducts are not specified, Contractor shall contact the Engineer/Designer for direction on duct selection before proceeding.

11. Maintain a sufficient length of cable in each maintenance hole or handhole to properly rack the cable. Rack cables in maintenance holes and handholes as soon as practicable, but within one week after cable installation. Route cables in maintenance holes and handholes to avoid blocking duct access.

12. When more than one cable is being installed in a conduit, pull all cables through the conduit simultaneously.

13. Where practicable, feed cables into ducts from the end of the duct that creates the least sidewall pressure on a bend during installation (i.e. feed cable from the end closest to the bend).

14. Use pulling compound or lubricant where necessary. Use lubricants that are compatible with the cable jacket material and in accordance with the manufacturer's recommendations. Do not use soap-based lubricants. Where cable is pulled through a maintenance hole or handhole, re-lubricate the cable prior to feeding into the next duct. Immediately after cables have been installed, clean lubricant from exposed cables in maintenance holes and handholes and at termination points using dry rags.

15. Seal cable ends with end caps immediately after installation and until terminated in a termination enclosure to prevent moisture entry into the core of filled cables and to prevent damage during installation.

16. Provide a <u>service loop</u> long enough in the ER/TR's to reach termination equipment if moved to the farthest side of the room away from the entrance point of the cable plus the height from ceiling to finished floor, but <u>no less than a minimum of 25 feet at each end</u>.

17. Comply with the NEC 50-ft rule when installing outdoor-rated cable (i.e. do not exceed 50 feet of exposed outdoor-rated cable length within a building).

18. Cable at the backboards:

    a. Lay and dress cables to allow future cabling to enter raceway (conduit or otherwise) without obstruction by maintaining a working distance from these openings.

    b. Route cable as close as possible to the ceiling, floor or other corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

    c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Tie-wrap together similarly routed and similar cables and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

19. Cable in the Telecommunications Rooms and Equipment Rooms:

    a. For rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals.

20. Building Entrances: Seal conduits (both in-use and spare) that enter the building from the outside plant to prevent intrusion of water, gases, and rodents.

21. Maintenance Hole/Handhole: Seal conduits and innerduct (both in-use and spare) that attach to the MH/HH to prevent water, gases, and rodents from entering the conduit.

C. Copper Cable:

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Provide copper cable in quantities and pair counts as shown on the Construction Documents.

2. Test copper cable as indicated above.

3. Terminate all pairs within a cable; un-terminated cable pairs are not acceptable. Termination shall be as specified in Division 16 Section – "Inside Plant Communications Circuits" except as noted in this section.

4. For shielded cable, bond the shield at both ends to the ground lug on the Building Entrance Protector.

5. Copper splices are not acceptable except at patch panels for connector pigtails.

D. Fiber Cable:

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

1. Provide fiber optic cable in quantities, strand counts, and types (singlemode, multimode, or composite multimode/singlemode (hybrid)), as shown on the Construction Documents. Provide cable with fan-out kits for both ends.

2. Test fiber optic cable as indicated above.

3. Terminate all fiber strands within a fiber cable; installation of "dark fiber" is not acceptable. **Termination shall be as specified in Division 16 Section – "Inside Plant Communications Circuits" except as noted in this section.**

4. Where shielded cable is called for in Construction Documents, bond both ends of the metallic shield (or metallic strength) member to the nearest TGB (as furnished under Division 16 Section –"*Grounding and Bonding for Telecommunications"*).

5. Fiber splices are not acceptable except where terminating OSP or Riser fiber onto Pigtails with factory-attached connectors at a fiber distribution shelf or LIU.

6. The service slack stored inside the fiber patch panel shall be a minimum of 3m (10 ft) in length.

> List additional cable product installation requirements above as applicable to this project.

3.9 LABELING AND ADMINISTRATION

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. General: Labeling and administration shall comply with ANSI/TIA/EIA-606-A and standard industry practices.

B. Color Coding: Apply industry standard color coded labels to cable termination fields and hardware. Always apply the same color label to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the backboard behind the termination equipment, may be the color of a cover on the termination equipment, or may be the actual color of the insert label on the termination equipment. Use the following color code:

1. Orange: Identification of the telecommunication service provider (telephone company) network demarcation point.

2. Green: Identification of customer extension of the network demarcation point.

3. White: Identification of first-level backbone cables in the building containing the main cross-connect (MC) and a horizontal cross-connect (HC), or between the MC and an intermediary cross-connect (IC).

4. Gray: Identification of the second-level backbone (tie) cables in the building between HCs, cables between MCs, or between an IC and a HC.

5. Blue: Identification of the horizontal distribution (station) cables between the HC and telecommunications outlet (TO). A blue color coded label is only required at the telecommunications room end of the cable, not at the station end of the cable.

6. Brown: Identification of inter-building backbone cables.

7. Yellow: Identification of inmate phone termination fields, auxiliary circuits, alarms, maintenance, security, bridging blocks, and other miscellaneous circuits.

8. Red: Identification of key telephone systems.

C. Termination Equipment:

1. Copper Building Entrance Protectors:

a. Label each BEP on the outside with a minimum of ½ inch high lettering that clearly indicates the building at the opposite end of the cable. Label each BEP on the inside with details for each cable terminating in the panel: the cable identifier, the cable pair-count and the building at the opposite end of the cable.

1) Example: A BEP used to terminate a 100-PR cable identified as “C12” from Building “A” would have the following label on the outside of the BEP: “Building A”. Another label would be located inside the BEP and would read “C12, 100-PR, Building A.”

2. Fiber Patch Panels:

a. Outside the panel: Label fiber patch panels on the outside with a minimum of ½ inch high lettering that clearly indicates the building at the opposite end of each cable. In addition, label patch panels with a patch panel designation label as follows:

1) General: Label patch panels sequentially within a given closet. Labels shall be of the form “R#-PP#” where “R” stands for “Rack”, “#” is the sequential rack number

within a given closet, “PP” stands for “Patch Panel” and “#” is the sequential fiber patch panel number within that rack.

a) Example: The second campus fiber patch panel within Rack 1 would have the label “R1-PP2”.

b. Inside the Panel:

1) General: Label patch panels with a single label which details the following information for cables terminating in the panel: The cable identifier, the building at the opposite end of the cable, the telecommunications room at the opposite end of the cable, the fiber type (62.5/125μm multimode, 50/125μm multimode, singlemode, composite) and the strand counts.

2) Connector Panels: Label each connector panel with the cable identifier (“F#”) of the fiber cable terminating in that connector panel.

a) Example: Connector panel “B” terminates the first twelve strands of campus backbone fiber cable “F4”. The label would be “F4.”

b) Example Connector panel “C” terminates the second twelve strands of campus backbone fiber cable “F4”. The label would be “F4.”

3) Ports: Label each duplex port with the tube and strand color/number nomenclature in the form of “tube:strand/strand”.

a) Example: The duplex port terminating the rose-colored strand and the aqua-colored strand in the blue tube within fiber F22, would be labeled “blue:rose/aqua.”

D. Grounding/Bonding Conductors shall be labeled as follows:

1. “WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR.-- DO NOT REMOVE OR DISCONNECT! If disconnected, report to facility management immediately!”

E. Cable:

1. Copper Cables: Labels shall include the cable identifier in the form of “M#” where “M” is the cable media type (“C” for “administrative copper” media or “I” for “inmate copper” media) and “#” is the sequential cable number for that cable type (as assigned on the Construction Documents), the origination and destination building names and telecommunications room identifiers, the pair count and cut length.

a. Example: The 350 foot long, 100-PR campus copper backbone cable identified on the Construction Documents as “C2”, terminating in telecommunications room “1A” within Building “G” and in telecommunications room “2A” within Building “H”, would be labeled with the following information: “C2”, 100-PR, 350-FT, BUILDING “H” - “1A”, BUILDING “G” - “2A”.

2. Fiber Cables: Labels shall include the cable identifier in the form of “F#” where “F” indicates “fiber” media, and “#” is the sequential cable number for that cable type (as assigned on the Construction Documents), the origination and destination building names and telecommunications room identifiers, the fiber type(s), strand count(s), and cut length.

a. Example: The 250 foot long, 12-strand, 62.5/125μm campus fiber backbone cable identified on the Construction Documents as “F4”, terminating in telecommunications room “1A” within Building “R” and in telecommunications room “2A” within Building “T”, would be labeled with the following information: "F4", 12-ST, 62.5/125μm, 250-FT, BUILDING "R" - "1A", BUILDING "T" - "2A".

3. Provide labels at each end of each cable within 24" of building entrance and again within 24" of termination point. Provide labels in each maintenance hole and handhole through which a cable passes. Label each cable immediately as it enters a maintenance hole or handhole and again just prior to exiting the maintenance hole or handhole. Where cabling is routed unexposed via innerduct through maintenance holes or handholes, provide labels on exterior of innerduct indicating contents of innerduct.

   a. Attach Wire Marking labels directly to small diameter cables such as 4-pair "only" inside buildings and non-outdoor environments.

   b. Attach Marker Tags to all larger diameter cables and to all cables in an outdoor environment preferably as a wrap or flag with nylon cable ties. The Marker Tag shall be placed onto the cable in an area such that it can easily be viewed.

F. Conduit Labels:

1. Verify the accuracy of existing conduit labels based on the information identified below, and correct as necessary.

2. If conduits are without labels, label each conduit end (existing or new) in a clear manner, with the information specified below.

3. Labeling information shall include:

   a. Location of the other end of the conduit (i.e. building name, telecommunications room identifier, or MH/HH identifier, MH wall direction of N, S, E, W), and MH duct identifier.

   b. Identify the conduit length.

4. Attach labels to conduit in buildings where conduit ends are not flush with walls, or attach to walls adjacent to each conduit where conduit ends are flush with walls.

   a. Labels attached to walls shall be permanently attached and labels placed in MH/HH's shall be water-proof.

G. Firestop Labels:

1. Refer to labeling requirement under the Firestopping section.

2. Labels shall be compliant with the most-current ANSI/TIA/EIA-606-A format.

List additional label product installation requirements above as applicable to this project.

3.10 PATCH CABLES

Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. Installation shall be as specified in Division 16 Section – "Inside Plant Communications Circuits."

List additional patch cable product installation requirements above as applicable to this project.

3.11 TESTING

> Review and edit the following installation requirements based on the products specified in PART 2 – Products above or on the products specified in another section if installed but not supplied under this section, and as applicable to this project.

A. It is Imperative for the Contractor to properly setup and configure the test equipment to ensure that proper testing is conducted based on the type of cable installed, the manufacturer's recommended test criteria, and the test requirements within this specification. Testing performed by Contractor with an improper setup or configuration or improperly calibrated test equipment will not be accepted and all tests shall be re-done at no additional expense to Owner.

1. Contractor should consider providing a sampling of the tests for review by the A/E's RCDD.

B. All cable provided to the Owner shall be tested prior to acceptance. Where spare cable is provided to Owner, cable shall be tested upon delivery at no additional expense to the Owner, and shall meet manufacturer's test criteria. Where spare cable is provided to Owner from ends of reels or other sources, or has incurred handling or been in subsequent transit since initial testing upon delivery, or in any way is suspect for potential damage since initial testing upon delivery, cable shall be re-tested at no additional expense to the Owner, and shall meet manufacturer's test criteria.

C. Provide electronic copies of original cable test machine results in both electronic format and in printed format as approved by the Owner and Engineer/Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the details of the test criteria, testing date, cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide complete test records and results to both the Owner and Engineer/Designer for review and acceptance within two weeks of Substantial Completion.

1. Copy original test machine test files to a CD directly from the machine tester.

a. For Fluke: Shall be Fluke Linkware.

2. Print test records in color for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic form (on CDROM) to both the Owner and Engineer/Designer for review. Handwritten test results will not be accepted.

a. For additions of only several cables, electronic form can be via e-mail attachment when approved by Owner.

D. Test the SCS after installation for compliance to all applicable standards as follows:

1. Copper Backbone Distribution: Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

a. Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 3 standards.

b. Test entire channel, from termination block to termination block.

c. Use a TIA/EIA Level IV testing instrument, certified re-calibration within the last twelve months by the manufacturer or more frequent if recommended by the manufacturer, field re-calibration occurring within thirty (30) days, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.

1) Fluke DTX-1800 with latest software and hardware releases for SYSTIMAX®, or approved equal.

2. Fiber: Test fiber cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

a. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:

1) For Backbone Distribution:

a) SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

b) A mated connection interface (connector-to-connector mating of two fiber ends) is defined as a single connection for the purposes of the above formula.

c) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).

b. Test all strands using a power meter test performed per ANSI/TIA/EIA-455-53A, and ANSI/TIA/EIA-568-B, or latest ANSI/TIA/EIA Standards and the SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

1) Test all strands bi-directional end-to-end.

2) Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.

3) Provide test measurements as follows:

a) For Multimode Cable: Test at both 850 nm and 1300 nm.

i. Multimode fiber tests shall be conducted using an LED light source.

b) For Singlemode Cable: Test at both 1310 nm and 1550 nm.

c. Test results shall conform to:

1) The criteria specified in ANSI/TIA/EIA-568-B (latest edition).

2) The Contractor’s calculated loss budget above.

3) The criteria specified in IEEE 802.3z (Gigabit Ethernet).

4) Both the optional and recommended criteria specified in SYSTIMAX® SCS Field Testing Guideline for Fiber-Optic Cabling Systems, Issue 3, August 2003 or latest edition.

5) Tests shall confirm/guarantee compliance to SYSTIMAX® and IEEE 802.3 Ethernet GigaSPEED performance for maximum end-to-end dB loss.

3. OSP 4-pair Copper cable:

a. Where a higher rated category cable is installed onto a lower rated category patch panel, perform two tests - one at each rating category.

b. Test all pairs of each copper station cable for conformance to ANSI/TIA/EIA 568-B.2-1 and 568-B.2-2 (or latest editions) Category 6 standards. To the extent possible, perform tests with building electrical systems fully powered on (i.e. Lights, HVAC, etc.).

1) Test each end-to-end permanent link (from the connector at the station (work area) to the connector or termination in the telecommunications room) utilizing sweep tests for Installed Length, Insertion Loss (IL), Near End Crosstalk (NEXT), Power Sum Near End Crosstalk (PSNEXT), Attenuation to Crosstalk Ratio (ACR), Power Sum Attenuation to Crosstalk Ratio (PSACR), Far End Cross Talk (FEXT), Equal Level Far End Crosstalk (ELFEXT), Power Sum Equal Level Far End Crosstalk (PSELFEXT), Return Loss (RL), Wire Map, Propagation Delay, Delay Skew, continuity, shorts, polarity, and presence of AC voltage. Test each cable in both directions at 250 MHz.

2) <u>NOTE: Owner requires cable tests using test parameters higher than minimum pass criteria for Category 6 cables</u>. Contractor shall set up tester for “Custom” test criteria to revise “PASS/FAIL” results accordingly.

a) SYSTIMAX® <u>**71-series** cables receiving less than **5 dB Headroom**</u> and <u>**81-series** cables receiving less than **6 dB Headroom**</u> on <u>Permanent Link tests</u> shall be re-examined for installation compliance at both ends of termination and along accessible horizontal pathway.

i. If corrective action by the Contractor fails to increase dB Headroom to the levels indicated above, both the Owner and Engineer/Designer shall be contacted to examine the cable installation and termination practices of the Contractor. At the Owner’s request, the SYSTIMAX® Regional Account Manager may be called in to review the cable installation and termination practices of the Contractor.

ii. If the SYSTIMAX® Regional Account Manager approves the cable installation and termination practices employed by the Contractor, the cables in question shall be re-tested using the SYSTIMAX® <u>Channel tests</u>. The cables shall receive a PASS on all SYSTIMAX® guaranteed Channel test criteria, else the Failed cables shall be removed, destroyed, and re-installed with the testing procedure re-started with the Permanent Link test indicated above.

3) Use a TIA/EIA Level IV testing instrument, certified re-calibration within the last twelve months by the manufacturer or more frequent if recommended by manufacturer, field re-calibration occurring at the start of testing, with the most current manufacturer’s software revision, capable of storing and printing test records for each cable within the system and equipped with the current and appropriate "SYSTIMAX® Gigaspeed test adapters".

a) Testing Device: Fluke Fluke DTX-1800 with latest software and hardware releases for SYSTIMAX® GigaSpeed CAT-6 XL horizontal distribution cables.

i. Universal Permanent Link Adapters: DSP-LIA101S

(1) CAT 6 Centered Personality Modules: DSP-PM06

(2) CAT 6 Personality Modules: DSP-PM25

b) Permanent Link Adapters shall be re-calibrated with the DTX-PLCAL module within the last six months.

4) Tests shall also confirm/guarantee compliance to SYSTIMAX® Ethernet GigaSPEED 1000B-T (1000 Mb/s IEEE 802.3ab) and 1000B-TX (1000 Mb/s ANSI/TIA/EIA-854) applications based on the data contained in the SYSTIMAX® Performance Verification of GigaSPEED XL Installations February 2nd, 2004 or latest edition.

5) Test results shall be test machine-produced in Fluke (most-recent version) cable test management software format:

a) LinkWare (most-current version)

E. Identify cables and equipment that do not pass to the Owner and Engineer/Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials <u>at no additional expense to the Owner</u>. Provide new test results to the Owner and Engineer/Designer in the same manner as above.

1. In addition to the above, if it is determined that the cable is at fault, remove the damaged cable and replace it with a new cable. Cable “repairs” are not acceptable. The procedure for removing the cable shall be as follows:

a. Prior to removal of damaged cable and installation of new cable:

1) Inform the Owner and Engineer/Designer of the schedule for the removal and installation.

2) Test the new cable on the reel per paragraph B, above.

3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.

4) Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

b. Remove the damaged cable and provide new cable.

c. After the removal of the damaged cable and installation of the new cable:

1) Test the new cable per the paragraph titled TESTING.

2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.

a) If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.

3) Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

d. If a cable(s) residing in the same innerduct or conduit is damaged by the Contractor during installation of other cable, Contractor shall replace damaged cable(s) no additional expense to Owner.

1) Replacement cables shall be subject to the testing procedures of the paragraph titled *TESTING*.

List additional testing requirements above as applicable to this project.

3.12 FOLLOW UP

> Review any contractor follow-up requirements with the DOC project manager and clearly state these requirements in the following paragraph(s).

A. For the first four weeks that the system is in full operation, provide technical assistance for trouble shooting, training, and problem solving by phone and (within 24 hours of notice) on site. Provide up to 40 hours of assistance (in addition to any warranty-related work), including phone, travel, and on site time during this period.

END OF SECTION