COMMUNICATIONS (Includes Information Outlets and Telecommunications Rooms)

Telecommunications equipment rooms are an increasingly critical part of building systems in today’s high tech world. As such, adequate space and location for the rooms as well as adequately size cable paths should be part of initial Design Development drawings and not be “squeezed in” to the floor plans during later development.

This guideline is intended for architectural, mechanical and electrical design as it pertains to UITS (University Information Technology Services) telecommunications infrastructure at Indiana University. The telecommunications system specified herein provides for voice, data, video and other low voltage signaling functions (such as for energy management and security systems) through twisted pair, fiber optic, and coaxial cable. The system shall provide acceptable outlets for any telecommunication device, which requires connection to devices, networks or information services serving general university needs.

Please note that for all new construction or major renovations, the only equipment which may be housed in telecommunications rooms will be equipment for UITS data network and voice services, door controllers for the telecommunications room(s) only, and non-intrusive cooling units which serve the telecommunications room only. Coaxial television equipment and cabling, other door controller systems equipment and cabling, other security systems equipment and cabling, and any other equipment, ducting, piping, and cabling shall not be installed in or routed through telecommunications equipment rooms. Control cables shall not be installed in telecommunications conduits or cable tray, except in very small quantities and with verifiable approval by the appropriate UITS representative.

For renovations in older buildings, some exceptions must be made for some of the items banned in newer construction. During renovation projects in these older telecommunications rooms, particular items will be addressed on a case by case basis. Examples of the exceptions will be addressed throughout this document. It is critical that ALL telecommunications components and installations will follow ALL state and national codes where safety is concerned.

For remodels and renovations in which jacks and/or station wire are to be removed or abandoned: (1) the jack/port(s) must be removed from the station end and the outlet covered with a blank plate, (2) the station wire/cabling must be removed in its entirety from the jack location to the telecommunications equipment room (IDF), and (3) the jack/port label(s) must be removed from the jackfield(s); if the associated jack/port is less than the current standard station wire Category rating, then the jack/port should also be removed from the jackfield. In some cases, empty jack/port slots in the existing jackfield may be repopulated with the current station wire Category rated station wire and jack/port modules; such instances must be approved by the appropriate UITS representative.
Some requirements may be stated generally because of rapid changes in technology. University Information Technology Services Telecommunications and Networks staff must be actively involved in a review and advisory capacity from project inception through construction with contacts available through the University Architect’s Office and through https://telecom.iu.edu/services. Greater detail with additional information is provided in the Division 27 Communications construction specifications document, available for download from the University Architects office website at http://www.iu.edu/~vpcpf/consultant-contractor/standards/telecomm-design.shtml, labeled under “Communication Systems - Structured Cabling - Division 27”.

GENERAL

Design architects, engineers, and eventually, contractors are expected to propose designs and build in accordance with the guidelines and requirements stated herein. Exceptions to the Design Guideline or the Division 27 specifications must be approved in written or email form by the appropriate UITS personnel, but such exceptions should not be considered until all other specification conforming solutions have been exhausted.

Telecommunication rooms not only need to accommodate initial equipment and services requirements, but provide ample facilities for future UITS equipment requirements, most especially where unfinished “shell spaces” are part of the overall space design. Each generation of networking equipment housed in the rooms produces more heat than the previous; adequate room size is not only necessary to house equipment, but also plays an important role in managing and dissipating heat loads.

The design architect shall schedule regular design progress meetings with the UITS Telecommunications Plant representative, a UITS Network representative, and a university Engineering Services representative. These linkages shall be made through the University Architect’s Office (preferred) or through https://telecom.iu.edu/services.

Telecommunications design shall comply with Federal and State codes, regulations, and standards with variances adopted as standards by Indiana University and the State of Indiana. In order to achieve compliance with BICSI telecommunications standards, the design architects/engineers must employ the services of an RCDD (Registered Communications Distribution Designer) if one is not already on staff. Applicable university, state and national standards include the latest editions of:

1. ANSI/NFPA 70 National Electrical Code with Indiana Amendments, latest edition
2. BICSI CO-OSP Customer Owned Outside Plant Manual
5. TIA-230 - Color Marking of Thermoplastic Wire
6. FCC Rules and Regulations
7. Indiana Administrative Code, Title 675, Article 22, Indiana Fire Prevention Codes
IU Building Telecommunications Design Guidelines

8. Joint Commission Accreditation of Hospitals Code
9. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
10. National Electrical Code
13. REA Standards for Engineering, Construction, and Installation
15. TIA 526-14-B Optical Power Loss Measurements for Installed Multimode Fiber Cable Plant – OFSTP-7
16. TIA 568-C Commercial Building Telecommunications Cabling
17. TIA 569-C Commercial Building Standard for Telecommunications Pathways and Spaces
18. TIA 598-C - Optical Fiber Cable Color Coding
19. TIA Standard ANSI/TIA-607-B - Commercial Building Grounding and Bonding Requirements for Telecommunications
20. TIA 604 Standards on Fiber Optic Connector Intermateability
21. TIA 606-B Administration Standard for Commercial Telecommunications Infrastructure
22. TIA 758-B Customer Owned Outside Plant Telecommunications Cabling Standard
24. TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
25. Indiana University Division 27 Communications specification

TOPOLOGY

Horizontal cabling shall be installed in a star topology, with each work area Information Outlet terminated via horizontal station cable to a horizontal cross-connect in a telecommunications room.

Floor telecommunications rooms (which may include the building MDF) should be located on the same floor as, and centrally located to the work areas served. In a large building, if the number of stations would require a significantly larger room, or if necessary to keep horizontal cabling runs within the specified lengths, more than one telecommunications room on some floors may be required; in such cases, the serving area of each telecommunications room must be clearly defined and strictly adhered to during cabling installation. In small buildings, a telecommunications room may serve multiple small floors if approved on a case-by-case basis by the appropriate UITS design representative, with the requirement that all other design criteria are met.

Where at all possible, telecommunications rooms should be vertically stacked within multi-floor buildings.

Telecommunications room doors must open into public spaces, preferably hallways. Doors should be oriented to open outward to provide easy egress from the room in case of emergency.
Station communications design is based on ‘one Information Outlet per workstation’, to be implemented as defined under “Information Outlet Types at IU”. Each Information Outlet must be sized with port counts by type and quantity for the needs of intended and possible future users of each Information Outlet location.

Horizontal (station) cabling extends from the work area Information Outlet/connector to the horizontal cross-connect in the telecommunications room. The maximum horizontal data cable length shall be 90 m (295 ft). The maximum horizontal cable link length is based on a maximum length of 5 m (16 ft) of work area line cord; therefore, no Information Outlet will be installed such that the intended workstation or device cannot be reasonably reached by a 16 ft cord.

Due to the need to maintain a secure and manageable campus network, as well as the need to maintain location records of Information Outlets and equipment associated with them for E911 response databases, all equipment connected to a given Information Outlet must be located in the same room as the outlet. Likewise, a local switch may not serve equipment in more than one room.

In certain circumstances, such as laboratory settings or temporary work clusters, communications data switching can be supplied from an in-room switch to individual stations, or run back to a wiring closet via horizontal cabling (preferred). Any application of an in-room switch must be approved prior to design and implemented by the Indiana University Technology Services (UITS) Network group. Those not approved will not be connected to the University data network. Further information on this topic may be obtained the Indiana University Bloomington Network Operations Center at noc@indiana.edu.

Large classrooms should be routed to Telecommunications Rooms and have wireless service, or be served with only wireless facilities where practical. Such decisions should be coordinated with a UITS wireless system representative.

TELECOMMUNICATIONS ROOMS, GENERAL

Architects/engineers must submit detailed layout diagram/drawing(s) for each telecommunications equipment room in each building in a project. Such drawings must be included in bid and construction documents. Drawings should include room locations and footprints; identification of all telecom related and non-telecom related materials, equipment, devices, and structures which occupy space in the telecommunications equipment rooms; and high voltage electrical gear adjacent to the telecommunications equipment rooms, with clearance measurements of telecom items from all such objects. A simple example of a layout drawing is included in this document and indicates minimum clearance requirements for equipment.
IU Building Telecommunications Design Guidelines

In smaller renovations, any deviations from these general requirements should be corrected where feasible and practical. Many remodels will not fall under either of these situations; however, the IDF which serves the remodel area must be reviewed by the appropriate UITS representative for cabling and network equipment capacities in order to determine if charges and construction beyond individual station cabling costs are necessary.

All telecommunications rooms should be designed to the two rack standard, with the exception of small buildings where the installation of large quantities of wiring and devices is not possible. In such small buildings, design would be handled on a case by case basis, with design approval required by the appropriate Indiana University UITS representative.

Telecom rack layout drawings must be included in bid and construction documents. The rack layout drawings provided in this document, and in the Division 27 document provided on the University Architect’s website, illustrate the specified arrangement of components in the telecom equipment racks. With nearly 1300 telecommunications rooms to manage on the largest IU campuses, and 200 more on regional campuses, uniform equipment arrangement is an important step in efficiency for those who provide ongoing service orders, repair, and upgrades to University telecommunications systems. Examples of rack layout drawings are included in this document, and may be requested in CAD form.

Very small buildings with fewer than 20 stations may have another option than a large telecom room. Such option may be discussed with the appropriate UITS representative during design.

In order to maintain network security, all telecommunications rooms must be able to be locked with a (1) telecommunications key core and (2) a cardkey system separate from all other building cardkey systems, so that such rooms will not be accessible to other trades or individuals who are not granted access to telecommunications equipment rooms.

Telecommunications rooms shall not house systems other than those related directly to telecom systems. Systems requiring access by non-UITS personnel must be located in spaces entirely outside of the telecommunications rooms. Examples of systems that not appropriate for placement in UITS telecommunications rooms include:

- Servers
- Security system monitors
- Fire alarm monitors
- IP camera monitoring systems
- Audio systems

Mechanical systems conduits and components, plumbing systems conduits and components, HVAC ducting and components, CaTV cables and equipment, and other mechanical and electrical systems conduits, cabling, and ducting shall not pass through
telecommunications rooms. (Note: At the IUPUI campus only, UITS Telecommunications is in charge of CATV, so that system is allowed in the telecom rooms.)

Thus, telecommunications rooms are not catch-all spaces in which to add forgotten utility chases or equipment at a later date, typically during construction. As noted above, **anything not directly serving the functionality of a telecommunications room simply does not belong in that room.**

Access panels for other building systems should not be located in telecommunications room.

Conduit placement, as well as other items installed in telecommunications rooms, must not interfere with working space clearances. Conduits should not be placed near the equipment racks in order to prevent damage to electronic equipment during future cable pulls as well as to allow for proper cable racking. Horizontal conduit penetrations should enter rooms near ceiling height. Vertical conduits should penetrate floors or ceilings within four (4) inches of walls. Conduits penetrating floors should be placed in or near room corners and away from equipment rack locations.

Where at all possible, racks installations should be oriented so that the front of patch panels and switches are visible from the opened door of the room.

The design must comply with ANSI/TIA-569 standard regarding the requirements and recommendations for separation of copper telecommunication cabling from sources of electromagnetic interference.

Signage for MDF/IDF rooms shall not contain any text listing of the use of the room, only the correct room number.

**MAIN BUIDING TELECOMMUNICATIONS ROOM (MDF/IDF-1/BDF)**

The primary functions of the main building telecommunications room are to (1) house the necessary hardware to provide electrical protection for outside plant cables, and (2) allow for cross connection between the outside plant cables that enter the building from the campus communication distribution network and the inside backbone cabling, as well as (3) to house splice closures and grounding and bonding facilities.

The room should be sized at a bare minimum of 100 sf with no dimension less than is necessary to allow for nine feet by ten feet (9’x10’) clear floor space before installation of equipment racks as illustrated on the “IDF ROOM – RACK LAYOUT” drawing elsewhere in this document and in the Division 27 specification; this minimum space requirement is not negotiable. Typically, a room will need to be no less than 10 feet on any side. The design must comply with the ANSI/TIA-569 standard regarding the requirements and recommendations for separation of copper telecommunication cabling.
regarding the requirements and recommendations for separation of copper telecommunication cabling from sources of electromagnetic interference.

The main telecommunications room will likely serve as a floor telecommunications room (IDF, or IDF-2) as well. If so, then the room should be sized by appropriate UITS Telecommunications personnel on a case-by-case basis, but with no dimension less than required to allow for the aforementioned clear floor space solely dedicated to telecom equipment racks and personnel movement. If future additional equipment racks are expected, then additional floor and necessary wall space must be added to the size of the room according to the space requirements of that equipment as well as any associated cabling and mechanical requirements.

In either case, the main telecommunications room will contain electronic network equipment necessary for service to the entire building and so must be environmentally controlled for both temperature and humidity as described elsewhere in this document.
Single Rack Configuration
300 ports maximum, initial
IDF ROOM - RACK LAYOUT

Open Space with minimum 3 feet of clearance

120v 20 amp TVSS duplex receptacle
208v Electrical outlets NEMA L6-20R

Equipment Footprint
Front of Patch panels
(facing toward door)

Equipment Footprint
Front of Switches

TWO RACKS
500 ports maximum, initial

Minimum interior space: 9' x 10' ***
*** See notes above!!!
IDF ROOM - LADDER RACK LAYOUT
Chatsworth Universal Cable Runway
Chatsworth 10250-7xx **
** where xx = 12, 15, 18, or 24

Stabilizes end of Equipment Rack(s)

TWO RACKS
500 ports maximum, initial

DESIGN NOTE: Section of ladder rack must be sized according to maximum cables. For example, if each 12” wide section above will be full, then trays from outside the room coming in will need to be a minimum total 36” of tray width.

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FLOOR TELECOMMUNICATIONS ROOM (IDF-2)

The primary function of a floor telecommunications room is the termination of horizontal and backbone cables onto compatible connecting hardware, as well as splice closures, grounding and bonding facilities.

A floor telecommunications room must provide an environmentally controlled environment as described elsewhere in this document in order to house electronic equipment necessary to connect to the campus data network. The telecommunications room also provides for the administration and routing of equipment cables/cords from the horizontal cross-connect to the telecommunications equipment.

A floor telecommunications room (IDF) should be sized at a bare minimum of 100 sf with no dimension less than is necessary to allow for nine feet by ten feet (9’x10’) clear floor space before installation of equipment racks as illustrated on the “IDF ROOM – RACK LAYOUT” drawing elsewhere in this document and in the Division 27 specification; this minimum space requirement is not negotiable. Typically a room will need to be no less than 10 feet on any side.

The design must comply with ANSI/TIA-569 standard regarding the requirements and recommendations for separation of copper telecommunication cabling from sources of electromagnetic interference.

SMALL BUILDING TELECOMMUNICATIONS MDF>IDF-1/BDF

Certain small buildings are not large enough in either size or number of stations to warrant a room dedicated to only telecommunications equipment.

In UITS approved situations, a lockable cabinet solution may be used which minimizes space utilization while maintaining essential university network security.

The number of network ports may not exceed 48 for this arrangement; 49 or more ports will require a dedicated telecommunications room as previously described, regardless of the stage of construction at which the 48 maximum ports is exceeded.

The cabinet will contain electronic network equipment; therefore, the room in which it is mounted must be environmentally controlled for both temperature and humidity as described elsewhere in this document.

This design also must comply with ANSI/TIA-569 standard regarding the requirements for minimal separation of copper telecommunication cabling from sources of electromagnetic interference and to meet electrical safety requirements.
CABINET LAYOUT
for small buildings

110 Block with Voice Panel tail
Jumper Ring Blocks

(Protector Block - by IU)

Cabinet swings open

4x8 plywood
2x8 plywood

4 inches AFF

48 ports maximum, initial

11/20/2015
CABINET LAYOUT
for small buildings

Open Floor Space with minimum 3 feet of clearance

48 ports maximum, initial

11/20/2015
SECURITY for TELECOMMUNICATIONS ROOMS

Telecommunications rooms will utilize the following security devices to provide controlled access and video/audio monitoring. Complete design should be coordinated with the appropriate UITS representative. Associated costs of infrastructure as well as hardware listed below are both project costs and are to be provided as part of the project. The control system for this equipment must be located in the telecommunications rooms, e.g., separate from any other building access control systems, and will be activated by UITS (University Information Technology Services) after all associated infrastructure, wiring, hardware and network equipment are installed and tested.

Access Control

The following devices support multiple card formats:

- Open Option, Inc. SSP-D2 Intelligent Two Door Controller
- Open Option, Inc. RSC-1 Single Reader
- Open Option, Inc. RSC-2 Dual Reader

**ACCESS CONTROL READER:** Allegion MT15 reader

Door access hardware

**LOCK:** Stanley Best Lock 45HW-7DEU14H L/C RQE RH 626
The part number can vary to allow for finish and handling of the door; however, the RQE (request to Exit) switch must be built into the lockset.

**DOOR CONTACT:** One (1) inch recessed door position contact
(for example, Sentrol 1078)

See the IU Division 28 specification for details.

Network Cameras

As a general guideline, a network based security camera will not be mounted inside Telecommunications Rooms unless specifically requested on a case by case basis. However, all Telecommunications Rooms shall have a Category 6A station wire terminated on a single port Information Outlet, mounted at ~7’2” aff unless noted
otherwise, located on the ceiling or wall in a location such that a camera mounted to it can monitor persons entering and leaving the room.

Cameras may be requested for other locations within the building as well. Only cabling for campus network based cameras may be terminated within telecommunications equipment rooms.

Should it be deemed necessary to install one or more devices at a later date, examples of acceptable cameras are:

Axis 216FD/216FD-V Network Cameras (power over Ethernet)
*For use in normal lighting conditions*

Axis P3301/-V Fixed Dome Network Cameras (power over Ethernet)
*For use in areas where extreme light changes can cause picture wash out, such as might be experienced around glass entryways or opened overhead doors*

Axis 225FD Network Camera (power over Ethernet)(outdoor camera)
*An environmental mini-dome camera for outdoor use*

See the IU Division 28 specification for other model details and options.

Exterior cameras mounted within 6 feet of a lightning ground or mounted on metal that can conduct lightning are required to be electrically protected.

**PATHWAYS**

The sizes of station device boxes are defined in the Division 27 specifications available on the UAO website. The telecommunications raceway system must be specified such that during installation, cable is not subject to sharp or binding edges. All newly installed pathway systems, including conduit, surface raceway and cable tray, shall be large enough that all of the telecommunication cabling installed as part of a project will not be filled to greater than 70% of the manufacturer’s stated capacity. For other systems cabling such as those for CATV, controls, access, and alarm systems, capacity must be calculated separately and added to the overall tray size in a separate channel, or be planned for installation in a separate pathway. Projects which included “shell space” must allow for future cabling requirements for those unfinished spaces in determining tray size. Cable tray outside the IDF’s for telecommunication cables should be specified with a minimum 12” width but still subject to the 70% maximum fill requirement. Cable paths must be designed and installed in such a manner that allows reasonable access to add or remove cables for future demand and maintenance purposes. Where conduit is used for wall penetrations between sections of cable tray, the minimum conduit capacity must be equal to the cable tray maximum capacity. Telecommunications rooms should not be used as pathways for other building systems.
IU Building Telecommunications Design Guidelines

Inside-building-rated cables are not designed to withstand the moisture and condensation which can occur in underground or below-slab conduits, which will render the cable(s) unusable in a short period of time. Conduits for interior grade telecommunication cables, such as riser rated and horizontal station cables, may be placed in a slab-on-grade, but must never be placed below the slab for any reason. Nevertheless, avoid placing conduits inside a slab-on-grade whenever possible.

ENT conduit is **not** acceptable for pathway for telecommunications cables.

Pathways and spaces shall be designed and installed to support horizontal cabling in accordance with the requirements of ANSI/TIA-569-A.

**BACKBONE CABELING**

Cabling from the Main Telecommunications Room (MDF, BDF, IDF-1) to each Telecommunications Room (IDF-2) is considered as backbone/riser cable.

Splices in backbone cable runs are not permitted. Wiring and fiber must be continuous from telecommunications room termination to telecommunications room termination.

The copper intra-building cabling and the riser cabling shall meet ANSI/TIA-568 Category 3 requirements.

**DESIGN SUMMARY**

The design architect/engineer must prove a summary sheet with Information Outlet counts by type, port counts by type, and total ports per serving IDF, as shown in the following example.

<table>
<thead>
<tr>
<th>FLOOR</th>
<th>SERVED FROM</th>
<th>IO TYPE</th>
<th>IO TYPE (# ports)</th>
<th># IO’s</th>
<th># PORTS</th>
<th>IDF TOTAL PORTS</th>
<th>INSTALLED RACKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>00606</td>
<td>ELEV</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>5</td>
<td>00505</td>
<td>STD</td>
<td>2</td>
<td>79</td>
<td>158</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>5</td>
<td>00505</td>
<td>WALL</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>5</td>
<td>00505</td>
<td>WAP</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>SUM</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>172</td>
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<th>IO TYPE</th>
<th>IO TYPE (# ports)</th>
<th># IO’s</th>
<th># PORTS</th>
<th>IDF TOTAL PORTS</th>
<th>INSTALLED RACKS</th>
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<td>STD</td>
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<td>163</td>
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</tr>
<tr>
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<td>WAP</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>SUM</td>
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<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>335</td>
<td>2</td>
</tr>
</tbody>
</table>

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"IO" = Information Outlet

The design architect/engineer will provide a riser diagram which indicates port counts, along with cable types, sizes and counts, developed in conjunction with the appropriate UITS representative. This diagram is used to provide network equipment cost estimates for budget purposes, as well as be included as part on the bid documents and construction specification drawings. The appropriate UITS representative will provide or must approve cable counts.
HORIZONTAL DATA CABELING

Horizontal cabling extends from the work station information outlet terminations to the telecommunications room terminations. Horizontal cabling includes horizontal cables, Information Outlet/connectors in the work area, and jackfield termination equipment in the telecommunications room.

In addition to satisfying today's telecommunications requirements, the horizontal cabling should be planned to reduce on-going maintenance and relocation, as well as accommodate future equipment and service changes. After construction of the building, the horizontal cabling is often much less accessible than the backbone cabling, with the result that the time, effort, skills and subsequent costs required for changes can be extremely high. Access to horizontal cabling can cause disruption to occupants and their work; therefore the amount of cabling not in conduit and which passes through office spaces should be minimized.

All new horizontal station cabling and terminations shall be Category 6A. Infrastructure will be sized and constructed to meet Category 6A requirements and specifications. Special care must be taken regarding bend radius requirements if installations are to pass acceptance testing.

These factors make the choice and layout of horizontal cabling structures very important to the design of the associated building structures. 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.

Horizontal cable length is the distance between terminations, that is, from the mechanical termination of the media at the horizontal cross-connect in the telecommunications room, to the termination on the Information Outlet/connector in the work area. Hence path layout for horizontal cabling should be made with reference to total cable length, and not by floor plan linear measurements.

The maximum horizontal cable distance for a Category 6A system shall be 90 m (295 ft). Any horizontal station wiring run longer than this will not be accepted by the University. Splices in horizontal cable runs are not permitted. Wiring must be continuous from outlet termination to jack field termination.

All horizontal cabling from a given room and within a specified serving area shall terminate in the same telecommunications room.
HORIZONTAL COAXIAL CABLING

Terminations for coaxial horizontal station cabling for Campus TV connections should be wall mounted in a neat manner as illustrated in the following picture. These terminations shall not be made in telecommunications rooms.
INFORMATION OUTLETS (IO’s)

An Information Outlet, as described below and used in this document, is defined as "providing access to all available communication media: twisted pair, coaxial cable, and in the future, fiber.” Data connectivity is the basic element of an outlet; if optional video and/or fiber optic services are required, they shall be so indicated in individual room or area descriptions.

The maximum horizontal copper station cable length is based on a maximum length of 5 m (16 ft) of work area cord. Therefore no Information Outlet will be installed such that the intended workstation or device cannot be reasonably reached by a 16 ft cord.

Information Outlet assemblies shall be located in fully accessible, permanent locations such as building columns and permanent walls. Multi-user Information Outlet assemblies shall not be located in ceiling spaces or in any obstructed area.

Information Outlet ports shall not be co-located in back boxes used for the audio/visual wiring and terminations which pull back to a wiring closet dedicated to audio/visual equipment.

Except for audio/visual locations which incorporate multiple connection types including university data network ports, Information Outlet ports shall not be co-located in back boxes used for coaxial cabling and terminations, nor with other cables which pull back to and terminate in a location dedicated to in-house (non-campus network system) cable television or CCTV equipment.

Gang assemblies will require minimum 2-7/8” deep 5-square boxes as specified in the Division 27 document to accommodate the IO assemblies and bending radius of future horizontal wiring.

See the list of “Information Outlet Types at IU” in this document.

DESIGN DRAWINGS

Design drawings shall include, but not be limited to:

1. Backbone cable routing and schematic riser diagram, including:
   1.1. Backbone cable types and sizes
   1.2. Information Outlet count, by type, by IDF
   1.3. Total port count (RJ45’s) by IDF
       (see example)
       (telecom plans will not be approved without this diagram, updated as necessary)
2. Telecommunication room locations, layouts, and details
3. Conduit / cable tray routing, elevations in relation to other mechanicals and building structures, sizes, and pull box and access point locations
4. Other supporting structures for telecommunications cabling
5. Grounding schematic for telecommunications rooms
6. Information Outlet locations and types with port counts
7. Elevator outlet(s) location(s) which connect to either voice or data services.
8. Fire alarm outlet(s) location(s) which connect to either voice or data services.

SPECIFIC TELECOM ROOM REQUIREMENTS

These requirements are for new construction and major renovations. There are many older buildings at all of the main and regional campuses that have dated telecom room designs; in many cases, it is acceptable to leave some components as they currently exist, but only if by doing so, safety, security, and acceptable network connectivity are ensured and maintained. Exceptions may be considered on a case-by-case basis, in coordination with the University Architect’s Office and UITS, as noted below.

1. Rooms should be located such that horizontal station cabling runs from mechanical termination at the Information Outlet to mechanical termination in the serving equipment room will not exceed a maximum cable length of 295 feet.

2. Rooms must be clear of mechanicals such as ventilation ducts, water, sewer, steam pipes, and any electric over 277v. (Note: As discussed above, it is imperative to minimize access to telecom rooms. In older room, these mechanicals are often present, but rarely require access. If security can be ensured, likely via electronic locks, it may be acceptable to leave some mechanicals in older rooms. However, it is not acceptable to have high voltage too near the rack.)

3. Do not locate near alternating current (AC) switch gear as defined in NEC Article 110 and referenced sections.

4. Minimum room height: 8'6"; no ceiling (walls must extend to deck to make room secure). (Note: Exceptions are possible on a case by case basis, through discussion with the UAO and UITS.)

5. Minimum door dimensions: 36"w and 80"h

6. 4' x 8' plywood backboard, 3/4" thick, fire rated, or painted with a light colored fire retardant paint, shall be mounted 4" AFF on all walls. Fire rated plywood may be painted with light colored fire retardant paint, but it is not required.

7. Control of heat and humidity is essential, to be maintained between 64°F and 78°F and between 25%RH and 55%RH non-condensing. (Note: Thermostats and temperature control are often not available in older telecom rooms. Running temperature of network equipment is critical, and can be determined from log files on those devices. Should the temperature of network equipment become too high, appropriated measures MUST be
taken to correct the issue. Installation of HVAC, room enlargement, or other forms of ventilation are required.)

7.1. Current network equipment generates the following maximum heat loads:
   1-142 ports – 7400 btu/hr max (HP5406 chassis, J9306A power supply)
   143-284 ports – 11100 btu/hr max (HP5412 chassis, J9306A power supply)
   285-426 ports – 18500 btu/hr max (HP5412 + HP5406, see above)

   Including potential growth, but excluding other heat generating equipment in an IDF room, for a:
   One rack solution, design for 18500 btu/hr max
   Two rack solution, design for 37000 btu/hr max

   Initial heat loads may be less than the maximum; therefore room cooling should be capable of adjustment.

7.2. Consideration should be given to the critical nature of extended telecommunications services to the building. Determine for each telecommunications room if telecommunications network equipment and room cooling should be connected to the building emergency power source such as the building UPS or generator system. If any IDF is required to have backup power and cooling, then the MDF must also have backup power and cooling.

8. Telecommunications Room key cores, electronic door systems, and security systems shall be included as part of the project.
   8.1. Floor Telecommunications Rooms and Main Building Telecommunications Room key sets should be the same.
   8.2. Campus telecommunications personnel shall approve key/locking arrangements.

9. Fluorescent lighting with a minimum of two fixtures should provide a minimum lighting level of 30-40 fc.
   9.1. Emergency lighting should be provided for telecommunications rooms.

10. Provide duplex outlets for task lighting and tools.

11. Depending on the size of the project and the number of stations served from each telecommunications room, provide one or two (or more) equipment racks with vertical wire management, 7' high and to accommodate 19" bay-mounted equipment in each telecommunications room.
   11.1. Equipment racks must be attached to floor and stabilized with overhead runway to a wall; additional racks may be required on specific projects.

12. Provide two (2) 208v circuits, each terminated on NEMA L6-20R outlets, wall mounted, for each network switch to be installed (typically one switch per 19” rack).
12.1. Mount between 12 and 24 inches aff off the back side of the equipment racks, and with 12 inches of the nearest equipment rack, but not between the equipment rack and the wall.

12.2. These outlets should be connected to the building emergency power source(s) if it is determined that the building’s or an individual IDF serving area network systems are required to run at all times, such as building or alarm systems. See previous item 7.2.

12.3. In single rack installations which might see a second rack added a future date: 12.3.1. install a center-type Patchrunner Vertical Cable Manager to allow for future expansion.

12.3.2. install a second pair of duplex outlet boxes above or below the first two outlets for future 208v power needs as described in 12.1. above.

12.4. See the “IDF ROOM – RACK LAYOUT” drawing.

13. At the network equipment rack location, standard 18” height, provide one 120v 20 amp dedicated duplex receptacle; isolate feed from motors, AC switch equipment, lighting circuits; minimize noise and interference.

13.1. This outlet should be connected to the building emergency power source(s) if it is determined that the building network systems or an individual IDF serving area are required to run at all times.

13.2. This outlet must be wall mounted adjacent to the point where the network equipment rack is mounted nearest to a room wall.

14. The riser system (Main Telecommunications Room to each Telephone Room, or, IDF-1/BDF to IDF-2) minimally should be sized as follows:

14.1. Category 3 shielded UTP for voice grade and alarm services, 25 pair 24 gauge

14.2. 12 fiber optic 50 micron multimode cable

14.3. 12 singlemode 8.3 micron cable

14.4. Final cable sizes must be verified during the design stage of the riser system.

14.5. Coaxial cables and equipment shall not be collocated in IDF rooms. Coordinate CATV cable, equipment selection (such as amplifiers), and system design with IU Building Systems (Electronics) personnel and IU Engineering Services (see http://www.indiana.edu/~phyplant/operations/building-systems/index.shtml); the Division 27 document contains part numbers and vendor information which is subject to revised design criteria provided by those groups.

15. Provide ladder type cable tray, minimum 12” wide, size to be determined by manufacturer’s capacity specifications at a maximum 70% fill for both weight and height capacities determined in conjunction with cable manufacturers specifications for loading, to surround room at a minimum height of 7’ aff from the bottom of the tray, and with a minimum unobstructed clearance of 12” above the tray.

15.1. Include a section of 12” wide or wider ladder rack, size to be determined by manufacturer’s capacity specifications at a maximum 70% fill, extending from the cable tray to each individual equipment rack.

15.2. All equipment racks and raceways shall be bonded per NEC.
16. A TGB (Telecommunications Ground Bus bar) shall be located in each Telecommunications Room and shall be tied back to the TMGB (Telecommunication Main Bus bar located in Main Telecommunications Room).

INFORMATION OUTLET (IO) TYPES AT IU

STANDARD Information Outlet (IO): Two Category 6A station cables terminated onto two Category 6A RJ-45 modules in a double or single gang configuration installed at the same height as 120 volt AC outlets (normally 18” above finished floor).

Courtesy Phone Jack (inside building): One station cable terminated on an RJ-45 surface mount wall phone plate jack. Top of phone set must be installed below 48”aff for compliance with ADA requirements; therefore, the wall mounting plate with jack must be mounted no higher than 45” aff, or less, such that the maximum set top height of 48” is not exceeded.

Emergency Phone Jack (outdoors): One multi-pair buried drop (outside, protected) terminated on an RJ-45 surface mount jack, mounted inside of a University specified phone base. Outside emergency phone cables must be electrically protected.

Elevator Phone Jack: One station cable terminated to one RJ-11 or RJ-45 (to be coordinated between UITS and elevator installer) surface mount jack, mounted in outlet box adjacent to, but outside of, the elevator control box. Jack must be openly accessible for testing and troubleshooting purposes.

Wall Jack: One Category 6A station cable terminated on one (1) RJ-45 jack. Wall mounted telephones require a special wall telephone jack that provides mounting lugs for the telephone and an eight position jack. The outlet box for this installation is a 2 gang box with a single gang plaster ring and will be positioned such that any aspect of an install phone shall be at 48” A.F.F. or slightly lower.

Modular Furniture Information Outlet (IO): Category 6A data cables installed into Category 6A data modules installed into a modular furniture bezel. Quantities to be determined by individual needs. Height will be determined by the furniture. Contact https://telecom.iu.edu/services for additional information.

Advanced User Information Outlet (IO): Multiple Category 6A station cables terminated into Category 6A RJ-45 jacks, designed to meet TIA-568-B.2-1 Category 6A standard, in single gang or double gang configurations installed at the same height as 120 volt AC outlets (normally 18” above finished floor). Quantity of RJ-45 jacks and configurations to be determined as part of the design process and in conjunction with the proper UITS Telecommunications representative.
WAP Jack (Wireless Access Point): Two Category 6A data station cables terminated into RJ-45 modules, in a single or double gang configuration, typically installed wall mount at 7’0” in height or ceiling mounted, unless otherwise specified. Refer to the following “WIRELESS DESIGN” section of this document.

Note 1: RJ45 jack outlets are to be wired to the TIA 568A wire map standard.
Note 2: Information outlets are to be installed 5 Square boxes.

WIRELESS DESIGN

Initial Wireless Design

UIITS is responsible for the wireless system design and the installation of all 802.11 type wireless access points at Indiana University. The design, implementation and changes should be approved by and coordinated with the UIITS wireless representative, Matt Bonadies (mbonadie@iu.edu), 812-855-2422, or his appointee.

The project is responsible for the installation of the horizontal infrastructure and cable necessary to support the wireless access points.

The total number of access points and their locations cannot be finalized until a wireless survey is done. For general coverage and budgeting purposes one (1) wireless access point shall be installed for every 1200 square feet of building space. In addition to providing general coverage, special considerations need to be made for large public areas, classrooms and conference rooms. Use the following chart to estimate the number of wireless access points necessary to provide coverage in these areas.

Classroom/Conference Room Access Points

<table>
<thead>
<tr>
<th>Number of Seats</th>
<th>Number of Access Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25</td>
<td>1</td>
</tr>
<tr>
<td>26 to 50</td>
<td>2</td>
</tr>
<tr>
<td>51 to 75</td>
<td>3</td>
</tr>
<tr>
<td>75 to 100</td>
<td>4</td>
</tr>
</tbody>
</table>

For bid/construction document purposes, the UIITS wireless system representative will need the following kinds of information.

By Room

1. Room purpose (Classroom, Dormitory, Office, Hallway, Lounge, etc.)
2. Square footage
3. Number of Information Outlets
4. Number of Users
5. Wall type (Concrete block, solid concrete, metal studs with drywall, etc.)
IU Building Telecommunications Design Guidelines

6. Wireless expected usage (WiFi VoIP, Data, Email, Web browsing, Video, etc.)
7. Expected Quality of Service (network capability vs. server capacities)
8. Expected growth in demand for services

Outdoor Coverage

Designate on drawings if and where outdoor wireless connectivity is required. Provide further information as described under “By Room”.

Additional information should include:

1. Antennas can be hidden or visible, with the understanding that hidden antennas may not offer the same degree of service. Methods of concealment can be discussed with the appropriate UITS representative.
2. Antennas can be on roof tops, pole mounted, or exterior wall mounted, but must first be approved by the University Architect’s Office on a case by case basis.

Infrastructure Requirements

The following infrastructure needs to be in place to support wireless access points:

1. Each access point information outlet shall have two (2) CAT 6A cables installed.
2. The wireless information outlet shall be terminated on a 2 port Panduit faceplate with 2 568A - RJ 45 outlets, flush with ceiling tile in an 5 square electric box with single gang mud ring. If ceiling is not lift out the 5 square box should be located at ceiling or cloud height always with faceplate pointing toward the floor.
3. All wireless information outlets shall have a minimum of one (1) 1-inch conduits servicing the wireless information outlet.
4. All wireless information outlets shall be labeled clearly with a labeler and with a +WD after the jack id number.

Example of Ceiling Tile Wireless Outlet Mount

Wireless Access Points may be wall or ceiling mounted; however, where at all possible, they should be ceiling mounted. Any deviation from ceiling mounting should be approved by the UITS wireless representative. The preferred method of location and mounting is subject to change, so verify current methods and locations at a timely point in the design process. In any case, Wireless Access Points should never be mounted in close proximity to one another, including on opposite sides of the same wall.

All installations must be terminated into a specified electrical box and comply with applicable standards of the IU Division 27 specification, including labeling.

The following pictures provide an example of an acceptable means of mounting an outlet in a suspended ceiling system.
INTERIOR COURTESY PHONES

The guidelines for security phones at IU were adapted at the direction of the Office of Public Safety and Institutional Assurance (PSIA), with assistance from UITS Telecommunications.

The goal of these guidelines is to ensure at least one (1) analog (non-VOIP) phone is installed on each floor of an IU owned building. Exceptions may include former residences that have been converted into IU office space.

More information on PSIA can be found at https://protect.iu.edu/about.

The following individuals participated in the development of these guidelines:

Tom Davis - Chief Security Officer
Jerry Minger- Director of Public Safety
Diane Mack- University Director of Emergency Management and Continuity
Debbie Fletcher- IU Bloomington Director, Emergency Management & Continuity
Joe Romero- Regional Campus Director, Emergency Management & Continuity
Carlos Garcia- IUPUI Director, Emergency Management and Continuity
Ken Long- Assistant Director for IU Bloomington Emergency Operations
The guidelines for determining the placement of Interior Courtesy Phones are described below:

- **Interior Courtesy Phones**
  - 1 analog phone will be placed on every floor, of every building, near passenger elevators.
  - It will have the ability to make 911, Campus, Local and toll free calls.
  - Depending on building size and layout, additional courtesy phones may be required. The following individuals will be the authority for adding additional courtesy phones.
    - **IUB** - Debbie Fletcher and/or Laury Flint
    - **IUPUI** - Carlos Garcia and Bob True
    - **Regional Campuses** - Joe Romero and respective campus police chief
  - Additional courtesy phones can also be installed by a department at the expense of the department.

- **Campus Rewire Project**
  - As part of the campus rewire project, security phones will be installed per the guidelines above, and in compliance with Division 27 standards.
  - Funding for the installation shall come from the rewire project.

- **New Construction**
  - Courtesy phone installation shall follow the guidelines set forth in Division 27.
  - Funding for the installation shall come from the building project.

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**EMERGENCY PHONES**


**AUDIO/VISUAL ROOMS and SECURITY ROOMS**

Another class of rooms loosely associated with telecommunications rooms are A/V and Security rooms. The specifications for these rooms are not part of this document, but space for these increasingly important equipment installations needs to be allocated during the earliest phases of building design.

Contact and additional information is available at [http://uits.iu.edu/page/clas](http://uits.iu.edu/page/clas).
OUTSIDE PLANT CONDUIT SYSTEM

On any building construction that requires outside plant conduit and manhole systems, the cost of providing a necessary functioning underground facilities conduit path from a UITS designated existing telecommunications maintenance structure (manhole or handhole) containing UITS cables, to the new building or structure is a project cost. The strong preference is that new conduits should be provided back to a manhole where cable can be spliced if necessary; the extending of conduits from handholes must be approved by the appropriate UITS representative. If an existing conduit run is to be cut off, and/or extended and reterminated into a new manhole or handhole for the purpose of pulling new cables through those existing conduits, then it becomes the responsibility of the project to determine their functionality and, if necessary, repair or replace the existing conduits until substantial completion of the project, just as though they were new construction. Such work shall ultimately provide a cleared, tested and usable conduit system as described in the Indiana University Division 27 specifications.

For convenience, this section references information from the Telecommunications Industry Association TIA-758 Customer-Owned Outside Plant Telecommunications Infrastructure Standard. Refer to the document for further details.

Conduits: Typically, Schedule 40 nonmetallic that meets NEMA standard TC-2. The outside of conduits installed into manholes should be sealed against moisture and dirt penetration.

Where possible, conduits should penetrate manhole at precast knockout locations or at same height. Conduits should NOT penetrate manholes in the collars, in the middle of side walls, or in the case of existing manholes, at locations blocked by existing cables. Conduit terminations should not extend beyond the manhole walls. Conduit penetration locations should allow for easy racking of cables around the walls.

Conduits should be installed at a minimum depth of 30”, surrounded with granular backfill material for a minimum of 3” all sides and capped with a minimum of 4” of concrete. An orange warning tape should be placed above the concrete cap at 18” from ground level. Mule tape should be installed in all conduits.

One conduit per run should have a conductive wire install for the purpose of utility locates.
Conduits terminations: Outside plant conduits which penetrate the walls of manholes, handholes, and building entrances through walls must be terminated flush to the wall using bell ends, illustrated below.

Pulling points: A manhole or handhole. Pulling points should be located for safe and easy access by personnel and equipment; the location should allow for necessary water pumping operations.

Manhole: Standard manhole size is 12’x6’x7’ Type A for inline, Type J for corners in manhole runs, with 32” lid with penta-head bolts and labeled “Communications”. Manholes are typically used for splice points and pulling points. Manholes shall have corrosion-resistant pulling irons, grounded cable racks, and ladder. The floor should have a sump for drainage.
Handhole: Standard handhole size is a 4’x4’x4’ concrete precast unit with sumphole; a 30”x4’x4’ handhole may be used for one or two duct runs only and with prior approval by the appropriate University representative. Handholes are typically used as pulling points only. Handholes should be installed in a manner to provide adequate drainage.

Lengths: The section length of conduit between pulling points should not exceed 600 ft without prior approval of the appropriate University representative. Friction and tension design should not allow for pulling tensions on fiber optic cables of greater than 600 lbs.

Bends: Sharp bends, that is a bend with a radius of less than 10 times the diameter of the conduit, must NOT be utilized for conduits that will carry communications cables. Bends which reduce the inner diameter of the conduit are not permitted. The number of bends should be minimized; the total degrees of bend in conduit(s) between pulling points should not exceed 180 degrees.

Slope: Conduits should be installed to slope away from buildings and toward pulling points.

Duct Plugs: Conduits must be sealed to resist liquid and gas infiltration at all building entrance points and maintenance holes.

Innerduct: Innerducts will not be used unless specifically requested by the appropriate University representative.

Bridge crossings: Route design should avoid attachments to bridges and similar structures unless approved by the appropriate University representative.

OUTSIDE PLANT CABLING

GENERAL

On the IUB and IUPUI campuses, UITS provides outside plant (OSP) cables and terminations to a new building IDF-1 (MDF) without cost to the project.

On the regional campuses, the cost for materials and installation of both copper and fiber optic outside plant cabling must be included in the project design and construction costs.

OSP cable will be placed in underground conduit entirely when at all possible. Other options are direct buried, on aerial strand, or some combination of these three.

OSP COPPER

OSP copper cables for low risk applications may be RDUP PE89 type cable, while cables which are all or in part direct buried and require additional mechanical and/or rodent protection must be RDUP PE39 type cable.
OSP FIBER OPTIC

OSP Fiber cables:

Loose tube (ALTOS) Gel Free all-dielectric cable, designed for outdoor and limited indoor use for backbones in lashed aerial and duct installations

Corning:

- 12 strand SM fiber (012EU4-T4101D20)
- 24 Strand SM fiber (024EU4-T4101D20)
- 72 Strand SM fiber (072EU4-T4101D20)
- 144 Strand SM fiber (144EU4-T4101D20)

Loose tube (ALTOS) Gel Free double jacket cable, designed for duct and aerial (lashed) installation.

- 12 Strand SM fiber (012EUE-T4101D20)
- 24 Strand SM fiber (024EUE-T4101D20)
- 72 Strand SM fiber (072EUE-T4101D20)
- 144 Strand SM fiber (144EUE-T4101D20)

Indoor/Outdoor (FREEDM) loose tube gel-free riser cables are flame-retardant, indoor/outdoor, riser-rated cables designed for interbuilding and intrabuilding backbones in aerial, duct and riser applications.

- 12 Strand SM fiber (012EUF-T4101D20)
- 24 Strand SM fiber (024EUF-T4101D20)
- 72 Strand SM fiber (072EUF-T4101D20)
- 144 Strand SM Fiber (144EUF-T4101D20)

OSP Fiber Hardware:

Corning Pretium Connector Housing
- 4 U rack housing (PCH-04U)

Corning Coupler panels
- Duplex APC, 12 F, SM (CCH-CP12-D9)

Corning Fuselite LC Buffer Tube Fanout splice on connectors
- Singlemode APC (SOC-LCA-FAN-SM)

Corning Buffer Tube Fan out, Outdoor
- 12 F, 25” (FAN0D25-12)

Corning CCH Connector module housing, pigtailed
- Duplex APC 12 F, Singlemode (CCH-RM12-B3-P03RH)
AFL Connector Housing
- Xpress Fiber Management 4U panel (FM001090-B)

AFL Coupler panel
- 6 LC Duplex Panels (FM002804)

AFL Poli-MOD Splice on Module
- 12 fiber LC-APC fuse module (PM-L-12-ALC-0-S-01)

AFL Adaptor plate (For Corning CCH/PCH panels)
- FM001636

Associated mounting hardware
- All hardware shall be mounted according to manufacturer’s specifications
- All hardware shall be mounted securely and completely; all required crews, bolts, tie wraps, etc., shall be utilized
- All necessary bonding and grounding hardware
- Examples of mounting hardware are 6” D Rings, Panduit LPMF-58-M Low Profiles, and Panduit PLT35-M
- 11” Tie-wraps, or equivalents

APPENDIX: DIVISION 27 PREPARATION

The current Indiana University UITS Division 27 document, posted at http://www.indiana.edu/~uao/ under the “Contracts/Standards” tab, shall be inserted unedited into the project specifications document. Parts which are not applicable may be deleted from a given project’s documentation, but with section label still included and labeled as “Not Applicable” or “Removed”. Additions may be made to the document as required, but must be identified as such. However, the Division 27 specification is not subject to either interpretation or revision without express written approval by the appropriate UITS representative.

The UITS Division 27 document should be used as an addendum to this Design Guide during design the design process. Likewise, this document serves as an addendum to the UITS Division 27 specification for bidding and construction.