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Overview of Technology-Infrastructure Practices

Introduction

The purpose of the document is to describe how Information Services and Technology (IS&T) works with the Danforth Campus partners on design and installation of the technology infrastructure supporting staff/administration, teaching, learning, and research at the University. Depending on the project, these partners include, but not limited to, the directors of IT and Facilities for each of the Danforth Schools, Facilities Planning and Management, the Classroom Monitoring Committee (CMC), and the Teaching Center. Other partners will be involved as required by the specific project.

As we begin the process of understanding the construction requirements for all new renovations and capital projects, we also need to include all aspects of technology. For example, wireless networking, cellular phone services and DAS (Distributed Antenna Systems), and wired network connectivity are becoming standard utility services for every building. As faculty, students, staff, and visitors are bringing multiple devices to campus, they expect ubiquitous connectivity in offices, gathering spaces and classrooms. The increased need to use technology throughout the Danforth Campus for a wide variety of purposes drives the need for requirements such as,

- Availability of network resources around-the-clock and for emergency response, including during power outages.
- Reliable wireless connections throughout all interior spaces, including basements for maintenance operations, security and emergency response.
- Support for interactive video presentations, video conferencing and remote class sessions, requiring reliable, high-speed network connections throughout buildings.
- A secure and reliable network to support building control systems, alarms, closed circuit cameras and internet based telephones.
- The number of devices any one individual brings to campus continues to rise and with it an expectation of ubiquitous connectivity.

Process

From the beginning of a building or renovation design project, Information Services & Technology works closely with the relevant campus partners to ensure that the technology infrastructure is designed to meet the requirements and to cohere with the University’s standards. In the case of projects that include University managed classrooms, IS&T works with the Teaching Center staff to ensure that the technology infrastructure will support the installation and use of technology according to The Teaching Center’s classrooms standards. In other cases, IS&T will work with the directors of IT and Facilities of the relevant school on their projects.

IS&T will assign a project liaison to communicate with the campus partners on specific technology needs throughout the project. This project liaison will also communicate with the zone manager, and The Teaching Center where appropriate, when and where projects are to be done, and ensure that the projects are completed per standards.

The preferred approach for documenting technology requirements for projects is to provide drawings dedicated to IS&T. Upon submission of DD and 50% CAD drawings, IS&T will then produce wireless (WLAN) and distributed antenna design to be overlaid on the construction drawings.

Any variance from minimal design requirements will be reviewed by IS&T and the space owner(s). Discussions will include why variances are requested and how this might impact the University’s commitment to having “ubiquitous connectivity” on campus. This request for variance will then be presented to the following for approval;
the Associate Vice Chancellor for Facilities Planning and Management, the Vice Chancellor and Chief Information Officer, the highest level executive responsible for the building/space in question, i.e. the deans of the schools (for school owned buildings and spaces), or the Executive Director of The Teaching Center (for University managed classrooms). Final escalation is to the Provost and the Executive Vice Chancellor for Administration. Any and all decisions will be documented in writing.

**General Guidelines/Standards**

Information Services & Technology is responsible for overseeing installation, maintenance and administration of all campus telecommunications, wireless, DAS, and network critical physical infrastructure. This responsibility includes working with the end users to ensure that the infrastructure fits the technology, and the design of the technology, needed by end users. It also includes ensuring that each building’s infrastructure is planned to support adequate telecommunications rooms, cabling and wiring within the buildings, and cabling between buildings to support the University’s diverse requirements for voice, data, wireless, and DAS.

Adherence to standards and codes is employed to increase the value of the investment in the infrastructure, reduce the labor expense of maintaining the system, decrease the expense of installation at a later time, extend the useful economic life of the system, and provide effective service to users. Adherence to standards and codes also makes it possible to administer the critical infrastructure necessary for daily information technology and to support the mission and vision for growth at the University.

**General Planning Guidance**

This section is intended to convey the most current information technology infrastructure guidelines for the work areas typically found at the University. These are the minimum initial planning requirements to design and build the appropriate infrastructure to support the foreseeable use of the intended facility. For each type of work area listed in this section, the end user shall consult with Information Services & Technology to help determine the specific configuration necessary to meet work area requirements.

**Types of Work Area**

- Classrooms/Lecture Halls/Auditoriums – a minimum of two communications outlets, one typical and one non-typical (see below for outlet description).
- Conference Rooms – a minimum of one typical communications outlet in each room. Rooms more than 500 sq. ft. should have two typical communications outlets.
- Faculty and Staff Offices – a minimum of one typical communication outlets for offices of 100 sq. ft. or less. Offices greater than 100 sq. ft. may require an additional communications outlet.
- Residential Rooms - a minimum of one typical residential communications outlet per bed.

**Philosophy of WiFi and DAS placement**

- Wireless (WiFi) – all spaces within buildings will be designed for ubiquitous wireless coverage, based on forecasted capacity.
- DAS (Distributed Antenna System) - all spaces within buildings will be designed for ubiquitous cellular coverage, based on forecasted capacity.

**Outlet Description**

- Typical Communications Outlet (Per University Standards) – One voice and two network cables
• Non-Typical Communications Outlet (Per University Standards) – One voice, two network, one catv, one two strand SM fiber, one two strand MM fiber cables
• Typical Residential Communications Outlet – One voice, one network, and one catv

Technology Categories

• Wired network
• Wireless network
• Cellular phone service – Distributed Antenna Systems

Note – All future considerations and recommendations to the standards will be shared and discussed with the Medical School CIT.
Technology: Wired Network

This encompasses the cabling, in-room connections, network equipment, wiring closets and back-up power required to support the university’s multiple data networks. All cabling infrastructure guidelines and specifications are provided by IS&T to ensure the installation meets the needs of the University. Specification standards can be found at http://nss.wustl.edu/infrastructure/Pages/default.aspx

Design Considerations:

The wired data network continues to be a critical technology component and is the backbone for connecting all forms of technology, including wireless networks. Functions dependent on wired network infrastructure include,

- Internet Access
- CCTV
- Building control systems
- Alarm systems
- Alertus emergency notification
- Door access systems
- Access to university and school systems
- Video and voice communications
- Classroom technology
- Wireless network access points and controllers
- Internet television services

Several elements will impact building design and construction.

- Allocation of Telecom Rooms for network equipment and related infrastructure
- Specification for the number of fiber and copper cables based on current utilization and anticipated network growth and technology changes
- Placement of cabling and network connections, to include pathways for future cabling
- Back-up power requirements including UPS and generators

IS&T has responsibility for providing budgetary cost estimates, building design requirements for space and placement, specifications for contractors, deployment supervision, and acceptance of the completed installation for building projects on the Danforth, West, North and Residential campuses. This is essential to ensure a consistent and secure environment for network connectivity at the University.

Related Documents: University wiring standards

IS&T Contact: Network Planning & Services
314-935-5009
Technology: Wireless Network (WLAN or WiFi)

Wireless networking includes support for use of unlicensed radio frequency technology using 802.11 protocols to transmit data (commonly referred to as WiFi). This technology provides connections to mobile devices in close proximity to network transmitters and receivers or network access points (AP). The APs in turn require connection to the university wired network. This technology is most appropriate for extending the university network to mobile devices in defined spaces.

Design Considerations:

Deployment of any wireless infrastructure needs to be carefully planned and engineered. The design and deployment of a wireless network for a particular location is influenced primarily by interference and capacity planning factors. Each design must include careful and exhaustive signal strength measurements, which take into account the three-dimensional nature of wireless network devices, interference caused by other devices utilizing the same unlicensed spectrum and obstacles such as concrete walls, metal supports, and low E or lead lined glass.

The design must also take into account the potential load on the wireless network. A large number of wireless users in one area such as a large classroom or lecture hall, for example, may require the use of two or more wireless access points configured to balance load. A less dense but more spread out coverage area, such as a lawn between two buildings may require a "coverage-orientation" as opposed to a "capacity-orientation" design with a different set of configuration options. In addition, it is important to note that the bandwidth provided by the wired network far exceeds that provided by wireless LANs. Users attempting to substitute wireless LANs for wired LANs can expect degradation of performance and speed as well as potential loss of signal from time to time.

Several elements will impact building design and construction.

- Specification for the number and type of access points
- Placement of cabling and network connections
- Back-up power requirements including uninterruptible power supplies (UPS) and generators

Planning should begin with the IS&T liaison consulting with the owner and end user of the space to ascertain the intended use of the space. This discussion should happen prior to the design. In the case of University-managed classrooms, The Teaching Center is the space owner, and should be the point of contact for room requirement. The wireless needs of the end user may also influence the design.

IS&T has responsibility for providing budgetary cost estimates, building design requirements for space and placement, specifications for contractors, deployment supervision, and acceptance of the completed installation for building projects on the Danforth, West, North and Residential campuses. This is essential to ensure a consistent and secure environment for network connectivity at the University.

Related Documents: University wiring standards and wireless design guidelines

IS&T Contact: Network Planning & Services
314-935-5009

Technology: Cellular phone service – Distributed Antenna Systems (DAS)
Cellular phone services are controlled by third party providers and require the use of licensed radio frequencies. Each provider has their own, slightly unique technology for sending and receiving signals. Extending cellular signals onto campus and into buildings requires the cooperation and investment of the cellular service providers.

The cellular technology is generally designed to transmit and receive radio signals over large outdoor areas. Physical structures can block signal transmission resulting in poor phone reception. Distributed antenna systems (DAS) provide a strategy for capturing and re-broadcasting cellular signals in areas of poor coverage, including inside buildings. WUSTL has deployed multiple configurations of DAS to provide cost effective options for partnering with the third party owners of the cellular RF licenses and services.

**Design Considerations:**

Similar to WLAN, DAS implementations have the same design guidelines, with one difference. Designs must accommodate capacity and coverage for the four major cellular carriers (Sprint, T-Mobile, AT&T, and Verizon).

Deployment of any DAS needs to be carefully planned and engineered. The design and deployment of a DAS for a particular location is influenced primarily by interference and capacity planning factors. Each design must include careful and exhaustive signal strength measurements, which take into account interference caused by other cellular transmitters and obstacles such as concrete walls, metal supports, and low E or lead lined windows.

The design must also take into account the potential load on the DAS. A large number of smartphones in one area such as a large classroom or lecture hall, for example, may require the use of two or more antennas configured to balance load. A less dense but more spread out coverage area, such as a lawn between two buildings may require a "coverage-orientation" as opposed to a "capacity-orientation" design with a different set of configuration options.

Several elements will impact building design and construction.

- Specification for the number and type of antenna’s
- Placement of cabling, and signal distribution equipment in buildings
- Placement of carriers’ equipment for connections to the DAS or the “Head End”
- Capacity of the university’s fiber network to connect Head End and distribution equipment across campus
- Back-up power requirements including UPS and generators

IS&T has responsibility in providing budgetary costs and engaging a DAS engineer for design, deployment, and management of the distributed antenna system the Danforth campus. This is essential to ensure a consistent environment for cellular coverage at the University.

**Related Documents:**

**IS&T Contact:** Network Planning & Services
314-935-5009
Specifications for Communication Cabling Distribution Systems

General Overview

Listed below are the separate sub-systems of Washington University’s structured cabling system standard. The sub-systems are each summarized and then described in detail as separate sections in this document. All telecommunications wiring systems must adhere fully to all applicable TIA/EIA Telecommunications Building Wiring Standards. The requirements for Washington University (WU) communications cabling sub-systems provide for:

1. **Service Entrance and Termination Room (Entrance Facility – EF)**

   This is the main telecommunications building service entrance. It is the area where the demarcation between inter and intra building cable is located. At WU this room is typically the Telecommunications Room on the lowest level of the building.

2. **Equipment Room (ER)**

   This area contains the electronic equipment that transitions between the core campus data, voice and video backbones and the building backbone. This securable room is to be dedicated to this purpose with no other building services sharing the space. This space may be co-located with the Service Entrance and Termination Room provided the room is sized for both functions. At Washington University all Telecommunications Rooms house active network equipment and are treated as ERs.

3. **Telecommunications Room (TR)**

   This room provides for demarcation between horizontal cabling serving work areas and the building video, data and voice backbone cabling. Additionally, this room may contain electronic equipment that transitions between the data, voice and video building backbone and the end user telecommunications equipment. This securable room is to be dedicated to this purpose with no other building services sharing the space. This space may be co-located with the Service Entrance and Termination Room and/or ER provided the room is sized for both functions. At Washington University all TRs house active network equipment and are treated as ERs.

4. **Communications Conduits (CC)**

   Communication conduit requirements depart from that for “normal” electrical power distribution. Communications conduit sizing does not follow NEC in terms of the maximum number of conductors allowed per unit volume. Due to the need for facilitating frequent adds, moves and changes, communications conduits are generously sized. Conduits entering the building are usually 4 inches with inner duct partitioning. Conduits between building TRs are also usually 4 inch. in diameter. Conduits servicing end user spaces are usually 1”. Conduits between floors interconnecting TRs are usually “stubbed” and 1” conduits servicing end users information outlets are also usually “stubbed “ to above the ceiling and thence to the nearest corridor/hallway telecommunications horizontal pathway leading to the TR.

**Communications Pathways (CP)**

Communications pathways are the single most critical component of the structured cable system. WU does not, in general, require a separate “home-runned” 1” conduit from the end user information outlet to the per
floor TR. In general, WU prefers to utilize wiring hangers, sometimes known as J-Hooks, or cable trays. A key feature of the j-hook/cable tray arrangement is its flexibility in ongoing moves, adds, and changes to the cabling system over the lifetime of the building. Cable trays are required through all hallways and corridors and will terminate in TR.

5. **Telecommunications Wiring**

WU specifies the latest standard in twisted pair wiring. This cable carries the bulk of data and voice services. In general, WU does not require fiber or coaxial cable to the desktop though limited instances of this may be required and will be specified during the design process. All cable is plenum rated.

6. **Building Riser**

The building backbone riser system connects TRs to each other, to the main service entrance room and to the ER. WU specifies several separate cable systems to provide for the data, video and voice needs of the building occupants. Riser rated twisted pair copper “bulk” cables, coax, and both single mode and multimode fiber along with their termination systems are specified.

7. **Grounding and Bonding**

All cabling systems and electronics distribution equipment must be grounded for both safety and electromagnetic interference reasons. Specifications for how this is to be affected are found in this section.

8. **Electrical Power**

Provisioning the electrical power for communications systems requires special attention. Electrical interference as well as power quality must be attended in order to minimize long-term maintenance costs and end user disruptions.

**SERVICE ENTRANCE AND TERMINATION ROOM (EF)**

This room is the required service entrance for Telecommunications service (voice, data, video, FASS, BACS). The minimum size and number of conduits to a building is four 4” conduits with two of the four having three 1¼” inner ducts for fiber optic cabling. If the building has a tunnel attached, then interbuilding conduits will not be required.

The location shall be within 50’ of the point where electrical facilities enter the building.

Never run more than 50’ of exposed non-fire-rated entrance cable within a building. If more than 50’ of cable is required between the entry point and the termination point, use rigid metallic conduit to enclose the cable to within 50’ or less of the termination point or a transition splice from outside plant cable to indoor rated cable is acceptable. Conduit must be grounded.

The room shall be dedicated to Washington University’s Network Services and Support.

The basic requirements for WU’s EF are the same as a TR.

Approved manufacturers of fiber optic cable are Mohawk and Siecor. All outside plant cable in non-protected or protected pathways (tunnels, direct bury, and overhead) shall be loose-tube, armored, and include a trace wire.

*The fiber and copper entrance facility cabling counts will be provided on a per project basis and based on building size, function, and number of users.*
EQUIPMENT ROOMS (ER)

Equipment Rooms provide space and maintain a suitable operating environment for communications equipment. ERs are generally considered to serve a building, where TRs serve one floor or a section of a floor. In most cases at WU, each TR will house active equipment and will meet all ER specifications.

The room should be located so it has access to the intra and inter backbone pathway, is accessible for delivery of equipment, away from potential sources of EMI, away from machinery that causes vibration, and away from steam pipes, drains, and clean-outs.

If the ER is on a different floor then the Service and Termination Room, it must be stacked above the Service Entrance and Termination Room.

The room shall be dedicated to Washington University’s departments of Communication Services and Network Technology Services.

1. The basic requirements for an ER are:

   Minimum size for small buildings.
   - serving area of <1,000 sq.ft., 3’ X 4’.
   - serving area of <5,000 sq.ft., 6’ X 6’.

   Minimum size for large buildings.
   - serving area of <8,000 sq.ft., 6' X 10'
   - serving area of <10,000 sq.ft., 8' X 10'
   - serving area of <20,000 sq.ft., 10' X 15'
   - serving area of <30,000 sq.ft., 15' X 15'
   - serving area of <40,000 sq.ft., 17' X 17'
   - serving area of <50,000 sq.ft., 19' X 19'

2. Minimum ceiling height is 9’ 6”, with the exposed slab as the ceiling.

3. Location, number, and size of conduits, and sleeves between the Service Entrance and Termination Room, ERs, and TRs will be specified during the design phase of the project.

4. Rooms shall have outward swinging, fully opening, and lockable doors that are at least 36 inches in width and 80 inches in height. The door will be outfitted with the University’s standard standalone card reader. If door cannot be outfitted with card reader, then it must be keyed to match the “MD-81” lock.

5. To avoid dust, floors shall be tile and all exposed concrete, brick, and gypsum board shall be painted or sealed. Carpet is not allowed.

6. Rooms shall have a dedicated HVAC, with positive air pressure, to control temperature and humidity. The heat dissipation will be specific to each building, but should be in the range of 750 to 5,000 Btu per equipment rack. Relative humidity should be controlled at 30% to 50%. Temperature should be controlled at 64 to 75 degrees. Condensing units will not be located in the ER/TR.

7. ERs cannot have any water pipes in the room, above the room, or in the floor below the room. If sprinklers are required in ER or TR, install wire cages or other protection to prevent them from being accidentally set off. Sprinkler heads should not be installed directly over active equipment.
8. Provide a building ground wire, with bus bar, to the room. Locate the bus bar at the lower left corner of the plywood backboard. Network Technology Services or Communication Services will indicate on which backboard to place the bus bar. See Grounding section.

9. Provide a minimum lighting to be equivalent of 540 lux (50 foot-candles) measured 3 feet AFF.

10. Each wall, except the wall which contains the entrance door, shall have 3/4" X 4' X 8' sheets of A-C fire retardant plywood installed on them. The plywood shall reach from corner to corner. Install the plywood vertically at 6” AFF and fastened securely with a minimum of five (5) equally spaced fasteners along each vertical edge and one column of five (5) equally spaced fasteners centered on each sheet of plywood. Paint the plywood with two coats of fire retardant low-gloss, light-colored paint.

11. On each wall, except the wall containing the door, install two A/C 20-amp electrical fourplex outlets at 12” AFF. In the larger rooms, 10’ X 15’ and larger, install three A/C 20 amp electrical fourplex outlets evenly spaced along each wall. See Power section. Install a dedicated 208 volt 30-amp circuit to support a rack mountable UPS with L6-30 receptacle. The size of the UPS will be determined during the design phase along with the size and type of electrical receptacle.

12. Minimum floor loading should be 4.8 kPA (100 lb/ft²).

13. Install three 7’ racks, without panels, to support network termination devices and network electronics. The amount of services required to support the building may require more than one cabinet to be installed. Fasten the cabinet(s) to the floor and bond the cabinet to the ground bus. Number and location of the cabinets will be supplied during the design phase of the project.

14. Install cable tray from the cabinet(s) to the plywood backboard. Bond the cable tray(s) to the ground bus. Cable tray fences are required every 12” to 16” to support cable bundles. The exact amount is determined by the total length of tray for each room.

15. When the ER is also used as a Service and TR and/or a TR, Network Technology Services or Communication Services will alter the size of the room based on the type and amount of services required to support the building. Network Technology Services or Communication Services will also take into consideration the intended use of the building when determining the size of the ER.

16. Install one Uninterruptible Power Supply in each ER.

TELECOMMUNICATIONS ROOMS (TR)

A per floor centrally located TR shall be provided for in the design of the building. If a horizontal distance of 90m between TR and work area outlet cannot be attained a second TR might be required per floor. These rooms will not be shared with other physical plant systems. In most cases at WU, each TR will house active equipment and will meet all ER specifications.

A TR provides the connection point between the building backbone and horizontal distribution pathways.

The TRs must be stacked above each other on each floor. If rooms are not stacked, the TR shall have a means to access the TR's on the floor above and below via metal conduits or sleeves.

The location shall be as close as possible to the center of the floor it is intended to serve. This is to minimize the horizontal cable lengths and duplication of electronic equipment.

The basic requirements for a TR are:
1. Maximum distance between the TR and a telecommunications outlet is 295 ft. as per the cable pathway.

2. There shall be at least one TR per floor.

3. The basic requirements for an TR are:
   - Minimum size for small buildings.
     - serving area of <1,000 sq.ft., wall enclosure.
     - serving area of <5,000 sq.ft., 4.5' X 4.5'
   - Minimum size for large buildings.
     - serving area of <5,000 sq.ft., 10' X 7'
     - serving area of <8,000 sq.ft., 10' X 9'
     - serving area of <10,000 sq.ft., 10' X 11'

4. The typical WU ER/TR size is 10’ X 11’ per each floor.

5. Minimum ceiling height is 9' 6", with the exposed slab as the ceiling.

6. Provide and install four STI EZPath Series 44 (part # EZD44) sleeves between TRs located on different floors. One 3" conduit shall be installed between TRs located on the same floor. Location of conduits, cable trays, and sleeves shall be coordinated with Network Services and Support.

7. Rooms shall have outward swinging, fully opening, and lockable doors that are at least 36 inches in width and 80 inches in height. The door shall be outfitted with the University standard standalone card reader. If the door cannot be outfitted with a card reader, then it must be keyed to match the “MD-81” lock.

8. To avoid dust, floors shall be tile and all exposed concrete, brick, and gypsum board shall be painted or sealed. Carpet is not allowed.

9. Rooms shall have a dedicated HVAC, with positive air pressure, to control temperature and humidity. The heat dissipation will be specific to each building, but should be in the range of 750 to 5,000 Btu per equipment rack. Relative humidity should be controlled at 30% to 50%. Temperature should be controlled at 64 to 75 degrees. Condensing units will not be located in the ER/TR.

10. TRs cannot have any water pipes in the room, above the room, or in the floor below the room. If sprinklers are required in ER or TR, install wire cages or other protection to prevent them from being accidentally set off. Sprinkler heads should not be installed directly over active equipment.

11. Provide a building ground wire, with bus bar, to the room. Locate the bus bar at the lower left corner of the plywood backboard. Network Services and Support will indicate on which backboard to place the bus bar. See Grounding section.

12. Provide a minimum lighting to be equivalent of 540 lux (50 foot-candles) measured 3 feet AFF.

13. Each wall, except the wall which contains the entrance door, shall have 3/4" X 4' X 8' sheets of A-C fire retardant plywood installed on them. The plywood shall reach from corner to corner. Install the plywood vertically at 6" AFF and fastened securely with a minimum of five (5) equally spaced fasteners along each vertical edge and one column of five (5) equally spaced fasteners centered on each sheet of plywood. Paint the plywood with two coats of fire retardant low-gloss, light-colored paint.

14. On each wall, except the wall containing the door, install two A/C 20-amp electrical fourplex outlets at 12” AFF. In the larger rooms, 10’ X 15’ and larger, install three A/C 20 amp electrical fourplex outlets evenly spaced along each wall. See Power section. Install a dedicated 208 volt 30-amp circuit to support a rack.
mountable UPS with L6-30 receptacle. The size of the UPS will be determined during the design phase along with the size and type of electrical receptacle

15. Minimum floor loading should be 2.4 kPa (50 lb/ft²).

16. Install three 7’ racks, without panels, to support network termination devices and network electronics. The amount of services required to support the building may require more racks to be installed. Number, manufacturer, and location of these cabinets will be provided during the design phase of the project. Fasten the cabinet(s) to the floor and bond the cabinet(s) to the ground bus.

17. Install cable tray from the rack(s) to the plywood backboard. Bond the cable tray(s) to the ground bus. Cable tray fences are required every 12” to 16” to support cable bundles. The exact amount is determined by the total length of tray for each room. The manufacturer and location will be provided during the design phase of the project.

18. When the TR is also used as a Service and Termination Room and/or an ER, Network Services and Support will alter the size of the room based on the type and amount of services required to support the building. Network Services and Support will also take into consideration the intended use of the building when determining the size of the TR.

19. Each TR shall contain a smoke/fire sensor as part of the overall building fire alarm system.

20. The Ethernet cables will be terminated in the data rack in patch panels with cable management. The voice cables will be terminated on wall mounted racks. CATV will be mounted on a wall mounted swing rack. The specific part numbers of the patch panels, racks, and cable management devices will be provided during the design phase of the project.

21. The room shall be dedicated to Washington University’s Network Telecommunication Services.

22. Install one Uninterruptible Power Supply in each TR.

See attached document labeled “Typical Washington University Telecommunications Room Layout”.

COMMUNICATIONS CONDUITS AND INFORMATION OUTLETS

The minimum conduit and outlet specifications for Washington University’s communication cabling system are as follows:

1. The communication entrance conduit shall consist of at least four (4), four (4) inch conduits run from the nearest existing maintenance hole, hand hole, or tunnel to the Service Entrance and Termination Room of the new facility. At least two 4” conduit will contain (3) 1 ¼” inner ducts. These conduits shall not contain more than two 90-degree bends and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts. No run of conduit shall exceed 500 feet between hand holes/maintenance holes. New manholes shall contain permanent ladders, pull rings, grounding system, a sump pit, and a floor drainage system to drain water. New hand holes shall contain, pull rings, grounding system, a sump pit, and a floor drainage system to drain water.

2. Conduit run outdoors for other communication purposes shall be a minimum of one-inch diameter, and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts. No run of conduit shall exceed 500 feet between pull points and contain no more than two 90-degree bends. If pull boxes are installed the conduits shall enter the pull box one foot above the bottom and the pull box shall have a means to drain water from them.
3. The conduits entering from outside of the building shall terminate 4” after they penetrate the outside wall. Cable tray shall be installed or conduit extended to the TR from the penetration point. A ground wire with bus bar shall be installed at the location the cable enters the building.

4. A one-inch conduit shall connect the work area outlet to the nearest cable tray or J-hook run. The conduit shall terminate within 4’ of the nearest cable tray or J-hook. The minimum size conduit run from the Telecommunications outlet to the nearest cable tray of J-hook shall be a one-inch EMT conduit.

5. The total length of conduit runs shall not exceed 150 feet in length, with the distance between pull boxes not to exceed 100 feet. Provide pull boxes in readily accessible locations. The installation of pull boxes in the conduit run shall be placed in line with the conduit run such that wire or fiber optic cable can be pulled through the pull box without incurring damage to the cable. No turns or bends of the conduit run are allowed within pull boxes.

6. Conduit installed for payphones, emergency phones and elevator phones shall be a ¾” EMT conduit and be a home run back to the TR and shall have a pull box after every 180 degree change in direction or elevation for every 150 feet. Conduit runs shall not exceed 295 ft. in length. Provide pull boxes in readily accessible locations. The installation of pull boxes in the conduit run shall be placed in line with the conduit run such that wire or fiber optic cable can be pulled through the pull box without incurring damage to the cable. No turns or bends of the conduit run are allowed with pull boxes.

7. No LB type fittings of any size are to be used for communication conduit.

8. No PVC conduit or PVC sleeves are to be used for communication conduit within the confines of a building.

9. Minimum radii for bends shall be 9-1/2 inches for 3/4-inch conduit, 10-1/2 inches for one inch conduit and the equivalent of long radius factory bends for larger sizes. The short radius bends of larger diameter conduit normally installed for electrical installations is not sufficient for communication cabling. Four (4) inch conduits installed for communication cabling will have a minimum four-foot radius bend.

10. Label all pull and junction boxes.

11. Provide a nylon pull cord in each empty conduit and run with a 200 LB pulling tension.

12. Conduit installation for communication purposes shall be installed with the probability of fiber optic cable being installed in it and pulling tension and minimum bend radius being critical factors for installing usable fiber optic cable as well as the category 5E cable.

13. All pathways and cable penetrations are required to use the approved STI fire stopping methodology.

COMMUNICATIONS PATHWAYS SPECIFICATIONS

The standards adopted by Washington University provide that a clear and accessible pathway for telecommunications horizontal cabling shall be maintained. These pathways are located between the TRs and the rooms containing the telecommunications outlets. The Architect and the Mechanical/Electrical/Plumbing consultants shall prepare drawings and specifications that insure a clear and accessible pathway for telecommunications wiring. Any pathway that is not accessible and/or provides a clear and workable pathway will need to be removed and reinstalled to provide a clear and accessible pathway. There are several methods available for providing a pathway for supporting telecommunications cables. The architectural design of each building is unique and requires an analysis of which method(s) are best suited for that
building. At WU, J-Hooks and cable trays are the preferred method of providing a pathway. All pathways and spaces must adhere to current TIA/EIA-569-B. Both pathway types are listed below.

1. **Cable Trays** - The cable tray shall be installed in accordance with the applicable electrical code. The cable tray is for dedicated use by Communication Services and Network Technology Services. No other cabling is to share the cable tray. Cable Tray must be installed with 12” of vertical space above the tray and with a minimum of 3” between the tray and finished ceiling.

2. **J-Hooks** - The model to use will be determined by the number of cables in that pathway. No other cabling is to share the J-Hooks with Communication Services and Network Technology Services. J-Hooks must be located on 4’ to 5’ centers to adequately support and distribute the cables weight.

### PER FLOOR TELECOMMUNICATIONS WIRING SYSTEMS

Installation and physical protection of Telecommunications cable is a very critical element for the cable to deliver its rated bandwidth. A "kink", "pinch", a bend radius less than 1.25 inches in diameter, or stretching of the cable by exceeding the 25 pound maximum pulling tension during installation will damage the cable to the point that it will not meet rated specifications and shall be replaced. Telecommunications cable termination standards requires that no more than the minimum amount of the common sheath be removed that is required for termination and no more than 1/2 inch of untwisting of conductors. Installation personnel shall be BICSI certified installers or equivalent and provide proof of certification.

At WU the minimum wiring system specification varies by building function and type. An addendum to the “Per Floor Telecommunications Wiring Systems” section will be attached separately.

All telecommunications wiring systems must adhere fully to the latest applicable to the current TIA/EIA Telecommunications Building Wiring Standards (ANSI/TIA/EIA-568B.1, B.2, B.3-1, and 569B), including:

1. The cable run from the TR to the work area outlet will not exceed 90m and will contain no splices.

2. All fiber optic cable will be installed in inner duct or armored rated cable.

3. At the user end of the cables, in the outlet box, there shall be 12” of slack after termination to facilitate future re-terminations.

4. Each of these two cables will be labeled on each end with a Telecommunications outlet number. The Telecommunications outlet numbering will contain the floor number and the sequence number of the cable (start with 1 and number sequentially). Each voice and network cable will be labeled with the jack ID.

5. The installation of the data and voice cables shall conform to the following clearances:

   - At least 127 millimeters (5 inches) from power lines carrying 2KVA or less
   - At least 305 millimeters (12 inches) from power lines carrying from 2 to 5KVA
   - At least 915 millimeters (36 inches) from power lines carrying more than 5KVA
   - At least 127 millimeters (5 inches) from all fluorescent lights and other sources of electromagnetic interference such as electric motors, HVAC equipment, arc welders, intercoms, etc.
BUILDING RISER SPECIFICATIONS

Twisted pair riser cables, fiber optic riser, and CATV Coax broadband riser cable, shall be installed from the EF to individual floor TRs.

The minimum specifications for this riser system is as follows:

1. Install eight (8) 25-pair category 5 plenum rated cables totaling 200 pair to be terminated on Siemons 66-blocks and on Homaco frames at the EF and at individual floor TRs.

2. Install one armored composite cable with 12-pair (24 strand) 50/125 (OM3) micron multimode fiber and 12-pair (24 strands) single mode fibers terminated with Siemon SC type connectors and placed in a rack mounted box.

3. Install a minimum of four (4) RG-6 Quad Shield coaxial cables from the EF to individual floor TRs.

GROUNDING AND LIGHTNING PROTECTION

Each EF, ER and the TR shall have a bus bar installed and bonded to ground as per the requirements of Telecommunications Industry Association standard ANSI/TIA/EIA-607 Grounding and Bonding Standard as follows:

1. An insulated copper ground wire shall be run from the building main electrical ground bus to the EF bus bar with no splices or connections other than the designated end points or conduit bonds if run in metal conduit.

2. An insulated copper ground wire shall be run from the EF bus bar to the ER bus bar and the ground bus bar in each TR. This ground wire shall be sized based on the cable size of the main electrical feed and the cable should be one continuous cable containing no splices. In the intermediate closets, the ground bus shall be connected to this cable with a "tap" connection.

3. If there is more than one closet riser in a building, each closet riser shall have the same ground system installed as stated in the previous paragraph. In addition, an insulated copper equipment ground shall be run to connect together the ground buses of each top floor closet and every third floor closet in between.

4. The routing path of this ground should be as direct as possible.

5. The minimum conductor size for this ground shall be a number 3 AWG insulated.

6. All racks and building entrance terminals shall be bonded to ground.

7. If this ground conductor passes through metal conduit or metal enclosures greater than three feet in length, each end of the conduit or enclosure shall be bonded to the ground conductor by approved means.

8. Each grounding plan shall be tested using a Two-Point Test Method, and the ohmic value shall be less than 0.1 ohm to be considered to have an adequate bonding between the two reference points.
LIFE SAFETY AND BUILDING AUTOMATION SYSTEMS

The Life Safety and Building Automation Systems typically consist of fire alarm, security and access control, heating, ventilating, and air conditioning, as well as energy management systems. The following outlines the installation of the services applicable to Washington University. It would also include the installation of the USN Network, which is comprised of specified network equipment.

1. Fire Alarm - Install one category 6E cable from fire alarm panel to a Siemens 66-block in the closest TR.

2. Security and Access Control - Install one category 6E cable from security panel to network patch panel in the closest TR.

3. Security loops - Install one category 6E cable from the security panel to the device that needs to be secured, such as AV equipment.

4. Indoor or Entrance Emergency Phones - Install one category 6E cable from phone to a Siemens 66-block in the closest TR.

5. Outdoor Emergency Phones - Install one 3-pair category 3 outside plant cable (with lightning protection) from phone to Siemens 66-block in the closest TR.

6. Elevator Phones - Install one category 6E cable from each elevator controller to a Siemens 66-block in the closest TR.

7. Laundry Controllers and Vending Machines - Install one category 6E cable from device location to network patch panel in the closest TR.

ACCEPTANCE TESTING

Fiber Optics – Backbone and Horizontal Fiber

1. Fiber backbone cables shall be 100% tested for insertion loss and length.

2. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

3. Insertion loss shall be tested at 850 nm and 1300 nm for 62.5/125 μm and 50/125 μm multimode and 1300 nm or 1550 nm for the appropriate single mode cable in at least one direction using the 1-jumper method.

4. All testing must adhere fully to current ANSI/TIA/EIA-568-A-4 Annex H, ANSI/TIA/EIA-526-14-A, and TSB 140 which requires OTDR trace for each fiber.

CATV Cabling

Test all cables with TDR for coaxial cables.

Copper Cabling – Outside Plant and Riser

1. Testing of all cable pairs from the MC/IC to TR or from TR to TR
2. The system shall be tested for shorts, opens, grounds, crosses, and transpositions.
3. Cable pair defects must not exceed 1 percent of the total number of pairs.

4. All repair and/or replacement of defective material and labor shall be done at no cost to Washington University.

5. All testing must adhere fully to current ANSI/TIA/EIA-568.

Copper Cabling – Horizontal Cabling

Horizontal cabling whose length does not exceed 90m for the permanent link and 100m for the channel shall be 100 percent tested to current ANSI/TIA/EIA-568 using a level III tester with Siemon approved test adapters.

DELIVERABLES - DOCUMENTS

1. Cable installation and termination personnel shall be specialists in Telecommunications systems installation with at least 5 years’ experience and must be a Siemons certified installer.

2. The contractor shall furnish and install all material required, including installation of communication cable, installation of communication outlets, and termination of all cable in the EF, ERs, and TRs.

3. The contractor shall test and certify all cable and provide documented results of the testing. The documented results of the testing can be supplied in ASCII format electronically, and or 3 printed copies. All Telecommunications cable shall be certified to perform at the speeds referenced in the standard for that cable. If any cable runs tests defective, the contractor shall replace defective cable. A twenty year Siemon System Six warranty shall be included on all cable and hardware installed by the contractor.

4. Contractor shall provide two copies of “as-built” drawings and an AutoCAD version of the completed project showing cable runs and location numbers assigned to rooms. This shall be provided to Network Services and Support, and Washington University Facilities upon completion. All manufacturer warranties will be transferred at this time. An as-built copy must be left behind in each Telecommunications Room referencing the connections that feed from that particular room.

Note: All outside plant specification are designed on a project to project basis. Please contact Network Planning and Services for further information.
Communication Cabling Specification: Research

Voice/Network/Typical

1. Furnish and install faceplate and modular jacks at each single gang outlet as described below:
   
   a. Siemon single gang Max Modular Faceplate (part # MX-FP-S-04-02).

   b. One Siemon modular jacks to be designated as stations Voice (part # MX-U3-02). Each module is an angled two pair-six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

   c. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

   d. Provide (part # MX-BL-02) blank to be installed in the unused opening.

   e. Note: All boxes are 4" square and a minimum of 2.5" depth (when using single gang faceplate, use a single-gang raised cover on all dual-gang outlet boxes).

2. Furnish, install and terminate the following cables for each outlet as described below:

   a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

   b. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 and N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

Voice/Network/Coax/Fiber/Non-Typical

1. Furnish and install faceplate and modular jacks at each double gang outlet as described below:

   a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).

   b. One Siemon modular jack to be designated as stations Voice (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

   c. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

   d. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).
e. One Siemon Duplex fiber optic type SC module to be designated as stations Fiber (part # MX-SC-02). This module is an Angled Duplex SC adaptor (2 ports). Provide the icon and place in designated area on modules (part # CT-ICON-09).

f. One Siemon Duplex fiber optic type SC module to be designated as stations Fiber (part # MX-SC-02). This module is an Angled Duplex SC adaptor (2 ports). Provide the icon and place in designated area on modules (part # CT-ICON-09).

g. Provide (part # MX-BL-02) blank to be in installed in the unused opening.

2. Furnish, install and terminate the following cables for each outlet as described below:

h. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

i. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 and N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

j. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F-type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

k. One 50/125 (OM3) micron two strand plenum rated multi-mode fiber cable to be designated as station fiber and installed onto (part # MX-SC-02), each strand to be terminated with SC connector and inserted into module at wall outlet. At the closet end terminate with SC connector and insert into a Siemon (part # RIC-F-SC6-01) and insert into a Siemon, Fiber Rack Interconnect Center (part # RIC3_01, size determined by the amount of fiber cables) which will be mounted in 19\" rack. All modules shall have (part # CT-ICON-09) icons.

l. One 9 micron two strand plenum rated single-mode fiber cable to be designated as station fiber and installed onto (part # MX-SC-02), each strand to be terminated with SC connector and inserted into module at wall outlet. At the closet end terminate with SC connector and insert into a Siemon (part # RIC-F-SC6-01) and insert into a Siemon, Fiber Rack Interconnect Center (part # RIC3_01, size determined by the amount of fiber cables) which will be mounted in 19\" rack. All modules shall have (part # CT-ICON-05) icons.

m. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.
4. Furnish and install faceplate and modular jacks at each single gang outlet as described below:
   
a. One Siemon single gang Max Modular Faceplate (part # MX-FP-S-01-02).
   
b. One Siemon modular jacks to be designated as stations Voice (part # MX-U3-02). Each module is an angled two pair-six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).
   
5. Furnish, install and terminate the following cables for each outlet as described below:
   
6.  
c. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

**Network Only**

7. Furnish and install faceplate and modular jacks at each single gang outlet as described below:
   
a. One Siemon single gang Max Modular Faceplate (part # MX-FP-S-02-02).
   
b. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).
   
8. Furnish, install and terminate the following cables for each outlet as described below:
   
c. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 and N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

**Pooled Classroom/Teaching Center/Podium**

1. Furnish and install faceplate and modular jacks at each double gang outlet as described below:
   
a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).
   
b. One Siemon modular jack to be designated as stations Voice (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).
   
c. Four Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).
   
d. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).
e. Two Siemon modular jacks to be designated as stations Security Loop (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-02).

2. Furnish, install and terminate the following cables for each outlet as described below:

a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

b. Four Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1, N2, N3, & N4 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

c. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F-type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

d. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cable to be designated as security loop to be wired at wall outlet on two (MX-U3-02). Terminate the White/Blue wire on the first module and the Blue/White wire on the second module, which will terminate on the White/Blue position on each module. Spare the White/Orange, White/Green, & White/Brown pairs around cable. Install cable to the nearest card access panel located within building and leave un-terminated at the panel location. These cables shall be designated as S1 along with the outlet number assigned. Place the white icon furnished with mod in the designated area on jack.

e. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.

Digital Signage

1. Furnish and install faceplate and modular jacks at each double gang outlet as described below:

a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).

b. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

c. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).
d. Two Siemon modular jacks to be designated as stations Security Loop (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-02).

e. Provide (part # MX-BL-02) blank to be in installed in the unused openings

2. Furnish, install and terminate the following cables for each outlet as described below:

a. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 & N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

b. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F- type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

c. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cable to be designated as security loop to be wired at wall outlet on two (MX-U3-02). Terminate the White/Blue wire on the first module and the Blue/White wire on the second module, which will terminate on the White/Blue position on each module. Spare the White/ Orange, White/Green, & White/Brown pairs around cable. Install cable to the nearest card access panel located within building and leave un-terminated at the panel location. These cables shall be designated as S1 along with the outlet number assigned. Place the white icon furnished with mod in the designated area on jack.

d. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.

2. Furnish and install Siemon # CC-2025-TB-DC and Siemon # SOB-CC frame standoff brackets with Siemon terminal blocks on designated wall in Telecommunications Room for termination of voice cables. Furnish and install 19” racks, patch panels and horizontal management for termination of network cables and fiber. Furnish and install (2) Homaco (part # 19-35-T18D) wall mount Swing-EZ rack for all CATV cables in Telecommunication Room.

a. Provide Siemon (part # S66M1-50) category 5E split type terminal block for all telephone terminations. Provide Siemon (part # HD6-48) category six patch panels for network terminations.

b. Provide Siemon (part # MX-PNL-48) bezel type patch panel for CATV terminations.

c. Provide and install a minimum of three 7x19” Siemon (part # RS3-07-S) equipment racks and adequate amount of Siemon (part # RS3-RWM-2) horizontal wire management for patching to Switches and Patch Panels on equipment racks. Provide and install a minimum one Geist (part # RCXRN102-102D20ST5-D) and one Geist (part # 2XPRCN062-103-L30TL6) 19” rack mount power strips with surge suppression for power to the electronic equipment.

d. Provide Homaco (part # 19-35-T18D) or comparable Swing-EZ wall mount rack for CATV terminations.
e. Provide 3/4"UL Classified grade A/C fire-retardant plywood on designated walls for installation of frames. Note: A side out C side to wall.

f. Note: All cables routed from Telecommunications Room out to wall outlets shall be routed within Telecommunication Room to equipment racks on ladder racking or cable runway, this shall be furnished and installed in a Black Finish. The equipment racks have a 12” ladder channel on top to accept runway.

Labeling and Standards

1. Cables at wall outlets and terminations at communication closet shall be identified and labeled as follows, depending on typical vs. non typical.

   **Typical**
   - V1 - first telephone (or voice) cable at a given outlet.
   - N1 - first network cable at a given outlet
   - N2 – second network cable at a given outlet

   **Non-Typical**
   - V1 - first telephone (or voice) cable at a given outlet.
   - N1 - first network cable at a given outlet
   - N2 – second network cable at a given outlet
   - CATV-1 first coax cable at a given outlet.
   - Fiber (50/125) -transmit fiber w/ markings on fiber sheath, receive fiber no markings on sheath
   - Fiber(single)-transmit fiber w/ markings on fiber sheath, receive fiber no markings on sheath

   **Pooled Classroom/Teaching Center/Podium**
   - V1 - first telephone (or voice) cable at a given outlet.
   - N1 - first network cable at a given outlet
   - N2 – second network cable at a given outlet
   - N3 - third network cable at a given outlet
   - N4 – fourth network cable at a given outlet
   - CATV-1 first coax cable at a given outlet
   - S1 – first Security Loop at a given outlet

   **Digital Signage**
   - N1 - first network cable at a given outlet
   - N2 – second network cable at a given outlet
   - CATV-1 first coax cable at a given outlet
   - S1 – first Security Loop at a given outlet

2. The first location shall start with the number (1) and continue, labels at wall outlet shall be TIA/EIA-606 Compliant

3. All of work described above shall be compliant to the current ANSI/TIA/EIA-568B.1, B.2, B.3-1 & 569B and follow NEC codes local or otherwise.

4. All voice and network terminations at communication closet shall be separated voice on Siemon frames mounted on wall and network on patch panels and 19” racks permanently mounted on floor of Telecommunication Room.

5. All station cables shall not exceed 90 meters from termination in closet to wall outlet.
6. Voice, Network, & Security Loop cable shall be Mohawk GigaLan (part # M57414-Blue) Plenum (No substitutions on cable manufacture or color). Coax cable shall be Commscope (part # 2227V) Plenum.

7. Fiber to desktop shall be a manufacture that uses Corning glass and must provide cut sheets to provide verification. All of the above mentioned equipment and scope of work shall be properly grounded and bonded per TIA/EIA-607. Any surface mounted raceway shall be Siemon Perimeters Raceway unless specified as voltage carrying.

8. Provide Siemon (part # MC6-10-02) and Siemon (part #MC6-07-02) Modular Interface patch Cords for use in Telecommunications Room and at work outlet for Network. (The sum of patch cables is determined by the total number of network drops. One to one relationship)

9. All installed cabling shall be bundled using a velcro strap solution throughout the cable run (No Tyraps) and shall be supported by a J-Hook, Cable Hook or Cable Hanger System solution (No Bridle Rings). Note: All cable shall be supported and contained using Category 6E Standard mounting devices.

10. In areas were a courtesy wall phone, pay-phone, elevator car and modem lines are to be installed, these areas are only required to have installed- 1-category 6E cable per unit, termination at outlet shall be determined by use and all of the above lines and shall be terminated on the voice side in the Telecommunication Room.

11. Cable trays must be installed in hallways and corridors and must be approved cable tray by Washington University Communications. Cables then routed into room via conduit stubbed out to cable tray or through J Hooks. These routes must be easily accessible for future use. Within Telecommunications Room use black finish Hoffman (part # LSS12BLK) ladder rack 12” wide and use black finish Hoffman retaining post kit (part # LRPB). Retaining post should be placed every 20’’ along ladder rack.

12. All entrance facility copper, fiber and coax shall be specified separately depending on the size of project.

13. Provide and install one American Power Conversion (APC) Rack-Mount UPS per Telecommunication Room:

   One American Power Conversion UPS (part # SURT6000XLT-1TF3), 6KVA - 208V L30: 120/208, Two American Power Conversion Battery Pack (part SURT192XLB) external battery pack.
   Four American Power Conversion two post rail kits (part # AP9625)
   This unit requires a 208 volt 30 amp circuit with an L6-30 plug.

14. Contractor shall provide the following CATV equipment list below:

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>QFRF ORR100048/SA</td>
<td>Fiber Receiver</td>
<td>1</td>
</tr>
<tr>
<td>OLT17600020</td>
<td>Rack Mount Kit</td>
<td>1</td>
</tr>
<tr>
<td>TCE48300310</td>
<td>Single Mode Jumper (SC/APC)</td>
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</tr>
<tr>
<td>BTL61103040</td>
<td>8 way coax splitter</td>
<td>1</td>
</tr>
<tr>
<td>OEM18100050</td>
<td>24 port splitter</td>
<td></td>
</tr>
<tr>
<td>TFC45400150</td>
<td>3 ft. RG6 patch cord</td>
<td></td>
</tr>
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</table>

   Buildings with two IDF’s or over 96 connections
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
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<tr>
<td>BTL41600285</td>
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<tr>
<td>OLT17600020</td>
<td>Rack Mount Kit</td>
<td>1</td>
</tr>
<tr>
<td>BTL61103040</td>
<td>8 way coax splitter</td>
<td>1</td>
</tr>
</tbody>
</table>
Communication Cabling Specification: Residential

Voice/Network/Coax/Typical

1. Furnish and install faceplate and modular jacks at each single gang outlet as described below:

   a. One Siemon single gang Max Modular Faceplate (part # MX-FP-S-04-02).

   b. One Siemon modular jacks to be designated as stations Voice (part # MX-U3-02). Each module is an angled two pair-six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

   c. One Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

   d. One Siemon F-Type bulkhead modular insert to be designated as stations CATV (part # MX-FA-02). This is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on module (part # CT-ICON-07).

   e. Provide (part # MX-BL-02) blank to be in installed in the unused opening.

   f. Note: All boxes are 4" square and a minimum of 2.5" depth (when using single gang faceplate, use a single-gang raised cover on all dual-gang outlet boxes).

2. Furnish, install and terminate the following cables for each outlet as described below:

   a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

   b. One Four-pair category 6E cables, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

   c. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F- type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in a wall mount Swing-EZ rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01).

Voice/Network/Coax/Fiber/Non-Typical

2. Furnish and install faceplate and modular jacks at each double gang outlet as described below:
a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).

b. One Siemon modular jack to be designated as stations Voice (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

c. One Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

d. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).

e. One Siemon Duplex fiber optic type SC module to be designated as stations Fiber (part # MX-SC-02). This module is an Angled Duplex SC adaptor (2 ports). Provide the icon and place in designated area on modules (part # CT-ICON-09).

f. One Siemon Duplex fiber optic type SC module to be designated as stations Fiber (part # MX-SC-02). This module is an Angled Duplex SC adaptor (2 ports). Provide the icon and place in designated area on modules (part # CT-ICON-09).

g. Provide (part # MX-BL-02) blank to be in installed in the unused opening

3. Furnish, install and terminate the following cables for each outlet as described below:

a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

b. One Four-pair category 6E cables, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

c. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F- type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

d. One 50/125 (OM3) micron two strand plenum rated multi-mode fiber cable to be designated as station fiber and installed onto (part # MX-SC-02), each strand to be terminated with SC connector and inserted into module at wall outlet. At the closet end terminate with SC connector and insert into a Siemon (part # RIC-F-SC6-01) and insert into a Siemon, Fiber Rack Interconnect Center (part # RIC3__-01, size determined by the amount of fiber cables) which will be mounted in 19” rack. All modules shall have (part # CT-ICON-09) icons.
e. One 9 micron two strand plenum rated single-mode fiber cable to be designated as station fiber and installed onto (part # MX-SC-02), each strand to be terminated with SC connector and inserted into module at wall outlet. At the closet end terminate with SC connector and insert into a Siemon (part # RIC-F-SC6-01) and insert into a Siemon, Fiber Rack Interconnect Center (part # RIC3__-01, size determined by the amount of fiber cables) which will be mounted in 19” rack. All modules shall have (part # CT-ICON-05) icons.

f. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.

Voice Only

2. Furnish and install faceplate and modular jacks at each single gang outlet as described below:

   a. One Siemon single gang Max Modular Faceplate (part # MX-FP-S-01-02).
   
   b. One Siemon modular jacks to be designated as stations Voice (part # MX-U3-02). Each module is an angled two pair-six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

3. Furnish, install and terminate the following cables for each outlet as described below:

   a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

Network Only

3. Furnish and install faceplate and modular jacks at each single gang outlet as described below:

   a. One Siemon single gang Max Modular Faceplate (part # MX-FP-S-02-02).
   
   b. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

4. Furnish, install and terminate the following cables for each outlet as described below:

   a. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 and N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.
Pooled Classroom/Teaching Center/Podium

3. Furnish and install faceplate and modular jacks at each double gang outlet as described below:

   a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).

   b. One Siemon modular jack to be designated as stations Voice (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-03).

   c. Four Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

   d. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).

   e. Two Siemon modular jacks to be designated as stations Security Loop (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-02).

4. Furnish, install and terminate the following cables for each outlet as described below:

   a. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cables to be designated as station voice to be wired at wall outlet on (MX-U3-02) modules using USOC six wire wiring scheme. Terminate the White/Blue & White/Orange pairs at outlet onto modules and spare the White/Green & White/Brown pairs around cable and terminate all pairs at closet end on Siemon category 5E S66M1-50 blocks. These cables shall be designated as V1 along with the outlet number assigned. Place the red voice icon furnished with mod in the designated area on jack.

   b. Four Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1, N2, N3, & N4 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

   c. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F-type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

   d. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cable to be designated as security loop to be wired at wall outlet on two (MX-U3-02). Terminate the White/Blue wire on the first module and the Blue/White wire on the second module, which will terminate on the White/Blue position on each module. Spare the White/ Orange, White/Green, & White/Brown pairs around cable. Install cable to the nearest card access panel located within building and leave un-terminated at the panel location. These cables shall be designated as S1 along with the outlet number assigned. Place the white icon furnished with mod in the designated area on jack.
e. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.

Digital Signage

3. Furnish and install faceplate and modular jacks at each double gang outlet as described below:

a. One Siemon double-gang Max Modular Faceplate (part # MX-FP-D-08-02).

b. Two Siemon Angled Max 6 Modules to be designated as stations Network (part # MX6-02). Each jack is an eight position eight conductor RJ-45 type. Provide the icon and place in designated area on modules (part # CT-ICON-06).

c. One Siemon F-Type bulkhead modular inserts to be designated as stations CATV (part # MX-FA-02). Each module is an Angled module with 1 F-type adapter. Provide the icon and place in designated area on modules (part # CT-ICON-07).

d. Two Siemon modular jacks to be designated as stations Security Loop (part # MX-U3-02). Each module is an angled two-pair six position jack. Provide the icon and place in designated area on modules (part # CT-ICON-02).

e. Provide (part # MX-BL-02) blank to be in installed in the unused openings.

4. Furnish, install and terminate the following cables for each outlet as described below:

a. Two Four-pair category 6E, 24 gauge MPP/CMP plenum rated UTP cables to be designated as station network to be wired at wall outlet on (MX6-02) modules using T568A wiring scheme termination at wall outlet per manufactures specification and at the closet end on patch panels (part # HD6-48) using the T568A wiring scheme. These cables shall be designated as N1 & N2 along with the outlet number assigned. Place the blue PC icon furnished with mod in designated area on jack.

b. One RG-6 CATV quad-shield plenum rated coaxial cables to be designated as station CATV and installed onto (part # MX-FA-02) having F-type terminations at wall outlet and inserted into faceplate. At closet end provide and install (part # MX-F-FA-01) F-type Flat module inserted into a (part # MX-PNL-48) which will be mounted in Swing-EZ wall mount rack. All modules inserted into panel shall have (part # CT-ICON-07) icons and any unused spaces in panel shall have (part # MX-BL-01) blanks installed. Use Belden part # SNS-1P6U CATV connectors.

c. One Four-pair category 6E 24 gauge MPP/CMP plenum rated UTP cable to be designated as security loop to be wired at wall outlet on two (MX-U3-02). Terminate the White/Blue wire on the first module and the Blue/White wire on the second module, which will terminate on the White/Blue position on each module. Spare the White/Orange, White/Green, & White/Brown pairs around cable. Install cable to the nearest card access panel located within building and leave un-terminated at the panel location. These cables shall be designated as S1 along with the outlet number assigned. Place the white icon furnished with mod in the designated area on jack.

d. Note: Part # MX-PNL-48 is a bezel type panel; adequate amount of panels shall be provided and installed depending on the amount of Coax station required in specifications.

5. Furnish and install Siemon # CC-2025-TB-DC and Siemon # SOB-CC frame standoff brackets with Siemon terminal blocks on designated wall in Telecommunications Room for termination of voice cables.
Furnish and install 19” racks, patch panels and horizontal management for termination of network cables and fiber. Furnish and install (2) Homaco (part # 19-35-T18D) wall mount Swing-EZ rack for all CATV cables in Telecommunication Room.

a. Provide Siemon (part # S66M1-50) category 5E split type terminal block for all telephone terminations. Provide Siemon (part # HD6-48) category six patch panels for network terminations.

b. Provide Siemon (part # MX-PNL-48) bezel type patch panel for CATV terminations.

c. Provide and install a minimum of three 7”x19” Siemon (part # RS3-07-S) equipment racks and adequate amount of Siemon (part # RS3-RWM-2) horizontal wire management for patching to Switches and Patch Panels on equipment racks. Provide and install a minimum one Geist (part # RCXRN102-102D20ST5-D) and one Geist (part # 2XPRCN062-103-L30TL6) 19” rack mount power strips with surge suppression for power to the electronic equipment.

d. Provide Homaco (part # 19-35-T18D) or comparable Swing-EZ wall mount rack for CATV terminations.

e. Provide 3/4”UL Classified grade A/C fire-retardant plywood on designated walls for installation of frames. Note: A side out C side to wall.

f. Note: All cables routed from Telecommunications Room out to wall outlets shall be routed within Telecommunication Room to equipment racks on ladder racking or cable runway, this shall be furnished and installed in a Black Finish. The equipment racks have a 12” ladder channel on top to accept runway.

Labeling and Standards

15. Cables at wall outlets and terminations at communication closet shall be identified and labeled as follows, depending on typical vs. non typical.

Typical
V1 - first telephone (or voice) cable at a given outlet.
N1 - first network cable at a given outlet
CATV-1 coax cable at a given outlet

Non-Typical
V1 - first telephone (or voice) cable at a given outlet.
N1 - first network cable at a given outlet
CATV-1 first coax cable at a given outlet.
Fiber (50/125) - transmit fiber w/ markings on fiber sheath, receive fiber no markings on sheath
Fiber(singled) - transmit fiber w/ markings on fiber sheath, receive fiber no markings on sheath

Pooled Classroom/Teaching Center/Podium
V1 - first telephone (or voice) cable at a given outlet.
N1 - first network cable at a given outlet
N2 – second network cable at a given outlet
N3 - third network cable at a given outlet
N4 – fourth network cable at a given outlet
CATV-1 first coax cable at a given outlet
S1 – first Security Loop at a given outlet
Digital Signage
N1 - first network cable at a given outlet
N2 – second network cable at a given outlet
CATV-1 first coax cable at a given outlet
S1 – first Security Loop at a given outlet

16. The first location shall start with the number (1) and continue, labels at wall outlet shall be TIA/EIA-606 Compliant

17. All of work described above shall be compliant to the current ANSI/TIA/EIA-568B.1, B.2, B.3-1 & 569B and follow NEC codes local or otherwise.

18. All voice and network terminations at communication closet shall be separated voice on Siemon frames mounted on wall and network on patch panels and 19” racks permanently mounted on floor of Telecommunication Room.

19. All station cables shall not exceed 90 meters from termination in closet to wall outlet.

20. Voice, Network, & Security Loop cable shall be Mohawk GigaLan (part # M57414-Blue) Plenum (No substitutions on cable manufacture or color). Coax cable shall be Commscope (part # 2227V) Plenum.

21. Fiber to desktop shall be a manufacture that uses Corning glass and must provide cut sheets to provide verification. All of the above mentioned equipment and scope of work shall be properly grounded and bonded per TIA/EIA-607. Any surface mounted raceway shall be Siemon Perimeters Raceway unless specified as voltage carrying.

22. Provide Siemon (part # MC6-10-02) and Siemon (part #MC6-07-02) Modular Interface patch Cords for use in Telecommunications Room and at work outlet for Network. (The sum of patch cables is determined by the total number of network drops. One to one relationship)

23. All installed cabling shall be bundled using a velcro strap solution throughout the cable run (No Tyraps) and shall be supported by a J-Hook, Cable Hook or Cable Hanger System solution (No Bridle Rings). Note: All cable shall be supported and contained using Category 6E Standard mounting devices.

24. In areas were a courtesy wall phone, pay-phone, elevator car and modem lines are to be installed, these areas are only required to have installed- 1-category 6E cable per unit, termination at outlet shall be determined by use and all of the above lines and shall be terminated on the voice side in the Telecommunication Room.

25. Cable trays must be installed in hallways and corridors and must be approved cable tray by Washington University Communications. Cables then routed into room via conduit stubbed out to cable tray or through J Hooks. These routes must be easily accessible for future use. Within Telecommunications Room use black finish Hoffman (part # LSS12BLK) ladder rack 12” wide and use black finish Hoffman retaining post kit (part # LRPB). Retaining post should be placed every 20” along ladder rack.

26. All entrance facility copper, fiber and coax shall be specified separately depending on the size of project.

27. Provide and install one American Power Conversion (APC) Rack-Mount UPS per Telecommunication Room:

One American Power Conversion UPS (part # SURT6000XLT-1TF3), 6KVA - 208V L30: 120/208,
Two American Power Conversion Battery Pack (part SURT192XLBP) external battery pack.
Four American Power Conversion two post rail kits (part # AP9625)
This unit requires a 208 volt 30 amp circuit with an L6-30 plug.

28. Contractor shall provide the following CATV equipment list below:

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<thead>
<tr>
<th>Items</th>
<th>Description</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>OLT48202010</td>
<td>Optical Receiver</td>
<td>1</td>
</tr>
<tr>
<td>OLT17600020</td>
<td>Rack Mount Kit</td>
<td>1</td>
</tr>
<tr>
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<td>Single Mode Jumper (SC/APC)</td>
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<td>1</td>
</tr>
<tr>
<td>OEM18100050</td>
<td>24 port splitter</td>
<td>Quantity determined by number of drops</td>
</tr>
<tr>
<td>TFC45400150</td>
<td>3 ft. RG6 patch cord</td>
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Buildings with two IDF’s or over 96 connections

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<td>BTL41600285</td>
<td>Rack Amp</td>
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<tr>
<td>OLT17600020</td>
<td>Rack Mount Kit</td>
<td>1</td>
</tr>
<tr>
<td>BTL61103040</td>
<td>8 way coax splitter</td>
<td>1</td>
</tr>
</tbody>
</table>
Telecommunication Room Layout
Emergency Phone Specification

- Location of Blue Lights Phones will be determined by Washington University Campus Police.

- Blue Light Phones located outside the building; install a three pair buried outdoor cable (PE 89) from telephone to nearest Telecommunications Room. If the distance from the point of entry to the nearest Telecommunications Room is more than 50ft., transition to indoor rated cable.

- Blue Light Phones located on or within a building, install a cat 6E voice cable from phone to nearest Telecommunications Room and terminated on 66 blocks.

- Install lightning protection within building and surge suppression at phone.

- Telephone cable and electric must be run in two separate one inch conduits.

- Ramtel PLC-8 Stanchion (mid night blue) is to be used at all locations that are not attached to a building. This is replacing the 4” galvanized pole.

- Part numbers for Ramtel Phones:
  RR733 (One button emergency phone with enclosure but no door).
  800-1018 (Surge suppression at blue light)
  Two palm button
  
  RR734 (One bottom emergency phone with keypad and enclosure, no door)(Building Entrance Phones)
  800-1018 (Surge suppression at blue light)
  Two palm button

- Contact for purchase of phones: Ramtel Corporation, 115 Railroad Av., Johnston, RI. 02919
  (Tel. # 401-231-3340)

- All phones must have the Washington University silk screening, two inch palm button, and surge suppression.

- No substitutions of manufactures or part numbers.
Ramtel Single Button Phone – RR733

Building Entrance Phones
Ramtel Single Button with Key Pad Phone – RR734

Ramtel Stanchion – PLC-8
Washington University List of Qualified Communications Contractors

Sachs Systems
Contact: Kris Huels
Telephone #: 636-532-2000
Fax #: 636-532-0065
Email Address: khuels@sachsco.com

Geco systems
Contact: Gary Julius, RCDD
Telephone #: 314-773-1111
Fax #: 314-771-2688
Email Address: gary.julius@Geco.com

TSI (Telcom Services Installation, Inc.)
Contact: Joe Straatmann
Telephone #: 636-949-8889
Fax #: 636-925-2111
Email Address: jstraatmann@tsi-inc.com

Bell Communications
Contact: Mark Kettler
Telephone #: 314-447-9068
Fax #: 314-739-0717
Email Address: mktetter@bellectrical.com

Communications Projects Under $25,000 add the following Contractors:

Telewiring, Inc.
Contact: Eric Longland
Telephone #: 636-532-9218
Fax #: 636-532-0486
Email Address: ericl@telewiring.com

TD4 Electrical (MBE)
Contact: Tom Endermuhle
Telephone #: 314-655-9846
Fax #: 314-772-5813
Email Address: tendermuhle@td4llc.com

Master Communications, Inc. (WBE)
Dan Enright, RCDD
Telephone #: 314-215-4110
Fax #: 636-779-1199
Email Address: danenright@mastercomminc.com
Revision History (for internal use and viewing only)