A/E Design Guide for Drawings and Spec Section 27 17 51 Communications Infrastructure.

Instructions to A/E: Communications Infrastructure specification 27 17 51 shall be included and coordinated with the master specifications unless directed otherwise by the University Project Manager.

All submittals and approvals that need to be provided to/by UW-IT shall be done through the CPD Owner's Representative.

GENERAL

1.1 QUALITY CONTROL

A. Engineer Qualifications

1. The engineering firm responsible for the communications design is to have a Registered Communications Distribution Designer (RCDD) who shall be available for regular review of infrastructure installed with this Section.

    a. At a minimum, the RCDD shall attend the pre-installation meeting and on-site pre-installation walk-throughs and, at Owner's sole discretion, be available for two (2) further on-site reviews with Owner's UW Information Technology (UW-IT) staff prior to covering communications infrastructure from sight.

2. The Designer shall have successfully completed five (5) designs equal in magnitude (in terms of size and construction cost) specified in the following sections with same equipment under the design firms current business name within the previous three (3) years.

3. The Designer shall have demonstrated experience in the system design of all components specified herein;

4. Only full-time permanent employees/staff of the design firm are approved to provide designs and documentation as set forth herein;

5. The Design Firm shall provide the needed software and the Designer shall be proficient in layered Auto Cad Design for incorporation into Auto Cad.

B. Optional Owner provided communication design

On a project by project bases, at the discretion of the Capital Projects Project Manager in agreement with UW-IT, the UW-IT Communication Infrastructure group may be hired as part of the design team to provide varying aspects of communication infrastructure design.

1.2 INFRASTRUCTURE DESIGN CRITERIA

A. Major Components

The infrastructure design for University projects consists of four major components

- Outside Plant Infrastructure
- MDF/IDF Rooms and Riser System
- Horizontal Distribution System -- Cable Tray and Conduit
- Station Distribution System -- Horizontal Pathway and Outlets

B. The design standards for the infrastructure system are described below. Detailed installation specifications are contained in the UW-IT Design Guide (http://www.washington.edu/admin/facilities/) Section 27 17 51 Communications Infrastructure.

The Architect/Engineer shall provide all necessary design resources to furnish a complete communications infrastructure design according to the standards and practices set forth herein.

C. Pre-design planning

1. The communications infrastructure design can be reasonably determined before the number of actual offices and communications outlets is known. This can be accomplished by using the assignable square footage (ASF) of the building as a benchmark.
2. The ASF is the sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or use. Space defined as building service, circulation, mechanical, or structural is excluded.
3. Formula for Pre-design Budgetary Purposes: Estimate the maximum number of outlets that must be supported if all assignable space was designed to contain nothing but high-density office space. Use 100 ASF as a standard office size for this calculation. The number of communications outlets to be equal to the total building ASF divided by 100. During the actual design process the criteria for determining number of actual outlets will be based on programing criteria.
4. These actual calculations are applicable at the initial programing phase and for budget purposes only. Contact UW-IT for specific design requirements based on actual size and functionality of rooms.

1.3 OUTSIDE PLANT INFRASTRUCTURE SYSTEMS

A. General

1. Backbone pathways consist of intra- and interbuilding pathways. Backbone pathways may be either vertical or horizontal. Interbuilding backbone pathways (outside plant) extend between buildings. Intrabuilding backbone pathways are contained within a building.

2. Outside Plant pathways interconnect separate buildings in campus environments as well as, in some cases, to the property line for connection of service provider. These consist of underground, buried, aerial, and utilidor pathways. When determining the size of the pathway, the quantity and size of cables, with an allowance for growth, shall be considered.

3. During the initial planning stage, all buildings identified on the site plan shall have a fundamental communications design plan developed, regardless of whether service is requested. The communications design plan shall include a pathway design that interconnects buildings. Contact UW-IT for directions in preparing a plan.

B. Outside Plant Pathways

1. Entrance and interbuilding pathways shall be provided. As a minimum, a facility shall be provided for the University communication services. The basic methods for provisioning are underground, buried, aerial (see C. 3 for qualifications), and utilidor pathways.
2. The Standard building entrance conditions consist of 3 each 4" conduit. The communications designer should verify that this is adequate based on the considerations in 3 below.
3. In determining the total number of pathways required, the planner shall consider;
   - Type and use of building
   - Growth potential
   - Difficulty of adding pathways in the future
   - Alternate entrance, and
   - Type and size of cables likely to be installed

C. General Considerations for Pathway Types

1. Underground

   Underground components are part of the interbuilding pathway system consisting of conduit, duct, trough and my include maintenance and/or handhole(s).

2. Direct burial

   a. Direct burial components are part of the interbuilding pathway system consisting of communications service cables which are completely encased in earth. Direct Burial will require trenching and plowing.
   b. The route selected shall be coordinated with the landscaping, fencing, trees, paved areas, and other services, and should follow a natural parallel line of sight such as property lines, sidewalks, and driveways. Because of possible fences and shrubbery, a distance of approximately six feet shall be maintained from the property lines.
   c. The design and installation of communications infrastructure in a trench used jointly by other trades shall meet applicable codes.
   d. When trenching for the installation of direct-buried cable, it is desirable to consider placing a conduit or duct in the trench for future use.

3. Aerial

   An aerial facility is a component of the interbuilding pathway consisting of poles, cable-support strand, and support system. Aerial is usually a temporary solution and is not utilized on the Seattle Main Campus site. When contemplating the use of aerial facilities obtain UW-IT approval and consider the following:

   - Aesthetics of the building and surrounding location
   - Storm loading
   - Applicable codes and municipal ordinances
   - Clearances and separation for electrical and road

- Mechanical protection
- Span lengths
- Building attachments
- Future cable plant reinforcement
- Number of cables involved

4. Utilidor

Utilidor pathway design will incorporate the following

- Corrosion-resistant pathway and associated hardware shall be used..
- Metal pathways and supports shall be bonded to ground.
- Provide a minimum 5-inch clearance between power and communication tray side-rails and utilidor wall for vertical communication cable pathway.
- Provide two stacked cable trays along utilidor wall below power distribution tray.
- Communication cable tray shall be 12 inches below power tray and second communication tray shall be a minimum of 10 inches from bottom of tray to top of tray below.

D. Outside Plant Pathway Design Considerations

1. Conduit/Duct

a. A minimum of two 4-inch pathways, with at least one spare 4-inch pathway, should be provided at each entrance point.

b. The conduit shall extend into undisturbed earth and a minimum of 600 mm (24 inches) beyond the exterior of the foundation. Separation from other service structures and depth of cover shall be provided per applicable codes. When terminated in a pull box, conduit shall be reamed and bushed. When terminated at the inside of the building wall, the conduit shall have a smooth, bell-shaped finish unless it extends further into the building, space, or area. The conduit or sleeve shall be securely fastened to the building.

c. Conduit types that should be considered to comply with the project requirements are:

- PVC Type B - a thin-wall plastic requiring concrete encasement.
- PVC Type C - a heavier walled plastic that can be direct buried.
- PVC Type D - ultraviolet (sunlight) and flame resistant.
- Multiple Plastic Duct (MPD) comes in molded formations of 4, 6, and 9 ducts and section lengths of approximately 1 meter (36 inches). MPD can be direct buried but needs special attention depending on soil conditions.
- Steel a rigid metal conduit made of galvanized steel.
- Fiberglass- a light, rigid, laminated duct.

d. Bends in underground conduit and duct are undesirable. However, when required, bends in conduit and duct runs shall be limited to the equivalent of no more than two 90-degree bends between pull points.

e. The inside radius of a bend in conduit shall be at least six times the internal diameter.

f. Underground conduit should be installed such that a slope exists at all points of the run to allow drainage and prevent the accumulation of water. A drain slope of no less than 100 mm per 30 meters (4 inches per 100 feet) is desirable.

g. Conduits shall be reamed to eliminate sharp edges and terminated with an insulated bushing

h. Pull strings or rope shall be placed in all installed conduits.

2. Maintenance holes: A maintenance hole is used to pull in cables in an underground, concealed manner. Maintenance holes shall be equipped with a sump, corrosion-resistant pulling iron, cable racks, and ladders that are grounded per applicable electrical code. Concrete used for maintenance holes shall be of at least 3,500 lb/in^2 strength. Communications maintenance holes shall not be used as a pathway for power and light conductors

1.4 SPACE DESIGN CONSIDERATIONS

A. Main Distribution Frame (MDF) Room & Intermediate Distribution Frame (IDF) Rooms General Requirements.

1. Door Sweeps. At all communication closets (MDF & IDF) doors shall have sweeps that form a barrier against particulates and dust migrating under the door into the room.

B. Main Distribution Frame (MDF) Room

1. General:

a. The MDF functions as the interconnection point between the building's internal systems and the communications services entering from the inter-building communications system. The MDF Room provides space for wall-mounted and freestanding equipment supporting the centrally-administered communications systems, as well as the point-of-presence for franchised utilities (i.e., the local telephone and cable TV companies).

b. The MDF Room shall be designed for exclusive communications services use and shall not be shared with equipment not serving the room (including electrical power, fire alarm distribution, or security system equipment, storage or custodial services). Major plumbing, electrical, and ventilation distribution systems must be routed outside the MDF Room.

2. MDF Room Location

a. Locate the MDF Room in an area (generally in the basement) with good access to both the campus inter-building utility system and the base of the vertical riser system(s). Orient room to avoid immediate adjacency to elevator shafts or below rooms which have future potential for water leakage.

b. Provide access directly off a public hallway. Service personnel should never need to enter offices, storerooms, restrooms, or other spaces to gain access to the MDF Room.

c. Remodels: If located within a larger Mechanical or Electrical Room, the MDF Room shall be partitioned, secured and ventilated with unrestricted and level access to a public hallway

3. MDF Room Size

a. The MDF Room shall be a minimum of 12-feet long by 10-feet wide. For buildings exceeding 50,000 ASF, room size shall increase a minimum of 30 square feet per each additional 50,000 ASF. As room size increases, a 3:2 length-to-width ratio shall be maintained.

b. In some MDF Rooms, additional space may be required to support franchised utilities' distribution equipment. UW-IT will inform the Project Manager and the A&E wherever this is the case.

c. When the program requirements allow, if program space is assigned on the same level as the MDF and when approved by UW-IT, the MDF may also serve and an Intermediate Distribution frame (IDF) Room. Sizing and provisioning shall be allowed to accommodate the provisioning for both room types.

4. Outside Plant System Connections to MDF

a. Include a pathway between the MDF Room and a location where access to UW-IT's outside plant system is available. Generally, this pathway will connect the MDF Room to the communications cable tray in UW-IT's outside plant system. The exact location shall be coordinated with UW-IT.

b. This pathway shall consist of a minimum of three 4-inch conduits or one 12-inch by 4-inch cable tray. Route the cable tray or conduit to provide support for feeder cables that connect to UW-IT's outside plant system and for riser cables that serve the IDF Rooms.

c. Cable tray (and any UW-IT approved pullboxes located in a conduit run) shall be mounted at a height and routed in a manner that is easily accessible to cable installation and service personnel using standard 8-foot ladders.

5. Riser System Connection

a. When the MDF Room is not aligned vertically with the IDF Rooms on the upper floors, or when there are two or more vertical stacks of IDF Rooms, use cable tray and/or 4-inch conduit to connect the MDF Room and the vertical riser(s). The number of connecting conduits shall equal the number of sleeves at the base of the riser system(s). Assign sleeves for each IDF room. Identify assignment on drawings.

b. When cable tray is used to connect the MDF Room to the base of the riser system(s), size the tray to provide a cross-sectional area equivalent to the required number of conduit sleeves through the walls.

6. MDF General Provisioning

a. Floor Loading; The floor must have commercial floor loading capacity of at least 100 lbf/ft^2 of distributed load and 2000 lbf/ft^2 for concentrated load.

b. Locate the door of the MDF Room on one of the shorter walls of the room. The door should be offset toward either side of this wall and as far from the MDF as possible. The door swing shall not in any way restrict access to riser sleeves, entrance conduits, cable tray, or the main backboard. An outward door swing is preferred. Coordinate with project architect. The door shall be 36-inches wide and 6-feet 8-inches high. It shall be keyed to the campus-wide communications master, not to the building master.

c. The fire rating of the walls and doors shall be maintained by using firestopping materials that comply with code.

d. MDF room shall be open to structure above.

e. Provide ladder cable tray (with capacity equivalent to incoming pathways and sized per NEC Article 318) around the periphery of the MDF Room to support and equitably

distribute cable within the room. The size and configuration may require cross-room segments. Tray shall be located six inches from the backboard wall.

f. Conduits, Sleeves and trays entering the MDF shall :

- Reamed and bushed.
- where entering from the structure above through into the MDF shall stop within 1 ½ - 3 feet above the plywood backboard and/or cable tray.
- where entering from the structure above through into the IDF shall stop within 1 ½ - 3 feet above the plywood backboard and/or cable tray.
- where penetrating through the floor shall stop 3-inches AFF.

g. Install ACX Douglas fir plywood backboards on all walls, extending from 1-foot AFF to 9-feet AFF and using standard 3/4-inch by 4-foot by 8-foot sheets. Care must be exercised in selecting sheets without voids. Because cable must be secured every four feet vertically as well as horizontally, provide additional plywood along the path where cable routes up to cable tray, conduit, or sleeves. Backboards shall have two coats of fire-resistant matte white paint. Leave one fire rating tag exposed at each sheet of plywood.

7. MDF Electrical Provisioning

a. Install a convenience outlet. Outlet may be non-dedicated but under no circumstances share a common circuit with communication equipment.

b. Power provisioning for communications equipment shall be as shown on Rack Layout Drawings provided in the UW-IT Design Guide;

http://www.washington.edu/admin/facilities/

c. Lighting Fixtures; Provide fluorescent lighting at a minimum level of 50-foot candles. Hang fixtures above the 9-foot 6-inch level or ceiling-mount without blocking conduit penetration and cable tray or interfering with cable routing and equipment installation. Locate a standard wall switch within the MDF Room on the strike-side of the door within easy reach. If there is more than one entry to the room, 3-way switches are required.

d. Equipment Grounding System; Provide a communications equipment grounding system and bond it to the building electrode grounding system. Route the equipment grounding system through the MDF Room and each IDF Room with a termination on the ground bus bar in each room. Position the ground bus bar horizontally, low on the backboard near the voice riser terminations without obstructing the path of future floor-to-floor and horizontal cables. Route ground wire off the edges of the backboard preserving unobstructed mounting surfaces for UW-IT use.

8. Environmental Requirements

a. The MDF Room must be secure and environmentally clean. Seal the floor to eliminate dust and static electricity charges.

b. At the MDF Room, for design purpose, assume a continuous 8000 BTU heat load and maintain the MDF Room temperature in the range 64-75 degrees F. The humidity level shall not exceed 30-55% RH. Measure these values at 5-feet AFF. Ensure a temperature change of no more than plus or minus 5-degrees or a humidity change of no more than plus or minus 10% over a 24-hour period of time. If it is determined that these parameters cannot be maintained without a mechanical solution, provide a year-

round, 24/7 HVAC system independent from the building's central needs that has dedicated controls within the MDF Room.

B. Intermediate Distribution Frame (IDF) Rooms

1. General:
   a. The IDF Room provides space and access to horizontal and riser pathways to support voice, data, and multimedia services).
   b. The model for the vertical distribution system consists of a minimum of one IDF Room on each floor, vertically aligned and interconnected to other IDF's with conduit sleeves to form a vertical riser system for the cable plant.
   c. IDF Rooms are for the exclusive use of UW-IT-administered communications services and shall not be shared with departmental groups, other support groups or utilities (such as custodial services, electrical power, or fire alarm). Major plumbing, electrical, and ventilation distribution systems must be routed outside these Rooms.

2. IDF Room Location
   a. Locate the IDF Room near permanent architectural features (e.g., staircases and shafts for utilities, ventilation, and elevators) in the core area.
   b. Provide access directly off a public hallway. Service personnel should never need to enter offices, storerooms, restrooms, or other spaces to gain access to the IDF Room.
   c. To establish acceptable placement and number of IDF Rooms, limit the straight-line distance from the IDF Room to the farthest point in the program area to about 150 feet. Each IDF Room shall be located centrally within the 10,000 ASF footprint it shall serve. Maximum station cable length from the IDF Room to outlet locations shall not exceed 295 feet (90 meters) terminal-to-terminal.

3. Number of IDF Rooms per Floor
   a. Provide a minimum of one IDF Room per floor.
   b. Provide additional IDF Rooms when maximum station cable length exceeds 295 feet (90 meters) terminal-to-terminal.

4. IDF Room Size
   a. The IDF Room shall be:
      - 10' by 7' for areas not exceeding 5,000 ASF.
      - 10' by 9' for areas not exceeding 7,500 ASF.
      - 10' x 11' for areas not exceeding 10,000 ASF
      - Where ASF exceeds 10,000 ASF, enlarge the IDF proportionately
   b. With UW-IT approval, for areas less than 5,000 ASF, an alternate IDF room may be considered. This "Shallow" IDF may be 8' wide and a minimum of 4' deep. Contact UW-IT for provisioning requirements.

5. IDF Riser Pathway

a. The pathway through a vertical riser system typically consists of a number of sleeves or conduits. The quantity installed will be fewest at the top of the riser system and will progressively increase in number as the riser moves down to the base. Since the maximum floor area served by each IDF Room is fixed, the following guideline provides the number of sleeves required between floors:

- The IDF Room(s) located on the highest floor of a building shall have a minimum of three 4-inch sleeves to the IDF Room directly below, and the number of sleeves shall increase by one sleeve every other floor. For example, a six-story building would have three sleeves on floors 6 and 5, four sleeves on floors 4 and 3, five sleeves on floors 2 and 1.
- Install from the top riser room to the roof a minimum of one 4-inch conduit and co-located power receptacle. Provide one watertight enclosure for each riser stack for conduit termination of these utilities. Evaluate the project specific conditions and review with UW-IT if deviating from this standard is being considered.

b. Connect IDF Rooms that cannot be vertically aligned (non-stacked) with a minimum of two 4-inch conduits in addition to the number dictated by the sleeve pattern described above. These additional conduits are required to provide the same effective cable capacity of the short conduit sleeves.

c. Sleeves entering the IDF shall have their usage identified on the project drawings. (i.e. "voice riser", fiber riser" etc.)

d. For a "satellite" IDF Room that does not have its own riser system, adjust the quantity of conduits in the sleeve pattern described above to reflect the increased cable quantity merging into the serving IDF Room for the vertical riser and station cable traveling through its sleeve system.

e. Cluster penetrations to minimize obstructions of backboard space resulting from the routing of cables from the penetrations.

6. IDF General Provisioning

a. Floor Loading; The floor must have commercial floor loading capacity of at least 50 lbf/ft^2.

b. Locate the the door on one of the shorter walls of the room. The door should offset toward either side and as far from the main backboard as possible. The door swing shall not in any way restrict access to riser sleeves, entrance conduits, cable tray, or the main backboard. An outward swing is preferred.. Coordinate with project architect. The door shall be 36-inches wide and 6-feet 8-inches high. It shall be keyed to the campus-wide communications master, not to the building master.

c. Where a "Shallow" IDF Room(s) has been approved by UW-IT provide double doorways that open outward. Fixed center posts and doorsills are not acceptable. Key the active leaf that is on the right; fix the left-most door at top and bottom with deadbolts.

d. The fire rating of the walls and doors shall be maintained by using firestopping materials that comply with code.

e. IDF rooms shall be open to structure above.

f. Provide ladder cable tray (with capacity equivalent to incoming pathways and sized per NEC Article 318) around the periphery of the IDF Room to support and equitably distribute cable within the room. The size and configuration may require cross-room segments. Tray shall be located six inches from the backboard wall.

g. Conduits, Sleeves and trays entering the IDF shall:

- be reamed and bushed.
- be vertically aligned with those penetrations in the IDF Rooms above and below.

- where entering from the structure above through into the IDF stop within 1 ½ - 3 feet above the plywood backboard and/or cable tray.
- where entering through walls stop no more than three inches into the room and be located within 1 ½ - 3 feet above the plywood backboard and/or cable tray.
- where penetrating through the floor stop 3-inches AFF.

h. Install ACX Douglas fir plywood backboards on all walls, extending from 1-foot AFF to 9-feet AFF and using standard 3/4-inch by 4-foot by 8-foot sheets. Care must be exercised in selecting sheets without voids. Because cable must be secured every four feet vertically as well as horizontally, provide additional plywood along the path where cable routes up to cable tray, conduit, or sleeves. Backboards shall have two coats of fire-resistant matte white paint. Leave one fire rating tag exposed at each sheet of plywood.

7. IDF Electrical Provisioning

a. Install a convenience outlet. Outlet may be non-dedicated but under no circumstances share a common circuit with communication equipment.

b. Power provisioning for communications equipment shall be as shown on Rack Layout Drawings provided in the UW-IT Design Guide;

https://itconnect.uw.edu/work/uw-it-design-guide/

c. Lighting Fixtures; Provide fluorescent lighting at a minimum level of 50-foot candles. Hang fixtures above the 9-foot 6-inch level or ceiling-mount without blocking conduit penetration and cable tray or interfering with cable routing and equipment installation. Locate a standard wall switch within the IDF Room on the strike-side of the door within easy reach. If there is more than one entry to the room, 3-way switches are required.

d. Equipment Grounding System; Route the equipment grounding system from the IDF Room through each IDF Room with a termination on the ground bus bar in each Room. Position the ground bus bar horizontally, low on the backboard wwithout obstructing the path of future floor-to-floor and horizontal cables. Verify location of bus bar with UW-IT early in the project design after location of equipment is determined. Route ground wire off edges of the backboard preserving unobstructed mounting surfaces.

8. Environmental Requirements

a. The IDF Room must be secure and environmentally clean. Seal the floor to eliminate dust and static electricity charges.

b. At IDF Rooms, for design purpose, assume a continuous 3,500 BTU heat load and a room temperature similar to adjacent hallway and office spaces, in a range not to exceed 64-75 degrees F. The humidity level shall not exceed 30-55% RH. Measure these values at 5-feet AFF. Ensure a temperature change of no more than plus or minus 5-degrees or a humidity change of no more than plus or minus 10% within a 24-hour period. . If it is determined that these parameters cannot be maintained without a mechanical solution provide a year-round, 24/7 HVAC system independent from the building's central needs that has dedicated controls within the MDF Room.

Grounding: See Grounding Drawings provided in the UW-IT Design Guide; https://itconnect.uw.edu/work/uw-it-design-guide/

1.5 HORIZONTAL DISTRIBUTION SYSTEM – SEE SPECIFICATION SECTION 27 17 51 PROVIDED IN THE UW-IT DESIGN GUIDE. HTTPS://ITCONNECT.UW.EDU/WORK/UW-IT-DESIGN-GUIDE/

1.6 STATION DISTRIBUTION SYSTEM – SEE SPECIFICATION SECTION 27 17 51 PROVIDED IN THE UW-IT DESIGN GUIDE. HTTPS://ITCONNECT.UW.EDU/WORK/UW-IT-DESIGN-GUIDE/