VOICE AND DATA COMMUNICATIONS

Related Sections

U-M Design Guideline Sections:
SBA 5.4- Telecommunication Rooms
260500 – Common Work Results for Electrical
260526 – Grounding and Bonding for Electrical
260533 –Electrical Materials and Methods
260543 - Underground services for Electrical Systems

U-M Master Specification Sections:
260533 –Electrical Materials and Methods
260543 - Underground services for Electrical Systems
272000 - Voice and Data Communications

U-M Standard Details:
260000 Series - Electrical Standard Details

Reference Documents:
ANSI/TIA/EIA-568-B, "Commercial Building Telecommunications Cabling Standard"
ANSI/TIA/EIA-569-A, "Commercial Building Standard for Telecommunication Pathways and Spaces"
ANSI/TIA/EIA-607, "Grounding and Bonding Requirements for Telecommunications in Commercial Buildings"

Design Requirements

Provide Building Entrance (BE) rooms, Telecommunication Rooms (TRs), telecommunication cable pathways, Work Area Outlets and incidentals as described below and in accordance with the Program Documents. Coordinate the telecommunications system design with the Design Manager. Copy the related Master Specification Sections and appropriate Standard Details into the design documents, and edit them to make them project specific.

Telecommunications systems in most U-M Ann Arbor Campus buildings are operated and maintained by the U-M ITSComm Department. In addition, ITSComm is usually involved with the telecommunications systems in U-M Health System buildings, on the U-M Dearborn and Flint Campuses, and at off-campus and leased facilities. This Guideline provides requirements for most University owned or operated buildings, even if the “serving utility” is not ITSComm.

System Description

The BE room is the main termination point in a building. TRs are distribution and termination rooms located on each floor of a building and serve Work Area Outlets within 293 cable feet (including 6 feet of slack at the TR room and 3 feet at the Work Area Outlet). If cable lengths will exceed 293 feet, provide additional TRs. The BE may also be the TR for that floor. Stack the BE and TRs wherever possible. The BE is connected to TRs via backbone cables in conduits. The BE is connected to equipment external to the building via service entrance cables in duct banks and outside plant cables in direct buried conduits. See Design Guideline SBA-C for additional architectural, mechanical and electrical requirements related to the BE and TRs.

ITSComm generally provides the network equipment, cabling and terminations from their network backbone to the Work Area Outlets, including the faceplates and telephone instruments at the outlets. Provide ITSComm with AutoCAD files of the completed CD phase telecommunication plan drawings. ITSComm will add numbers to the Work Area Outlets and cabling information to the drawings for their use in providing the cabling and terminations.

The current cable plant provides multiple 4-pair cables of copper conductors from each Work Area Outlet to the nearest BE or TR. These cables are used for all voice, telephone set power, and data services, including point-to-point and local area networking. Separate RG-6 coaxial cables are installed to locations noted for closed circuit TV and/or cable TV.

All Work Area Outlet (station) wiring will be home run from the Work Area Outlet to the nearest TR. For transmission integrity, no intermediate splices or terminals will be allowed. During renovations, if the existing cables will be too short, modify the existing cable pathways as necessary so new cables can be installed.

Telecommunication Service Entrance and Outside Plant Cabling

Consult with the Design Manager and ITSComm prior to proceeding with the telecommunication service entrance design.

Duct Banks, Manholes, Hand Holes and Underground Conduits

Provide a minimum of four 4-inch service entrance conduits in a concrete-encased duct bank extending from a location specified by ITSComm (typically a telecommunication manhole) to the building. Slope duct banks downward toward manholes and away from the building a minimum of 6 inches per 100 feet. Duct banks shall not route water from manholes into the building or contain traps between manholes where water may accumulate.

Encase service entrance conduits in concrete except where they terminate at poles. When terminating at a pole, clamp the conduits rigidly to the pole at a 90-degree separation from power conduits clamped to the pole.

Provide 12 foot by 6 foot by 7 foot high (inside dimensions) telecommunication manholes unless smaller manholes are approved by ITSComm.

Provide 1-1/2 inch minimum direct-buried conduits for outside plant cables serving emergency telephone kiosks, digital signs, parking controls and similar outdoor equipment.

Underground conduits shall not include more than 180 degrees of total bends or exceed 400 feet in length between pull points (manholes or hand holes), and shall have a bending radius of at least 10 times the conduit diameter. Provide manholes or hand holes in straight sections of conduit runs when necessary to meet these requirements. Hand holes shall not be used in place of conduit sweeps for directional changes in underground conduits. Conduit bodies, specifically LB fittings, are not allowed anywhere. Provide a nylon pull string in each conduit.

Provide a 6 inch wide red marker strip in the trench 1 foot above the duct bank or direct buried conduit.

In multi-utility trenches, the minimum spaces between telecommunication conduits or cabling and other facilities are: 3 inches where separated by concrete, 4 inches where separated by masonry, and 12 inches where separated by well-tamped earth.

Where conduits enter a building, extend the conduits 6 inches beyond the interior wall or floor. Plug spare conduits with water-tight mechanical seals.

If the termination point (typically the BE) of the building service entrance or outside plant cables is more than 50 feet inside the building, or if the cables run through plenum spaces, install the cables in galvanized steel rigid metal conduits. As an alternative and only when approved by ITSComm, provide a 4 foot by 4 foot minimum backboard where the cables entering the building can be spliced to cables rated for indoor use. Provide the NEC-required working space in front of the backboard. Piping and ductwork shall not be routed above the backboard.

Direct Buried Service Entrance Cables

Direct-buried service entrance cables are typically allowed only at off-campus and leased facilities, and only when specifically noted in the Program Documents. Consult with ITSComm prior to proceeding with direct-buried service entrance designs.

Inside Plant Cabling

Telecommunication Cable Pathways

Provide a continuous cable pathway between each Work Area Outlet and the nearest TR to support and protect the station cables. Acceptable cable pathways in order of preference are conduits, cable trays, J-hooks, wireways and underfloor duct systems. Cable pathways shall be continuous and unobstructed, accessible for maintenance and installation of additional cables with minimal disruption to building occupants, and located at a safe working height. Cable pathways serving multiple outlets shall include spare capacity for future use.

Conduits

Provide a conduit from each Work Area Outlet to the nearest TR or cable tray, or as a minimum to above the ceiling. Size conduits for a maximum of 40 percent fill. Minimum conduit size to an outlet box shall be 1 inch, except conduits to wall telephone outlet boxes may be 3/4 inch minimum. Alternate larger conduit sizes will be noted in the Program Documents.

Daisy chaining of outlet boxes is unacceptable, but up to three outlet boxes may be served from one NEC-sized junction box. Size the conduit feeding the junction box as follows:

- 1-1/4 inches for serving two outlet boxes.
- 1-1/2 inches for serving three outlet boxes.

Provide a 1-1/4 inch conduit for serving up to three 1-gang outlets in a surface raceway. Provide multiple 1-1/4 inch conduits to surface raceways containing high outlet densities.

Design conduit runs for minimal bends and as short a path as possible. Provide pull boxes sized in accordance with the NEC in straight sections of conduit every 100 feet or 180 degrees of total bends. For conduits over 2 inches in diameter, consult ITSComm on pull box size. Bends in conduits over 2 inches shall be long sweeps, and no conduit shall have a bend radius less than 10 times the conduit diameter. Conduit bodies, specifically LB fittings, are not allowed.

Conduits shall not be routed within 12 inches above or 4 inches horizontal from hot equipment and pipes, including boilers, water heaters, incinerators, hot water heating lines and steam lines, or through areas in which flammable or other hazardous material may be stored.

Terminate horizontal conduits entering a BE or TR 6 inches inside the room. Extend conduit floor sleeves 6 inches minimum above the floor. Terminate conduits with nylon insulated grounding bushings. Provide a nylon pull string in each conduit.

Fire seal between recessed outlet boxes located on opposite sides of a fire rated wall if the boxes are less than 24 inches apart.

After cables are installed, seal floor sleeves and wall penetrations in fire-rated walls using listed fire-sealing systems.

Cable Trays

Telecommunication cable trays shall be of the aluminum ladder type, or galvanized or zinc electroplated steel wire basket type. Aluminum center spline cable trays may be used only where approved by ITSComm, and only when supported so rigidly they do not tilt if unevenly loaded.

Size cable trays based upon the square footage of the area being served, the number of Work Area Outlets planned for the space, and the diameter of the cables as follows:

- If Work Area Outlet locations are not yet known, assume a minimum of one outlet for every 100 square feet of useable floor space served by the cable tray.

- Standard Work Area Outlets are served with three 4-pair cables with an average cable diameter of 0.165 inch each.
- Provide a minimum of 50 percent spare cable capacity for future use.
- The maximum allowable cable tray fill shall not exceed 50 percent of the tray cross-sectional area.

Design cable tray installations as follows:

- Provide 12 inches minimum access above and 18 inches minimum access on one side of cable trays for ease of cable pulling.
- Locate cable trays so they can be accessed safely from a ladder, taking into consideration access restrictions including ducts, pipes, conduits, light fixtures and ceiling grids.
- Ducts, pipes, conduits, light fixtures, ceiling grid support wires or other mechanical or electrical items shall not be attached to, pass through, or located within the cross-sectional area of cable trays.
- Cable trays shall not be used in place of conduit runs specified for computer room tie cables or other riser type cable installation.

Terminate cable trays entering a BE or TR 6 inches inside the room. Provide barriers in cable trays when necessary to separate circuits of different low voltage levels.

J-Hooks

Telecommunication cables may be installed in J-hooks above accessible ceilings in rooms, but J-hooks shall not be installed in corridors. Provide conduits or cable trays in corridors because the high quantity of cables will result in cable damage if the cables are installed in J-hooks.

Cables may be installed in J-hooks in unfinished open ceiling areas, but only if a minimum of 10 feet AFF, only if the cables will be protected from damage, and only if the cables are completely accessible for replacement. Cables shall not be installed in J-hooks in finished open ceiling areas or above inaccessible ceilings.

If cables in J-hooks penetrate a corridor wall from a room, and the distance from the wall to the cable tray is more than 18 inches, provide conduit stubs from the wall to the cable tray.

J-hooks for telecommunication cables shall be zinc electroplated steel or plastic, color coded silver or gray, listed for use in plenum spaces, with a minimum of 1 inch-wide cable support area, and rated for use with Category 6A UTP and similar cables. J-hooks shall be spaced a maximum of 5 feet apart. J-hooks installed to support telecommunication cables shall not be used to support any other types of cables.

Wireways and Underfloor Duct Systems

Power poles and surface raceways are generally not preferred, but power poles may be used to serve furniture systems in renovations. Surface raceways may be used to serve multiple outlet locations in renovations, at laboratory and computer benches, or for surface mount cable routing where conduit is inappropriate. Underfloor duct systems may be used to serve furniture not located against a wall, but only if cables can be easily replaced. Provide 20 percent spare cable capacity for future use. Provide dividers between power and telecommunication wiring.

Conduit connections to power poles and multi-outlet surface-mounted raceways shall be a minimum of 1 1/4 inches. Provide 6 inch x 6 inch x 4 inch junction boxes when necessary to transition to the top of power poles. Provide conduits to both ends of surface-mounted raceways containing high outlet densities. Maintain the cable minimum bend radius at all times.

Wireways may be built into furniture systems including wall partitions, auditorium seating, desks and laboratory benches, but only if the cable minimum bend radius is maintained at all times and the cables can be easily replaced.

Floor surface and under-carpet cable covers are strongly discouraged and may be used only where approved by ITSComm.

Work Area Outlets

Provide sufficient Work Area Outlets to meet current and anticipated future needs. Coordinate with the Design Manager and ITSComm to determine User needs. Consider the following:

- Most outdoor areas and parking structure floors require at least one emergency telephone.
- Laboratory suites and Housing facility lobbies typically require a campus telephone.
- Animal housing facilities typically require data connections to animal room monitoring panels.
- Housing facility student rooms require one data outlet per pillow, one voice outlet per room, and one RG-6 coaxial cable TV outlet per room.
- Medical facility patient waiting rooms typically require an RG-6 coaxial cable TV outlet.
- Housing facility laundry rooms require one data outlet per clothes washer, one per clothes dryer, and one for the Blue Bucks control panel.
- Offices typically require two outlets, one on each wall perpendicular to the door wall.
- Elevator controllers, unit substation watt-hour meters, building energy and water meters and sub-meters, and the building's main temperature control DDC system head end control panel typically require data connections.
- Parking attendant booths, cash registers in cafes and shops, Blue Bucks control panels and vending machines typically require data connections.
- Audio/visual racks and devices, classroom and conference room scheduling panels, and many lighting control panels and control devices require data connections.
- Buildings with U-M Wireless Network service require outlets for Wireless Access Point (WAP) devices. Request ITSComm to identify WAP outlet locations.

Outlet boxes shall be 4-11/16 inch sheet metal outlet boxes a minimum of 2-1/8 inches deep, with a double-gang plaster ring, except wall telephone outlet boxes shall have a single-gang plaster ring. ITSComm will provide the outlet box faceplates.

Provide floor boxes and poke-throughs sized to accommodate all power, data and audio/visual receptacles and jacks required for the project. Provide spare capacity for future use, dividers between power and telecommunication wiring, and cable training space to maintain cable minimum bend radii. Covers shall be flush, captive, and shall not pop open when rolled on by cart wheels or when stepped on with high heel shoes. Floor boxes and poke-throughs shall be approved by ITSComm.

Grounding, Bonding and Electrical Protection Requirements

Provide a 1/4 inch x 1 inch x 12 inch copper ground bus bar in each BE and TR, and connect each to the ground bus bar in the nearest electrical panel on the same floor with a No. 6 AWG, green insulated, stranded copper ground wire. See Design Guideline SBA-C.

Provide a No. 6 AWG, green insulated, continuous stranded copper ground wire from each TR ground bus bar to the BE room ground bus bar, and from the BE room ground bus bar to the main building ground bus bar (usually located in the unit substation room). The resistance to building ground shall be 1 ohm maximum.

Provide protection for ground wires subject to physical damage or abuse. Non-metallic conduit is preferred. Where metallic conduit is used, bond the conductor to the conduit at both ends.

Bond telecommunication conduits to cable trays using listed grounding bushings and ground straps or using listed conduit grounding clamps. Bond conduits, cable trays, metallic wireways and metallic underfloor duct systems to the nearest BE or TR ground bus bar with No. 12 AWG, green insulated, stranded copper ground wire.

Bond telecommunication cable shields on one end to the nearest BE or TR ground bus bar.