Infrastructure and Design Standards

Wright State University Computing and Telecom Services Infrastructure Standards
Design Guidelines and Specifications
July 25, 2012

Notice

This is a "Living Document" intended to define the minimum telecommunications infrastructure design requirements in new construction, renovations and IT infrastructure projects. It will be updated as standards, codes and practices are revised. The date on this cover page references its last revision.

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FOREWORD

This is a Wright State University, CaTS Telecommunications Design Guideline Specification Document.

The purpose of this document is to describe and specify the standards and practices as they pertain to the design and installation of communications and networking requirements at Wright State University. This document is based on standards including ANSI/TIA/EIA 568B, 569A, 570, 606A and guidelines including BICSI Telecommunications Design Manual 11th Edition, see these references for further detail. This document does not replace any national or local standards, regulations or codes, but enhances them. If the standards and practices of Wright State University exceed national or local standards, regulations or codes, Wright State Universitys practices shall take precedent.

The scope of this document includes the design and installation methods of communication Telecommunication Rooms (TRs), cabling distributions systems, work area outlet locations, cable specifications, testing, documentation and administration. This document shall be the minimum standard of reference for all phases of communications and networking for all new design and upgrades at Wright State University. This document is subject to change in form and technical content as warranted by advancements in building construction techniques and telecommunications technology. As such, Wright State University specifically reserves the right to add to and revise, the information contained herein.

Room types with minimum sizes and function
Table 1 - Summary of rooms used to service a building or campus

Note:

- ***All room sizes and dimensions must be approved in writing by Wright State University and CaTS prior to design.***
- ***All sizes indicated below are inside room dimensions.***

Space name	Acronym	Minimum Recommended space size	Functions / equipment
Equipment Room	ER	Case-by-case	- entrance protection - transition for access provider cables - distribution point to other ER/TRBs - cable infrastructure pathway - voice MDF/PBX location - wireless - paging - backbone data communications - CATV - video conferencing
Telecommunications Room/Building	TRB	12 ft x 12 ft	- entrance protection for cables PBXR - distribution point to other building (TRBs) - cable infrastructure pathway - data communications - voice BDF and IDF - wireless - paging - CATV - video conferencing
Telecommunication Room	TR	10 ft x 10 ft	- cable infrastructure pathway - data communications - voice IDF - wireless - paging - CATV - video conferencing

Scope

General
The scope of this document includes the design and installation methods of Equipment Rooms, Telecommunications Rooms, cabling distributions systems, work area outlet locations, cable specifications, testing, documentation and administration. This document shall be the minimum standard of reference for all phases of communications and networking for all new design and upgrades at Wright State University.

References
The following codes and standards contain provisions that, through reference in this text, constitute provisions of Document. At the time of publication, the editions indicated were valid. All codes and standards are subject to revision; parties to agreements based on this Document shall apply the most recent editions of the codes standards indicated. All Personnel involved with the design or installation of communication and networking at Wright State University must have access to the following documents. All equipment, construction practices, design principles and installations must conform to the latest version of any or all of the following standards and codes, published by the following organizations, where applicable;

- Federal Communications Commission (FCC)
- Institute of Electrical and Electronics Engineers, Inc (IEEE)
- National Fire Protection Association (NFPA)
- National Electrical Safety Code (NESC)
- American National Standards Institute (ANSI)
- Telecommunications Industry Association (TIA)
- Electronic Industries Alliance (EIA)
- Building Industry Consulting Service International (BICSI)

DEFINITION OF TERMS, ACRONYMS AND ABBREVIATIONS

General
This section contains definitions of terms, acronyms, and abbreviations that have a special meaning or that are unique to the technical content of this document. The terms that are used in only one clause may be defined within, and at the beginning of, that clause.

Definition of terms
Equipment Room (ER): An ER Room is a special purpose room designed to serve as a campus point of demarcation. An ER Room may service multiple TRBs in a campus design. In large campuses multiply ERs may be required and interconnected. Equipment Rooms can contain equipment to support all of the following: entrance protection, access provider terminations, cable infrastructure pathway, voice MDF, wireless, data communications' paging, CATV and video conferencing.

Building Telecommunications Room (TRB): A TRB is a special purpose room designed to serve a single building with multiple TRs. The TRB may also contain the necessary equipment to function as a TR for the floor it is located on. A TRB can contain equipment to

support all of the following: entrance protection, cable infrastructure pathway, data communications, voice BDF and IDF, wireless, paging, CATV and video conferencing.

Telecommunication Room: A TR is a special purpose room designed to serve a single floor. In buildings with multiple floors, TRs shall be vertically stacked to form a backbone pathway. The TR is the point in the Data and Voice infrastructure that the backbone and horizontal distribution systems are connected to each other. A TR can contain equipment to support all of the following: cable infrastructure pathway, data communications, voice IDF, wireless, paging, CATV and video conferencing.

Access Point: An Access Point is a space use to transition backbone and horizontal cabling between floors within a building riser system. An Access Point may contain splices but is not suitable for cable terminations

Acronyms

AP	Access Point
AFF	Above the Finished Floor
BICSI	Building Industry Consultants Service International
CAT	Category
CATV	Community Antenna Television (cable television)
HH	Handhole
MH	Maintenance Hole
PBX	Private Branch Exchange (Phone Switch)
TR	Telecommunication Room
TRB	Building Telecommunications Room
TGB	Telecommunications Grounding Busbar
TMGB	Main Telecommunications Grounding Busbar
TDMM	Telecommunications Distribution Methods Manual (BICSI Publication)
UTP	Unshielded Twisted Pair

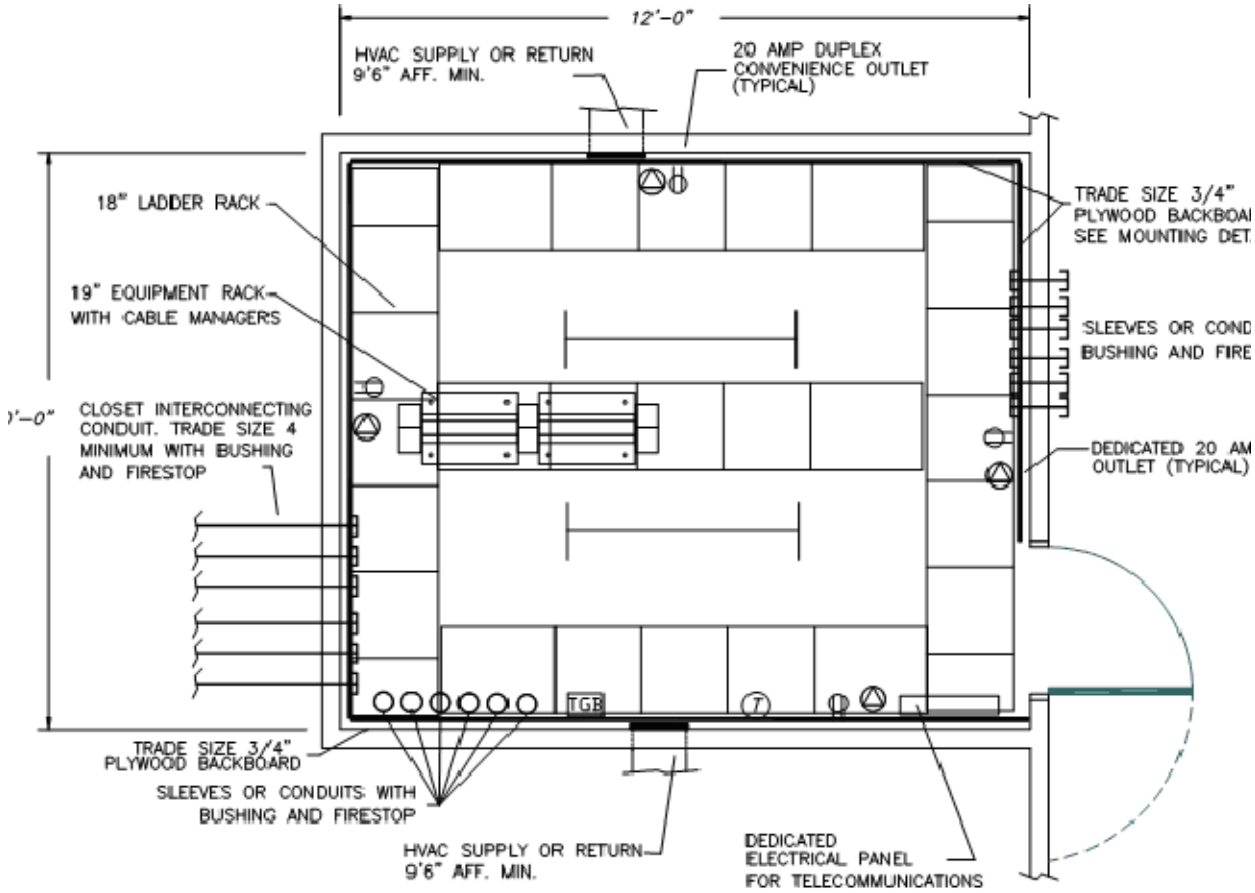
Also see "References" for additional codes and standards Acronyms.

DESIGN GUIDELINES
100 Telecommunications rooms
Telecommunications Room / Building Equipment Rooms

100-1 General

The following section will outline the location, design and pathway requirements for Building Equipment Rooms (TRB) and Telecommunication Rooms (TR).

Figure 1 - Example of a Telecommunications Room



100-2 Location
TRBs and TRs locations must meet the following requirements

- Location should be selected so that the room may be expanded.
- Shall be located as close as practicable to the center core of the building to minimize horizontal cable distances (Maximum cable length is 295' (90m) from TR to drop location)
- Shall be accessible through common-use corridors that will allow the delivery of large cable reels and equipment and access for repairs 24x7.
- In multiple floor applications, TRBs and TRs shall have all 4 walls vertically stacked.

TRBs and TRs may not be inside of or be part of a Mechanical space, Equipment room, Washroom, storage area, janitor closet. All room locations must be approved in writing by Wright State University prior to design.

100-3 Electromagnetic interference
Rooms shall be located away from sources of electromagnetic interference. Special attention shall be given to electrical power supply transformers, motors and generators, x-ray equipment, elevator equipment, and induction devices.

100-4 Access
Access to the Rooms shall be 24 hours-per-day, 365 days-per-year basis (24x7). Access shall be through common use corridors and not accessed by way of any other room.

Design

100-5 Architectural

5.1 Size
Rooms shall have a minimum inside dimension of 10ft. x 10ft. If these rooms require additional square footage based on additional requirements, the size shall be determined on a case-by-case basis. Wright State University must approve all room dimensions in writing.

5.2 Walls
All four (4) walls shall be floor to deck and have a 2-hour fire rating.

5.3 Plywood backboards
All four (4) walls shall be covered with Â¾ in. exterior grade plywood, preferably void free. Plywood shall be fire-rated to meet applicable codes. To reduce warping, fire-rated plywood shall be kiln-dried to maximum moisture content of 15%. Plywood shall be painted on all 6 sides with a gray fire retardant paint. Mount plywood 2" above the top of the electrical outlets or surface raceway. Top of plywood shall be level with the top of the cable tray but shall not exceed 9' AFF.

5.4 Ceiling height
The height between the finished floor and the lowest point of the ceiling should be a minimum of 3 m (10 ft).

5.5 Treatment
Floors, walls, and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting. Floor covering shall be a vinyl anti-static material. Color shall be determined on a case-by-case basis.

5.6 False ceiling
Room shall not have a false ceiling to permit maximum use of cable pathways both vertically and horizontally. In such cases where fire-proofing may be sprayed onto the exposed ceiling, the fire-proofing shall be treated to mitigate airborne dust. If walls do not extend to the deck the a drop ceiling shall be installed at 10 foot AFF or the walls should be extended to the deck.

5.7 Door
Doors shall be a minimum of 0.9 m (36 in) wide and 2 m (80 in) high, without doorsill, hinged to open outward (code permitting) or slide side-to-side, or be removable. Consideration could be given to using double doors with a removable center-post. The door(s) shall be fitted with a lock which is keyed for a Telecom Closet key. The door frame shall be prepped for an electric strike for a Card Access system. All doors should have a sill at the bottom to protect against dust.

5.8 Floor loading
The TRBs shall be located on floor areas designed with a minimum floor loading of 4.8 kPa (100 lbf/ft^2). The TRs shall be located on floor areas designed with a minimum floor loading of 2.4 kPa (50 lbf/ft^2). The project structural engineer shall verify that concentrations of proposed equipment do not exceed the floor-loading limit.

5.9 Signage
Signage, if used, should be developed within the security plan of the building. CaTS would prefer no signage.

5.10 Contaminants
The rooms shall be protected from contaminants and pollutants that could affect operation and material integrity of the installed equipment.

100-6 Heating, Ventilation and Air Conditioning (HVAC)

6.1. Continuous operation
HVAC shall be available on a 24 hours-per-day, 365 days-per-year basis. A stand‘alone unit should be installed for Telecommunication Rooms. The TRB should be a minimum of 24,000 BTU and the TR should be a minimum of 12,000 BTU units.

6.2. Standby operation
If a standby power source is available in the building, consideration should be given to also connecting the HVAC system serving the Communications Rooms to the standby supply.

6.3. Operational parameters
The temperature and humidity shall be controlled to provide continuous operating ranges of 18 °ℜC (64 °ℜF) to 24 °ℜC (75 °ℜF) with 30% to 55% relative humidity. The ambient temperature and humidity shall be measured at a distance of 1.5 m (5 ft) above the floor level, after the equipment is in operation, at any point along an equipment aisle centerline.

6.4. Positive pressure
A positive pressure differential with respect to surrounding areas should be provided with a minimum of one air change per hour.

6.5. Vibration
Mechanical vibration coupled to equipment or the cabling infrastructure can lead to service failures over time. A common example of this type of failure would be loosened connections. If there is a potential for vibration within the building that will be conveyed to the TR via the building structure, the project structural engineer should design in safeguards against excessive TR vibration.

6.6. Other mechanical fixtures
Mechanical fixtures (e.g., piping, ductwork, pneumatic tubing electrical conduits) not related to the support of TR/TRB shall not be installed in, pass through, under or enter the TR/TRB. In addition, the area adjacent to the exterior of the TR/TRB walls shall remain clear for cable pathways entering the TR/TRB.

100-7 Electrical

7.1. Lighting
Lighting shall be a minimum of 500 lx (50 foot candles) measured 1 m (3 ft) above the finished floor, mounted 8.5 ft minimum above the finished floor. Light fixtures must be independently supported from the building structure. Light fixtures shall not be mounted to, or supported by the cable tray.

NOTE - Lighting fixtures should not be powered from the same electrical distribution panel as the TR/TRB. Dimmer switches shall not be used and emergency lighting and signs should be properly placed such that an absence of primary lighting will not hamper emergency exit.

7.2. Power

7.3. General
Each TR shall contain an electrical sub panel for the TRB and all the TRs that will be fed from that TRB. TRs shall be fed from the sub panel in the TRB so that all outlets in all TRs are on emergency power.

7.4. Panel
The electrical sub panel shall be fed from the building emergency electrical power system. The panel shall be sized to accommodate the TRB and all the TRs that will be serviced by it. The panel shall have a laser printed directory to indicate rooms served by breaker.

7.5. Equipment 110v Outlets
TRBs / TRs shall be equipped with a minimum of three (3) dedicated 110V, 20A circuits. Outlets shall be 110V, 20A duplex outlets designed. Outlets may be wall mounted, installed in divided surface raceway or installed on strut channel above equipment racks depending on room configuration. Outlets shall be installed 12" from finished floor to center. All outlets shall have a laser printed circuit identifiers affixed to it indicating the panel room number, panel ID and circuit number. Wright State University may specify additional outlets on a case-by-case basis.

7.6. Convenience 110v Outlets
TRBs/ TRs shall be equipped with convenience outlet placed on each wall of the TR for uses other than network equipment (i.e. power tools, testing equipment). This outlet shall be run from a separate electrical panel. All outlets shall have a laser printed circuit identifiers affixed to it indicating the panel room number, panel ID and circuit number. Wright State University may specify additional outlets on a case-by-case basis.

7.7. Location of power conditioning systems
Where applicable, dedicated environmental control equipment, such as power conditioning systems, and UPS up to 100 kVA shall be permitted to be installed in the TR. UPS larger than 100 kVA should be located in a separate room. This must be approved in writing by Wright State University prior to design.

7.8. Bonding and grounding
TRBs shall have a TMGB installed to which all TGBs in TRs, equipment, conduits, cable shields, cable trays, sleeves, etc. shall be bonded. The TMGB shall be connected to the main electrical service ground of the building with a minimum conductor size 2 AWG. A larger conductor size may be required based on the distance between the TMGB and the main electrical service ground. The TMGB shall also be bonded to building structural steel.

TRs shall have a TGB installed to which all equipment, conduits, cable shields, cable trays, sleeves, etc. shall be bonded. The TGB shall be connected to the TMGB located in the TRB with a minimum conductor size 6 AWG. A larger conductor size may be required based on the distance between the TMGB and the TGB. The conductor shall be continuous from the TMGB to the TGB. The TGB shall also be bonded to building structural steel if close and accessible. A separately derived ground or isolated ground system is not permitted.

100-8. Miscellaneous Requirements

8.1. Fire protection

Fire protection of the Telecommunications Rooms, if required, shall be provided as per applicable code. If sprinklers are required within the spaces, the heads shall be provided with wire cages to prevent accidental operation. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room. For some applications, consideration should be given to the installation of alternate fire-suppression systems, confirm applications with Wirght State University.

8.2. Water infiltration

The TRBs/TRs shall not be located below water level unless preventive measures against water infiltration are employed. The room shall be free of water or drain pipes not directly required in support of the equipment within the room. A floor drain shall be provided within the room if risk of water ingress exists.

200. Cable Pathways

1.1. General

Conduits and sleeves should extend 4- 6" into the TR/TRB. If the conduits or sleeves are subject to water intrusion they must drain away from the room and be watertight. All conduits and sleeves must have the ends plugged upon installation to keep debris from entering the conduits and sleeves. Cable tray shall not be run through walls. Conduits and sleeves must have bushings install at all ends and at all pull boxes. Wright State University must approve all pathway designs in writing.

Conduit pathways built for telecommunication cabling have more stringent bending and pull box requirements than electrical cabling and must be adhered to (i.e. a telecommunications conduit can have no more them 180 degrees of cumulative bends between pull points where as a conduit installed for electrical wiring may have 360 degrees of bends between pull points).

2.1. Ladder Rack

A 12" wide ladder rack shall be run around the inside perimeter of the room for the distribution of cabling inside the room. An 12" wide ladder rack shall also be run down the center of the room for the free standing racks that will be installed. The rack shall be mounted 7'0" from finished floor to the bottom of the tray. There shall be no other equipment, lights, conduits, fixtures etc. attached to, mounted on, running through or on the ladder rack except those needed to support the ladder rack systems. Ladder racking may not be run through walls.

3.0. Sleeves/Conduits

3.1. Horizontal UTP

The quantity of horizontal sleeves installed in each TR/TRB for horizontal cabling shall be three (3) 4" sleeves. The sleeves shall be a minimum 8'-0" AFF to the bottom of the sleeves. Sleeves that are installed above 9'-0" AFF must have vertical ladder racking installed from the bottom of the sleeve to the top of the cable tray for lashing of cables in the vertical run.

3.2. Vertical Backbone
In a multi-store building where TRs are stacked to form a riser, a minimum of three (3) -4" sleeves shall be installed between the stacked TRs.

3.3. Horizontal Backbone Inter-building
Backbone pathways in the form of four (4)-4" conduits shall be installed between the TRB of each building and the nearest designated maintenance hole servicing that building.

3.4. Horizontal Backbone Intra-building
If the TRs are not vertically stacked on the TRB, backbone pathways in the form of three (3)-4" conduits shall be installed between the TRB of the building and each TR. All conduits and innerducts are to be threaded with a pull rope with footage markers. In multi-story building where TRs are stacked to form a riser, a minimum of three (3)-4" conduits shall be installed between the TRB and the first TR in the stack. Cable tray can be used for Inter-building Backbone distribution only with the use of properly sized innerduct or by the installation of a physical separation for the protection of the Backbone cables from general cable installation. Wright State University must approve use of cable tray as a backbone distribution system.

General Telecommunication Room Design

Telecommunication Room design shall follow all BICSI TDMM design recommendations. Wright State University must approve all final design in writing. A detailed T3 drawing will be required for Telecommunication Plans, for more information on drawing detail see BICSI TDMM 12th Edition.

300 Interior Communications Pathways

1.1. General
The Interior Communications Pathways will provide a distribution system for all system cabling that will be served by the building TRs. The pathways for a building may include all or some of the following, cable tray, continues conduit systems, conduit stubs, sleeves, and cable hangers. All pathways must be approved in writing by Wright State University prior to design completion. Interior pathway design shall follow all BICSI TDMM design recommendations and TIA568-B and TIA569-A standards.

Conduit pathways built for telecommunication cabling have more stringent bending and pull box requirements then electrical cabling and must be adhered to (i.e. a telecommunications conduit can have no more them 180 degrees of cumulative bends between pull points where as a conduit installed for electrical wiring may have 360 degrees of bends between pull points).

2.0. Interior Pathways

2.1. Cable Tray

A continuous cable tray system shall be installed on each floor. Minimum tray size shall be 12" x 4" deep with 1" rungs every 9" on floors that have a TR . For all other floors the cable tray shall be 12" x 4" deep with 1" rungs every 9". When making turn and elevation changes the appropriate tray accessories, having the proper bend radius, must be used. For access to, and installation of, cables in the cable tray, the following clearances are required around the cable tray. The cable tray system shall have 1'-0" clearance measured from the top most surface of the tray. Access from the sides shall be 6" to 1'. Access to the cable tray from below shall be unobstructed its entire length. There shall be no other equipment, lights, conduits, fixtures etc. attached to, mounted on, running through or on the cable trays except those needed to support the tray systems. Cable tray may not be run through walls. The tray shall stop at all walls where sleeves or conduits will be installed, the tray shall continue on the others side of the wall.

3.0. Conduit:

3.1. General

Sizes indicated for conduits are trade sizes in all cases.

- Conduits shall have an insulated bushing installed prior to the installation of telecommunications cabling.
- Conduits must have the ends plugged upon installation to keep debris from entering them.
- Conduit needs to run in the most direct route possible, usually parallel with building lines.
- Conduit runs shall contain no continuous sections longer than 100 feet. If runs total more than 100 feet, pull points or pull boxes need to be inserted.
- Conduit shall have no more than 180 degrees of cumulative bends between pull points or more than 90 degrees of bends at any one point.
- Electrical Metallic Tubing shall be electro-galvanized steel.

3.2. Outlet / Conduit location

3.3. New construction wall outlet

Conduit from the cable tray to a typical wall outlet should be a minimum of 1". Each 1" conduit will service only **one** wall outlet location. The conduit will be terminated in a 4" x 4" x 2.75" deep box with a pull string. The box shall be fitted with either a single or double gang mud ring to suit the outlet configuration required.

Outlets are typically located at the following heights to center:

- Desks 18" AFF
- Wall Phones 48" AFF
- Pay Phones 48" AFF

Conduits run to the cable tray should end approximately 4"- 6" inches away from the top or bottom edge of the cable tray to maintain a proper bend radius.

3.4. New construction floor outlet

Conduit from the cable tray to a typical floor outlet should be a minimum of 1". Each conduit will service only **one** floor outlet location. The conduit will start at the cable tray located on the same floor as the work area. Confirm all floor outlets meet Fire Code and will accommodate manufacturers jacks and outlets.

3.5. Renovations

For areas being renovated, the minimum requirement for horizontal wiring shall be the same as new construction. If walls cannot be accessed the university has a number of options that can be used. These will be determined on case by case basis and approved by Wright State University.

4.1. Sleeves

- Sizes indicated for sleeves are trade sizes in all cases.
- Sleeves shall have an insulated bushing installed prior to the installation of telecommunications cabling.
- Sleeves must have the ends plugged upon installation to keep debris from entering them.
- Sleeves used at wall transition points for cable tray systems shall be 4". Quantity of sleeves shall be equal to the capacity of the cable tray.
- All sleeves shall have a minimum 2-hour UL listed fire rated assembly installed regardless if the wall or floor is not fire rated or has a rating of lesser value. If the wall or floor has a fire rating greater than 2 hours the sleeve shall have an equal rating in all cases
- The minimum sleeve size installed for any penetration shall be 1 1/2".
- Bonding and grounding
  All metallic conduits, cable trays, sleeves, etc. shall be bonded back to the TGB in the TR that serves cabling in that serving zone.

400 Exterior Communications Pathways

1.1. General

The Exterior Communications Pathways will provide a campus distribution system for all system cabling that will be served by the TRBs. The pathways for a campus distribution system may include all or some of the following, maintenance holes, hand holes, innerduct for both in conduits and direct buried, conduit, multi-cell conduits, All pathways must be approved in writing by Wright State University prior to design completion. Exterior pathway design shall follow all BICSI TDMM and BICSI Customer Owned Outside Plant Design Manual design recommendations and TIA568B and 569A standards. Wright State University must approve all final design in writing.

Conduit pathways built for telecommunication cabling have more stringent bending and pull box requirements than electrical cabling and must be adhered to (i.e. a telecommunications conduit can have no more than 180 degrees of cumulative bends between pull points where as a conduit installed for electrical wiring may have 360 degrees of bends between pull points).

2. Exterior Pathways

2.1. General

Sizes indicated for conduits and innerduct are trade sizes in all cases.

3.0. Conduit

3.1. All conduits will be in the form of 4" in all cases.

3.2. Conduits must have the ends plugged upon installation to keep debris from entering them.

3.3. Conduit runs shall contain no continuous sections longer than 300 feet. If runs total more than 300 feet, pull points need to be inserted.

3.4. Conduit shall have no more than 180 degrees of cumulative bends between pull points or more than 90 degrees of bends at any one point.

3.5. All bends must be long, sweeping bends with a radius not less than six times the internal diameter of conduits 50 mm (2 in) or smaller, or ten times the internal diameter of conduits larger than 50 mm (2 in).

3.6. All conduits must be mandreled prior to turning over to the university.

3.7. All ends of conduit must be reamed.

3.8. All conduits entering a building must be pitched to drain away from the building to avert water intrusion.

3.9. To prevent conduit shearing, conduits enter through walls shall be metal and extend to undisturbed earth, particularly where such backfill is susceptible to load bearing tension.

3.10. All conduits that do not have innerduct install inside of them shall be threaded with pull ropes with footage markers.

3.11. Rigid Galvanized Steel Conduit shall be hot-dipped galvanized steel, including threads.

3.12. Rigid Non-Metallic PVC Conduit

3.13. Extra-Heavy wall conduit: Schedule 80, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground

use.

3.13. Heavy wall conduit: Schedule 40, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and concrete encasement.

4.1. Conduit Depth Requirements
Top of conduit must be buried at least 36 inches below the ground surface.

4.2. Encasement
All underground conduits shall be concrete encased. Concrete shall encase the conduit 360 degrees by a minimum of 4 inches.

4.3. Conduit Orientation
Manufactured conduit spacer shall be used for all conduits in the duct bank so conduits can maintain the same orientation at all points of access.

4.5. Separation From Other Utilities

Power up to 1KVA:

- 12 in. of well- packed earth
- 4 in. of masonry
- 4 in. of concrete

Gas, Oil, Water, etc.:

- 12 in. when parallel
- 6 in. when crossing

5.1. Innerducts

- Innerducts must have the ends plugged upon installation to keep debris from entering them.
- All innerducts shall be threaded with pull ropes with footage markers.
- Innerduct shall not be directly buried or concert incased as a replacement to conduits.

6.0. Maintenance Holes

6.1. General
Joint Use Maintenance Holes (MHs) are not permitted

6.2. Conduit Entry Points
Conduits entering the MH are to be placed at opposite ends of a MH.

6.3. Covers

- Covers shall always be round and centrally located on single- cover maintenance holes.
- Frames and covers used in roads or driveways shall be rated to withstand vehicular traffic.
- For MH over 3.7 m (12 ft) long, follow these guidelines:
    - Between 3.7 m (12 ft) and 6 m (20 ft) use two covers.
    - Over 6 m (20 ft), use three covers.

6.4. Interior Hardware

All hardware in MHs must be galvanized.

MHs shall be equipped with the following:

- Bonding inserts and struts for racking.
- Pulling eyes at least 22 mm (7/ 8 in) in diameter.
- A sump of at least 200 mm (8 in) in diameter.
- An entry ladder (where feasible).

6.5. Identifying Covers

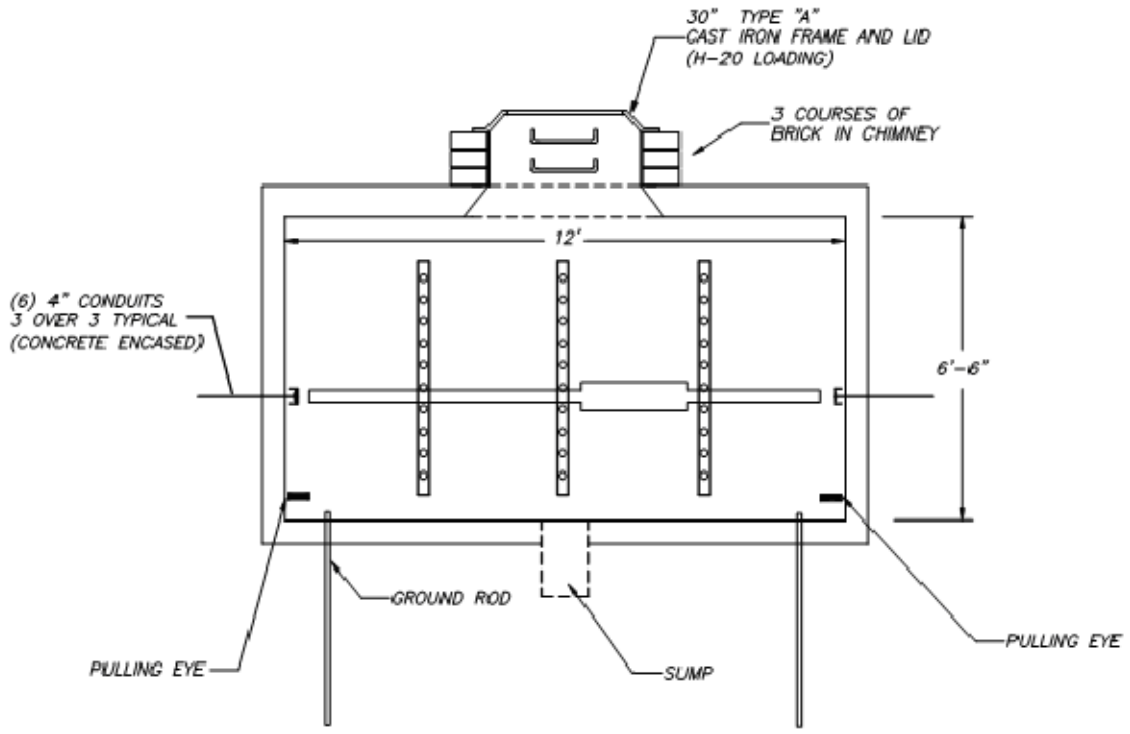
All covers shall have TELECOMMUNICATIONS pre-marked on the cover for easy identification.

6.6. Concrete Strength

The strength of concrete used for MHs shall be at least 24 000 kPa (3500 psi).

NOTE: Stronger concrete may be stipulated in certain installations.

Figure 2 - Example of a Maintenance Hole



7.0 Handhole

7.1. General

Handholes (HHs) are smaller than maintenance holes (MHs), but the covers provide full access to the entire space inside the hole. HH shall be used as pull- through points only. HHs shall not be used as splice points, unless specified by the project manager. HH shall not be used in conduit runs that have more than four (4) 4in conduits.

- Frames and covers used in roads or driveways shall be rated to withstand vehicular traffic.
- Joint Use HH are not permitted.
- Minimum size 24”X36”

7.2. Conduit Entry Points

Conduits entering the HH are to be aligned on opposite walls of the HH at the same elevation.

7.3. Identifying Covers

All covers shall have TELECOMMUNICATIONS pre-marked on the cover for easy identification.

500 Backbone Cabling

1.1. General

Backbone cabling is the media over which Voice, Video, Data, Audio, Community antenna television (CATV) signals will be transmitted to the TR's. The media used for the transmission of the signals will be copper, fiber and coax. Backbone cables are broken into two types, inter-building and intra-building. Inter-building cabling has very strict requirements when entering a building. Cable insulation type, lightning protection and termination methods are important considerations when designing outside plant (OSP) cabling.

2.1. Sizing of backbone cabling for support of a building is directly related to the building's functions both during initial occupancy and future use. There is no generic backbone installation that will fit all applications. Design of the building's backbone cabling will be on a case-by-case basis. Generally, Optical Fiber, High Pair Count Copper and Coaxial cable will be installed for backbone applications.

2.2. Backbone cable design shall follow all BICSI TDMM design recommendations and TIA568B standards. Wright State University must approve all final design in writing.

600 Horizontal Cabling

1.1. General

The following will describe the **minimum** work area outlet requirements for area such as, a standard 8"x10" office, classroom and conference room, special locations and residents halls. The exact placement and quantities of outlets and pathways must be approved in writing by Wright State University prior to design completion.

1.2. Any deviation from this shall require written approval from the Wright State University Project Manager.

1.3. Horizontal cable design shall follow all BICSI TDMM design recommendations and TIA568B standards. Wright State University must approve all final design in writing.

1.4. In general, install one work station drop on each wall measuring 12'-0" in linear length. Provide additional work area outlets as required so that no "point" along the liner wall space is more than 12'-0" from a network outlet. This rule is intended to keep the network station cord from exceeding the maximum length of 10'-0" from the wall outlet to the network device.

1.5. A minimum of one duplex electrical outlet shall be installed within 16", but not closer than 8", of every work station location.

2.1. Standard 8'x10' office

Each office shall have a minimum of two (2) work station locations, one on each wall perpendicular to the door wall. The work station locations should be three (3) feet from the back wall (furthest from the door).

3.1. Classroom

Each classroom designed on a case by case basis

4.1. Conference room
Each conference room shall have a minimum of two (2) work area outlets. Location shall be determined on a case-by-case basis.

5.1. Special locations
Computer rooms, labs, shared workspaces and other such areas must be reviewed on an individual basis for the quantity and types of work area outlets required.

6.1 Wireless Access Point
A wireless access point is comprised of one 4-pair Category 6 twisted pair data cable. The location will typically be located below the drop ceiling when possible and terminated in a typical surface or flush mounted jack. The locations for these cables shall be determined by Wright State University CaTS department. Contact and arrange for these engineering services on a per project basis.

700 Testing, Identification and Administration

7.1. Testing
Testing of Copper UTP cables shall conform to TIA 569-B.2

Testing of Optical Fiber cables shall conform to TIA 568-B.3.

7.2. Identification
Identification of Cabling, Pathways and Hardware shall conform to TIA 606-A