

ANNEX "E" – DATA/TELECOMMUNICATIONS SPACES AND SERVICES
(DESIGN CRITERIA FOR ASSOCIATES)

PART 1 – QUALIFICATIONS OF THE ASSOCIATE

- A. The **Associate's firm** shall be regularly engaged in the design and construction supervision of data and telecommunications cabling systems of the type and design specified herein:
1. The Data/Telecommunications Associate shall be fully capable and experienced in the information transport system specified.
 2. The Data/Telecommunications Associate shall have been in the data/ telecommunications installation business for a period of not less than five (5) years and have completed a minimum of five (5) projects of similar size and complexity.
 3. The Associate must have a Registered Communications Distribution Designer (RCDD) on staff who will be ultimately responsible for this project.
 4. The Project RCDD shall have a minimum of five (5) or more years of continuous uninterrupted RCDD certification. The RCDD shall hold the Outside Plant (OSP) Specialist Designation to qualify for interbuilding outside plan design.
 5. The RCDD must have sufficient experience in this type of project as to be able to lend adequate technical support to the field forces during installation.
 6. A resume of the responsible RCDD must be attached to the Associate's response for evaluation by the Owner.
 7. Should the RCDD assigned to this project change during the project, the new RCDD assigned must submit a resume for review by the Owner.
 8. If in the opinion of the Owner, the RCDD does not possess adequate qualifications to support the project, the Owner reserves the right to require the Associate to assign an RCDD whom, in the Owner's opinion, possesses the necessary skills and experience required of this project.
 9. The Owner may with full cooperation of the Associate, visit client installations to observe project design/implementation and consult with the references.
 10. Specified visits shall be arranged through the Associate; however, the Associate's personnel shall not be present during discussions with references.

11. The Associate shall provide a minimum of five (5) reference accounts at which similar work, both in scope and design, have been completed by the Associate within the last five (5) years.
12. The Owner will contract only with Associates having a successful history of design, implementation, and support.
13. All drawings, specifications and other contract documents and the Owner's proprietary information shall be returned to the Owner upon satisfactory completion of the contractual work.

PART 2 – GENERAL:

- A. The design criteria for data/telecommunication spaces and services, contained here-in, shall apply to all University of Toledo new construction and major renovation projects.
 1. "Major Renovation" shall be defined as a project that includes the addition of, or the upgrading of existing data/telecommunication cabling to an area or space, resulting in, but not limited to, one or more of the following:
 - a. Relocation or expansion of the Telecommunication Room.
 - b. Addition of one or more equipment racks and additional associated cable management.
 - c. Additions to or replacement of the backbone cabling infrastructure.
 - d. Replacement and/or upgrading of existing horizontal cabling, workstation outlets, patch panels and cable management.
 - e. As directed by the University of Toledo Rocket Telecom Department.
 2. "Minor Renovation" shall be defined as a project that includes and is limited to the following:
 - a. Utilization of existing telecommunication spaces, equipment racks, cable management and backbone cable infrastructure.
 - b. The addition of or replacement and/or upgrading of workstation outlets, patch panels and associated cable management consisting of fewer than fifty (50) cable drops.

- B. The design of data/telecommunication spaces and services shall be subject to review, comment and acceptance by the University of Toledo Rocket Telecom Department.
 - 1. Minor renovation projects shall adhere to this design criteria where and as applicable, subject to approval of the Rocket Telecom Department.
- C. The design of new data/telecommunication spaces shall comply with the following codes, standards and specifications.
 - 1. All N.E.C., national, state and local codes as applicable to the construction and installation of data/telecommunication systems and facilities.
 - 2. All EIA/TIA Standards 568-B1, -B2, -B2 Addendum 1, -B3, 569A, 570A, 606, 607, and the 9th edition of the BICSI Telecommunications Distribution Methods Manual (T.D.M.M.).
 - 3. All Division 16 Basic Materials and Methods sections of the UT Engineering Standard Electrical Specifications.
- D. The design of the data/telecommunication spaces shall be under the direct supervision of and in coordination with a Registered Communication Distribution Designer (RCDD).

PART 3 – DEFINITIONS AND SCOPE OF SPACES:

- A. DATA/TELECOMMUNICATION SPACES SHALL GENERALLY BE DEFINED AS FOLLOWS:
 - 1. The data/telecommunications entrance facility shall consist of the entrance point (room or space within the building) where telecommunication services enter, where joining of inter- and intra-building backbone facilities takes place, and where the proper grounding and bonding of these facilities is accomplished. The data/telecommunications entrance facility may also contain antenna entrances, and electronic equipment serving telecommunication functions.
 - 2. The Data/Telecommunication Equipment Room shall be a centralized space for the data/telecommunication equipment (e.g., PBX, computer mainframe, printers, disk drives, video switch, A/V control, etc.) that serves the building facility and occupants.
 - 3. The Data/Telecommunication Distribution Room shall be a space dedicated to the transition between the backbone and horizontal distribution pathways. The Telecommunications Room shall be able to contain telecommunications equipment, cable terminations and associated cross-connecting wiring.

- B. Depending upon the specifics of the individual facility, the data/telecommunication entrance facility, Equipment Room and Telecommunication Rooms may be separate dedicated spaces or combined together in one or more spaces (e.g. entrance facility and Main Distribution Room or Equipment Room and Main Distribution Room).
- C. New data/telecommunication spaces shall be dedicated to the data/telecommunication functions and related support facilities. **The data/telecommunication spaces shall not be shared with electrical distribution, electrical control systems, HVAC, mechanical systems, plumbing, storage or janitorial facilities.**
- D. The data/telecommunication spaces shall be laid out for the efficient utilization of the assigned space for the equipment to be installed with a minimum crossing of the interconnecting wiring.
- E. There shall be a minimum of one (1) data/telecommunication space per building. Horizontal distribution distance to the furthest data/telecommunication outlet shall not exceed 90 meters (295 ft.) total cabling length.
- F. The data/telecommunication space shall be located as close as practical to the center of the area served and preferably near the core area. There should be a minimum of one (1) Distribution Telecommunications Room per floor, however, where approved by the Owner, and workstation density allows, one (1) Distribution Telecommunications Room may serve three (3) floors (e.g., one (1) floor maximum above and one (1) floor maximum below).

PART 4 – SPECIAL CONDITIONS:

- A. The computer systems associated with this work shall not be taken off-line or removed from service during normal working hours.
- B. These systems are critical to the provisioning of services to the Owner's clients and shall not be interrupted by the Associate's activities.
- C. Arrangements must be made by the Associate to coordinate any such activities.
- D. The Associate shall be required to work around all of the conditions listed above as well as working with the Owner's staff to minimize disruptions to normal Owner activities.

PART 5 – DESIGN CONSIDERATIONS – GENERAL:

- A. Multiple spaces within a building shall be stacked vertically one above the other, with pathways between. Multiple spaces shall be interconnected by a minimum of one (1) 4" conduit or equal.

- B. Data/telecommunication spaces and interconnecting pathways shall be designed for a minimum of 100% growth and expansion.
- C. Data/telecommunication spaces and pathways shall not be located in enclosed stairways, elevator shafts and Elevator Equipment Rooms.
- D. Wherever possible, cable and raceway routings shall follow the logical structure of the building (i.e. follow hallways, aisles and corridors). All data/telecommunication spaces and pathways shall run parallel and perpendicular to the structure, diagonal runs shall not be permitted.
- E. An open ceiling distribution system is the preferred cable distribution system. An open ceiling distribution system shall not be installed above inaccessible ceiling areas such as "lock-in" type ceiling tiles, drywall or plaster. Suspended ceiling tiles shall be of the removable "lay-in" type and located at a maximum height of 11'-0" above the floor. The "open" wiring shall be accessible from an 8'-0" stepladder.
- F. Adequate and suitable space shall be available in the ceiling area for the distribution system. Mechanical systems (i.e. HVAC, sprinkler, etc.) shall be located as high as possible above the ceiling to provide space for the data/telecommunication spaces and pathways.
- G. Generally a minimum 24"W x 18"H continuous corridor or space is required immediately above the ceiling and light fixtures for major routes of 12" wide cable tray (dimensions may vary with specific cable tray requirements).
- H. A minimum of 3" of clearance space all around the cabling spaces and pathways shall be clear accessible space not required for the removal of tile, light fixtures or for service and access to other systems.
- I. Data/telecommunication spaces shall be protected from contaminants and pollutants that could affect operation and material integrity of the equipment installed. When contaminants may be present, vapor barriers, positive room pressure, or absolute filters shall be provided.
- J. Data/telecommunication spaces shall be located in accessible areas, preferably off a common corridor or in the core area, not immediately adjacent to stairways or elevator shafts.
- K. Fire protection of the data/telecommunication spaces shall be provided as per applicable codes.
 - 1. The preferred fire protection system for data/telecommunication spaces shall be a dedicated, self-contained "FM-200" system. The system shall be interconnected to and monitored by the facility fire alarm system.
 - 2. Data/telecommunication spaces to be protected by a sprinkler system, the system shall be a dedicated, dry, pre-action system. Sprinkler heads shall

be provided with wire cages to prevent accidental operation. Drainage troughs shall be provided under sprinkler pipes to prevent leakage onto the equipment within the room.

- L. Entrance facilities and Distribution Rooms shall be located on floor areas designed with a minimum floor loading of 50 lbs./ft². Equipment Rooms shall be located on floor areas designed with a minimum floor loading of 250 lbs./ft². The Associate shall verify the floor loading requirements.
- M. Data/telecommunication spaces shall not be located below potential water level unless positive preventative measures against water infiltration are employed. The space shall be free of water or drain pipes not directly required in the support of equipment within the room. A floor drain with trap and back flow preventor, or sump with automatic pump shall be provided within the room if risk of water infiltration exists.
- N. When selecting the data/telecommunication space site within the building, avoid locations that are restricted by building components that limit pathway access or future expansion, such as elevators, stairways, outside wall, load bearing walls, utility shafts, ductways and pipe chases, etc. Accessibility for the delivery of equipment to the space shall be provided for.
- O. Conduits, sleeves and slots through the space floor shall be located adjacent to and/or behind the door. Sleeves or slots shall not be left open except during cable installation and shall be properly fire stopped per applicable codes.
- P. The data/telecommunication space and pathways shall be located away from sources of Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI) at a distance which will reduce the interference to less than 3.0 V/m throughout the frequency spectrum. Special attention shall be given to electrical power supply transformers, motors, generators, x-ray equipment, D.C. drives, variable frequency drives, welders, radio/radar transmitters, induction devices, elevators, etc.
- Q. Minimum lighting levels in data/telecommunication spaces shall be 50-foot candles, measured 3 feet above the finished floor. Nominal fixture mounting height shall be 8'-6" above the finished floor.
- R. The walls of data/telecommunication spaces shall be full height, extending from the base floor to the deck above and fire rated as per applicable codes. False ceilings shall NOT be provided in entrance facilities and Distribution Rooms. False ceilings shall only be provided in Equipment Rooms at the Owner's direction.
- S. The doors of data/telecommunication spaces shall be a minimum of 36" wide x 80" high without a door sill, hinged to open outward and fitted with a lock and/or access control per The Project Standards. Where it is anticipated that large equipment may be installed in an Equipment Room, a double door 72" wide x 90" high, without door sill and center post shall be installed.

- T. If an emergency power source is available in the building, the Equipment Room power panel shall be sourced from the emergency power supply.
- U. Lighting fixtures and general use convenience outlets for data/telecommunication spaces shall not be powered from the same electrical distribution panel as the data/telecommunication equipment. Emergency lighting fixtures and exit signs shall be provided as required by code or directed.
- V. It shall be desirable to provide a dedicated power distribution panel with a dedicated ground conductor and surge suppression for the Data/Telecommunication Equipment Room.
- W. Dedicated electrical circuits with dedicated ground conductors and surge suppression shall be provided for data/telecommunication equipment as required.
- X. The floors, walls and ceilings of data/telecommunication spaces shall be sealed to prevent dusting. Finishes shall be light in color, to enhance lighting. Flooring materials shall have anti-static properties. A positive pressure differential, with respect to surrounding areas, shall be provided utilizing a filtered air source.
- Y. Data/telecommunication spaces shall have access provided to the main building grounding electrode per EIA/TIA 607 grounding standards.
- Z. **All four (4) walls** of data/telecommunication spaces shall be covered with rigidly fixed 3/4" thick A-C plywood panels, fire retardant treated and painted to match the wall finish to a height of 8'-0" and capable of supporting the attached equipment for telephone backboard use.
- AA. A **minimum of two (2)** dedicated 20 Amp, 120 VAC duplex electrical outlets on separate circuits shall be provided for equipment power in each data/telecommunication space; to be located as directed.
- AB. Duplex convenience outlets shall be located at 6'-0" intervals around the perimeter, and 18" above the floor on the walls of data/telecommunication spaces. One or more emergency power receptacles shall be provided if an emergency power distribution system is available.
- AC. HVAC facilities shall be included in the design of data/telecommunication spaces. Passive spaces shall be maintained at a temperature and humidity the same as adjacent occupied office spaces. A positive pressure shall be maintained with a minimum of one (1) air change per hour, or as required by applicable code. Where active devices (heat producing equipment) are present, a sufficient number of air changes shall be provided to dissipate the heat and maintain the specified temperature.
- AD. HVAC facilities shall be provided to Data/Telecommunication Rooms on a 24-hour per day, 365 days per year basis. If the building system cannot assure continuous

operation or for large equipment applications, a stand-alone system shall be provided.

- AE. The HVAC system for data/telecommunication spaces should be powered from the same emergency power source as the equipment where applicable.
- AF. The temperature and humidity of the Equipment Room shall be controlled to provide continuous operation at 64°F. to 75°F at 35% to 55% relative humidity, measured at a distance of 5'-0" above the floor, at any point along an equipment aisle center line. Humidification and/or dehumidification equipment may be required, depending upon local conditions.
- AG. HVAC equipment may either be floor mounted, wall mounted, or suspended from joists, or building structure above. If the HVAC equipment is suspended from above, the minimum clearance below shall be 10'-0". HVAC equipment including lines shall not be located over or above data/telecommunications equipment.
- AH. Battery enclosures for UPS and back-up systems shall be positively ventilated to the outside as per applicable codes.
- AI. Data/telecommunication spaces shall be sized to meet the known requirements of specific equipment to be installed, allowing for a minimum of 100% future expansion.
- AJ. Where the specific equipment and building utilization is not known, the following guidelines shall be utilized:
 - 1. Allow for one (1) data/telecommunication outlet, consisting of one (1) "voice" and two (2) "data" modular jack receptacles per one hundred square feet (100 ft.²) of usable workspace. See the UT Engineering Standard Specification 16751 for specific workstation outlet requirements.
 - 2. "Voice" distribution fields shall be wall mounted on telephone backboards as per Specification 16751.
 - 3. Allow for a minimum of 12" of depth for equipment mounted on telephone backboards.
 - 4. "Data" distribution fields shall be mounted on free standing 19" equipment racks, with cable management accessories as per Specification 16751.
 - 5. Allow for a minimum floor space requirement of 27" width x 36" depth for each equipment rack. Multiple equipment racks should be lined up side by side in a row.
 - 6. Allow for 36" clearance in front and back of the equipment racks and at least one end of the row. Rows of five (5) or more equipment racks shall have 36" clearance at each end.

7. Telephone backboards may be utilized for CATV distribution, fire alarm, building automation, access control systems, etc.
- AK. Data/telecommunication entrance facilities, Equipment Rooms and Distribution Rooms may be combined as required to meet the specifics of the individual facility.
- AL. Data/telecommunication spaces should be designed to serve the entire facility or building, unless the facility size requires otherwise. Allow a Distribution Room to serve a maximum of 40,000 sq. ft.
- AM. The minimum data/telecommunication space shall be an area of 11'-0" x 12'-0" with telephone backboards on all four (4) walls. The space may serve as a combined entrance facility, Equipment Room and Distribution Room. The area shall accommodate a maximum of three (3) equipment racks (including expansion) and shall serve an area of 20,000 sq. ft. or two hundred (200) "voice/data" drops maximum. See Figures 1a & 1b.
- AN. A typical data/telecommunication space (combining entrance facilities, a minimum equipment space requirement and a distribution field) to serve an area of 40,000 sq. ft. or four hundred (400) "voice/data" drops maximum, should be 11'-0" x 20'-0" with accommodations for a maximum of five (5) equipment racks (including expansion). See Figures 3a & 3b.

PART 6 – DESIGN RESPONSIBILITIES

- A. The Associate shall provide a fully designed data/telecommunication system as per the UT Engineering Standard Specifications and others.
- B. The data/telecommunication system design shall include, but not be limited to the following:
 1. Data/telecommunication pathways and spaces as per EIA/TIA-569A and as required to meet the UT Engineering Standard Specifications.
 2. Complete floor plans and layouts of all spaces, equipment layouts of all telephone backboards and equipment racks, service entrance facility details, cable routing, pathways and cable management details, data/telecommunication grounding details and power distribution details.
- C. The Architect and the Associate shall coordinate with the other design disciplines (i.e. mechanical, structural, etc.) to provide adequate data/communication pathways designed for accessibility and growth. The Architect and Associate should keep in mind that mechanical, structural and electrical facilities tend to be static systems, while the data/communication systems are dynamic in nature, constantly subject to add, moves and changes. Spaces and pathways design shall accommodate and facilitate continuing changes.

PART 7 – DESIGN SPECIFICS

A. TYPICAL OUTLET CONNECTIVITY:

1. Install all "voice" and "data" modules in accordance with the manufacturer's directions, using a single-punch 110 style impact or vendor approved insertion tool for cable termination.
2. The typical Single Person Resident Room shall have a connectivity consisting of a single gang, 6-port faceplate with one (1) "voice" modular jack, one (1) "data" modular jack, one (1) "CATV" modular jack and three (3) blank inserts.
3. The typical Two Person Resident Room, Lab, Classroom or Commons Area shall have a connectivity consisting of a double gang, 9-port faceplate with two (2) "voice" modular jacks, two (2) "data" modular jacks, one (1) "CATV" modular jack and four (4) blank inserts.
4. The typical Office shall have a connectivity consisting of a single gang, 6-port faceplate with two (2) "voice" modular jacks, two (2) "data" modular jacks and two (2) blank inserts.
5. Items 2, 3 and 4 above are typical sample connectivities only, for design/development and budget estimating purposes only. Actual connectivity shall be determined by U.T. Facilities Planning, in coordination with the end users and the Rocket Telecom Department. See Annex "A", Figure 2c for typical sample connectivity.
6. As a general rule, outlet faceplates utilizing four (4) or less ports shall make use of the single gang 6-port faceplate. Outlet faceplates utilizing five (5) or more ports shall make use of the double gang 9-port faceplate, thus assuring future expansion capability at the outlet location. Any deviation shall be approved by the Rocket Telecom Department in writing.
7. The standard TV outlet for public areas such as lounges, dining areas etc. shall include a "voice" and a "data" modular jacks with the "CATV" jack mounted in the single gang six (6) port faceplate with three (3) blank inserts.
8. Faceplates shall be stainless steel, gray or office white, as directed by the Architect, as per the University of Toledo Construction Design Standards Manual (current edition). **The Associate shall verify the faceplate material/ color matching with the Architect.**
9. **"Voice" modular jacks shall be terminated T568A wiring sequence and "data" modular jacks shall be terminated T568B wiring sequence.**

B. PAY PHONES AND EMERGENCY PHONES:

1. Each pay phone or emergency phone outlet shall be a 4-11/16" square double gang deep (2-1/8" deep) box with reinforced support, stud to stud and 1" conduit stubbed out above.
2. The pay phones and emergency phones shall be equipped with a 630 Series stainless steel wall phone plate and RJ-45 jack assembly, or as required to match the phone.
3. Mounting height shall be 48" above the floor or as required to meet ADA compliance.

C. VOICE/DATA/CATV/FIBER OPTIC FLUSH MOUNTED FACEPLATES:

1. Unless otherwise specified by the Owner, the standard outlet faceplate shall be gray in color or as directed by the Architect to match the standard electrical devices.
2. Standard flush mounted faceplates shall be mounted on the standard data/communication outlet with the appropriate single or double gang plaster ring, as per Specification Section 16741.
3. Standard flush mounted faceplates may be mounted on appropriate surface mounted double gang deep raceway boxes (i.e. "FD" Series cast or non-metallic).
4. With the Owners prior approval, the standard flush mounted faceplates may be utilized for "fishable" wall locations when mounted to the drywall panel, utilizing a single or a double gang plate mounting bracket, Caddy Fastener P/N MPLS, MPLS2 or Arlington #LV1, #LV2 as required.
5. An approved surface mounted enclosure may be surface mounted on the standard data/communication outlet with a double gang plaster ring.
6. **ONLY** with the Owner's prior approval, the approved surface mounted device may be utilized for "fishable" wall locations when mounted to the drywall panel, utilizing a two gang plate mounting bracket; Caddy Fastener P/N MPLS2 or Arlington #LV2 as required. **Method is not recommended and considered method of last resort.**
7. All wall openings will be neatly cut and trimmed with a drywall saw. No rough or exposed edges will be permitted.
8. The faceplate will be neatly installed and plumb to the floor. No exposed cables will be permitted.

9. In locations where the data/communication outlets are installed in metallic or non-metallic surface mounted raceway, a 106 duplex mounting frame, electrical ivory, office white or gray in color to match (U.N.O.) shall be utilized to provide support for up to two (2) "voice", "data", "CATV" or "fiber optic" modular jacks. **The Quad 106 frame is not recommended, and subject to Rocket Telecom Department approval .**

D. VOICE/DATA/CATV/FIBER OPTIC SURFACE MOUNTED – MODULAR FURNITURE:

1. When the data/communication outlet is to be mounted on modular furniture, the approved surface mounted enclosure assembly shall be utilized. The assembly shall be mounted to the modular furniture utilizing the appropriate Leviton Modular Furniture Adapter P/N 49222-HAO as required or an approved equal.
2. The data/communication outlets shall be located as directed by the Owner.
3. When available, the modular partition furniture raceway shall be utilized for the through routing of cables only, modular connectors shall not be installed in the built-in raceway system.
4. Cables entering the modular furniture raceway and the surface mounted enclosure assembly shall be neatly dressed in accordance with Category-5e/6 installation procedures. Pay particular care as to not kink or pinch cables or exceed the minimum cable bend radiuses.
5. All exposed cables shall be enclosed in a flexible PVC convoluted split duct (Tyton P/N CTP-xx, sized to fit the cables) or enclosed in expandable braided sleeving (Tyton P/N 4BSP) or approved equal by Panduit.
6. Secure the split duct or braided sleeving at both ends with black nylon tywraps. The split duct or sleeving shall be neatly dressed and secured inside the enclosure or raceway.
7. Provide an appropriately cut and clean knockout hole in the enclosure or raceway for the split duct or braided sleeving access. No exposed ends or tywraps shall be visible.

E. NON-METALLIC SURFACE MOUNTED RACEWAY FOR NON-FISHABLE WALLS:

1. With the Owner's prior approval, in areas requiring the data/communication faceplate assembly to be surface mounted on a non-fishable wall, a double gang deep (1-7/8" deep min.) non-metallic, surface mounted box, office white in color shall be utilized.

2. The surface mounted box shall be secured to the wall with a minimum of two (2) panhead screws or mushroom headed nail anchors, located in diagonally opposite corners.
3. The surface mounted double gang box shall be Hubbell P/N MT34TGB, MT678CTGB, MT678TGD, MT5RDB2G or MT10FC1B2 as required.
4. Coordinate the surface mounted box with the surface mounted raceway as required.
5. Utilize office white faceplates and snap-in fittings ("CATV", "F/O" and blanks) in lieu of the standard gray.
6. The surface mounted non-metallic raceway, office white in color shall be sized for the cable fill as required. The Associate to calculate for a 40% maximum fill. Do not rely on manufacturer's tables.
7. The surface mounted non-metallic raceway shall be furnished with a double-sided foam tape self-adhesive backing.
8. Each section of surface mounted raceway shall be secured to the wall with panhead screws or mushroom headed nail anchors on 24" to 30" maximum spacing, with a minimum of two (2) anchors per section.
9. The surface mounted non-metallic raceway shall be Hubbell Media Trak Series; Hubbell P/N MT3, MT4, MT5, MT6, MT7, MT8 or MT10 as required. Coordinate raceway size with cable fill requirements.
10. Install the surface mounted raceway in accordance with the manufacturer's instructions and recommendations, utilizing factory furnished associated fittings as required.
11. All raceway materials shall be neatly installed, running perpendicular or parallel to the floor as required. All raceway to be cut and neatly trimmed with an appropriate miter saw. No rough or exposed edges will be permitted. No exposed cables will be permitted.

F. CROSS CONNECT DESIGN:

1. Voice Cables:
 - a. Provide multiple-pair, Category-3 voice riser cables to connect the Telecommunications Room (TR), Intermediate Cross Connect (IC) and Horizontal Cross Connects (HC) located in the wiring closets with the Main Cross Connect (MC).
 - b. The riser cables to be terminated on Avaya or Siemon 66M1-50 (or Owner's approved equal) style blocks at the TR, HC, IC and MC.

- c. Individual user, horizontal, 4-pair, Category-3 voice cables to be terminated on 66 block equipped cross connect fields.
- d. The user voice cables shall be cross connected on the cross connect field, by the Owner, via jumper-wire to the multi-pair, Level-3, riser cable blocks.
- e. Provide 66 blocks and wall mounted frames at the TR, HC, IC and MC.
- f. The 66 blocks shall be installed on Homaco #5OM Series, Saunders #SB-720 Series or Owner approved equal wall mounted distribution frames equipped with distribution rings and stand off brackets.
- g. Locations requiring more than 40 blocks shall use multiple frames.
- h. The quantity of 66 blocks and distribution frames to be furnished and installed shall be detailed on the Engineering Drawings.
- i. Indicate on the drawings, the areas and rooms for mounting electrical or telephone equipment on telephone backboards of C-D Plugged-INT-APA plywood sheets 48"W x 96"H x 3/4"THK in size, painted with two coats of fire retardant paint; Flame Control No. 20-20as available from Glidden, Benjamin Moore, Pittsburgh Paint and Sherwin Williams.

2. User Data Cables:

- a. Provide 48-position Category-5e/6 modular patch panels for termination of user Category-5e/6 data cables at the TR's per specifications.
- b. The Category-5e/6 48-port patch panels shall be provided with two (2) cable support bars, stuffer caps, and designation label kits.
- c. All user data cabling for new construction shall be Category 6 with the exception of the following:
 - 1) Building automation, B.A. monitoring systems (Orange) and security CCTV monitoring system (Green) which shall be wired Category-5e.
 - 2) Small renovation projects within existing buildings consisting of existing wired spaces, wired Category-5/5e to existing Telecommunications Rooms, which may be wired Category-5e at the direction of the Owner.

3. Fiber Optic Cables:

- a. Fiber optic interconnect centers shall be provided in the TR/HC/IC/MC wiring closets to provide storage and protection for the fiber optic connections.
- b. The units shall contain mounting provisions for multi-fiber cables to facilitate the field termination of fiber optic cables by allowing a point to secure the cable.
- c. Fibers shall terminate on connectors as per specifications. The interconnect center shall be specified on the detailed Engineering Drawings.
- d. The fiber interconnect centers shall be by Hubbell or Owner approved equal.
- e. The fiber interconnect centers shall be equipped with fully populated connector panels.
- f. The MC shall be equipped with fiber optic distribution centers for termination of the inter-building fiber optic cables and the IC riser cables. The quantity of IC riser cable distribution centers shall be based on the quantity of associated IC's and indicated on the Engineering Drawings.
- g. The fiber distribution centers used for the inter-building fiber optic cables shall be by Hubbell or Owner approved equal.
- h. The total quantity of fiber interconnect centers shall be detailed on the Engineering Drawings.

G. EQUIPMENT, MATERIAL, INSTALLATION:

1. Distribution Rack Frames:

- a. The distribution relay rack frames shall be 19" wide by 84" high, heavy duty aluminum construction per E.I.A. Specification RS310C as per specifications or Owner approved equivalent.
- b. The distribution relay racks shall be equipped with lower front and rear guard rails and a mounting base dust cover assembly.
- c. The quantity of relay racks shall be indicated on the detailed Engineering Drawings.

2. Wall Mounted Data Cabinets:
 - a. Wall mounted data cabinets shall be used in IC/TR locations that do not have sufficient space for freestanding relay racks for equipment mounting.
 - b. Wall mounted data cabinets shall be utilized in retrofit applications only, freestanding racks shall be used in all new applications.
 - c. The wall mounted data cabinets shall be Great Lakes GLPPA818 or GLPP-7218 (or Associate approved equal) depending on equipment mounting requirements.

3. Patch Cord Organizers:
 - a. The data termination racks shall be provided with 1- and 2-R.M.U. patch cord organizers.
 - b. One organizer shall be provided directly above and below each 48-position patch panel.
 - c. The detailed Engineering Drawings to indicate the quantities and types of organizers to be furnished and installed.
 - d. The two (2) rack space patch cord organizer providing horizontal paths front side only for patch cords shall be the as per Appendix "A" or Owner approved equal.
 - e. The two (2) rack space patch cord organizer providing horizontal and vertical paths front side only for patch cords shall be as per Appendix "A" or Owner approved equal.
 - f. The one (1) rack space patch cord organizer providing horizontal paths front side only for patch cords shall be as per Appendix "A" or Owner approved equal.
 - g. The one (1) rack space patch cord organizer providing horizontal and vertical paths front side only for patch cords shall be per Appendix "A" or Owner approved equal.
 - h. Patch cord organizers providing horizontal paths front side only for patch cords shall be utilized on open equipment racks when vertical organizers are utilized between racks or in wall mounted cabinet enclosures with built-in vertical cable management.
 - i. Vertical cable organizers for use between and/or at the end of 84" relay racks (to be mounted with the loops to the front side only,

open channel to the rear) shall be 3" wide; on each end and 6" wide; between racks or Owner approved equal.

H. RACEWAYS AND CONDUITS:

1. Each standard voice/data/CATV outlet shall be a 4-11/16" square double gang deep (2-1/8" deep) box with 1-1/4" raised single gang or double gang plaster ring as required and 1" conduit (unless noted otherwise) stubbed out above the suspended ceiling into the bar joist area, or stubbed out below the floor into the bar joist area below as indicated on the drawings.
2. The stubbed out conduit shall turn towards the main cable routing path or cable tray and have a bushing installed.
3. Conduits home runned, extended to the cable tray and/or otherwise extended beyond the turn out, shall have a grounding bushing installed and be bonded to the data/telecommunication grounding system.
4. Each outlet shall be provided with a cover plate as noted on the detailed Engineering Drawings.
5. Each wall phone, pay phone or emergency phone shall be equipped with a single gang box with a reinforced support, 3/4" conduit stubbed out as above, to be indicated on the detailed Engineering Drawings.
6. Cable trays and raceways shall be detailed Engineering Drawings.
7. Cable trays shall be designed for the intended use and application. Cable trays shall be Chalfant Series 6A, Mono Systems Series "L" single spline, Flex Tray/ EZ Tray open steel mesh (breadbasket) or "Snake Tray" as required.
8. All cable tray mounting hardware, brackets and fittings shall be manufactured by the cable tray vendor.
9. All cable ladder shall be B-Line/Saunders Type "SB" aluminum or Owner approved equal.
10. All cable ladder hardware shall be manufactured by the cable ladder vendor.
11. All cable trays and raceways shall be adequately supported and installed in accordance with the manufacturer's recommendations.
12. A metal barrier strip shall be utilized in 12" or larger cable trays to separate telephone cables from data cables.

13. All telephone and data cable bundles, when sharing the same cable ladder, shall be separated by at least 4".
14. Cable tray systems shall be initially designed for a 25% fill, allowing for a 100% growth. Maximum cable fill depth for a cable tray system shall not exceed 1-1/2" in depth.

I. GROUNDING:

1. Provide a dedicated, low D.C. resistance to ground, insulated copper ground wire, originating from the electrical service entrance grounding point for the telecommunications systems.
2. The ground conductor shall be sized and noted on the drawings (#2 AWG copper minimum), and run to the Main Telecommunication Ground Bar.
3. The Associate shall have inspected, serviced and verified the existing telephone entrance ground at the MC, PBX Room or main telephone board to the line side of the water meter or electrical service entrance equipment, cleaning, re-tightening, or re-making all connections as required.
4. The Associate shall verify that all other electrical system grounds, structural building steel and metallic piping systems are bonded together. This is required by code of the electrical service and should already be accomplished, but must be verified and serviced as required.
5. Extend the data/communication ground conductor as required and detailed on the Engineering Drawings.
6. The dedicated telecommunication ground conductor shall be utilized to ground all data/communication/CATV equipment, rack frames, raceway, etc. as per EIA/TIA-607 standards.
7. Grounding and Bonding:
 - a. The equipment racks and cabinets shall accommodate a grounding conductor that will provide a low D.C. resistance path to ground.
 - b. The bonding conductor should not be less than No. 6 AWG copper, and shall meet NEC Article 250 requirements.
 - c. The frame and cabinet grounding conductor shall be bonded to the isolated grounding system originating from the service entrance grounding point.
8. The telecommunications ground shall not be utilized for power distribution panel grounding.

9. The ground shall meet NEC Article 250 requirements.
10. Upon completion of the installation of the data/communication grounding system, the Associate shall have performed standard ground system resistance tests with approved ground resistance test equipment and procedures.
11. Where tests show a resistance of the ground system 1 ohm or greater, the Associate shall take appropriate action to reduce the ground system resistance less than 1 ohm.
12. The telecommunications grounding system electrode resistance to earth shall be 5 ohms or less. The electrode system shall be augmented as required to meet the 5 ohms or less requirement.
13. The grounding system shall then be retested to demonstrate compliance.
14. Record the test results and provide description of test procedures for submission to Owner for approval.

PART 8 – EXECUTION

- A. The data/telecommunications cabling installation shall be fully compliant with the UT Standard Specifications 16453, 16731, 16741 and 16751.
- B. In addition to the aforementioned design criteria, the project contract documents and drawings shall clearly define and illustrate the following:
 1. Whenever possible, primary cable routing paths shall follow the logical structure of the building. All cable servicing an area should follow hallways and corridors where possible.
 2. When a wall must be breached, the cable shall pass through pre-established metal conduit sleeved openings.
 3. Cabling should enter and exit these areas at 90° angles, keeping in mind the minimum bend radius requirements for data cabling. This minimizes potentially harmful field effects on the data signal from other powered devices in the area (such as fluorescent lighting, air handlers, etc.).
 4. Corridor crossovers should be kept to a minimum.
 5. Route all cables and cable raceways parallel or perpendicular to building structure.
 6. No diagonal runs will be permitted, unless noted otherwise or pre-approved by the Owner.

7. All above ceiling space is to be considered "return air plenum" space, unless noted otherwise or determined by the Architect.
8. All non-plenum rated cables must be routed in conduits in plenum spaces.
9. It is the responsibility of the Data/Telecommunication Associate to verify "plenum" rating requirements.
10. All cables shall be installed as single continuous "home run" pulls from connector block to connector block, or workstation data/telecommunication outlet to patch panel.
11. No "in-line" connectors or splices, etc. will be permitted.
12. Cable that is run above a suspended ceiling should be supported by either a cable tray or "J Hook" hangers. **Bridle rings are not acceptable.**
13. Do not support cables from ductwork, plumbing lines, fire suppression or mechanical systems.
14. Do not lay data/communication cables on ductwork, piping and plumbing systems or on top of the lay-in ceiling tile.
15. All power devices or power sources emit a certain amount of electromagnetic interference (commonly called EMI).
16. To reduce or eliminate the field effect of this EMI on data traffic on a given cable channel, cable runs shall be kept the maximum distance from these sources.
17. In addition, running cables through the center of the building may reduce the external interference effects of EMI.
18. In cases where a cable must bear some stress (vertical risers, etc.), "Kellem" grips shall be used to spread the strain over a longer length of the cable, or cables shall be supported by means of vertical cable ladder.
19. Cabling Contractor to observe all minimum bend radius and tension limitations, etc. as specified by the cable manufacturer when installing the cables.
20. Vertical riser cables shall be neatly bundled and supported on vertical cable ladder by means of cable ties on 48" centers maximum.
21. Where required to meet maximum cable loads, a vertical messenger wire shall be installed in vertical risers:

- a. The Contractor shall install multi-pair telephone riser cables as per AT&T Standard Practices #627-610-225.
22. Provide bushings on all conduit sleeves and pre-stubbed wall conduits.
23. Coordinate the location of all partition workstation outlets with the architectural furniture layouts and the Architect.
24. Furnish and install new faceplates on existing wall boxes as specified by the Owner detail on the Engineering Drawings.
25. Provide non-metallic surface mounted raceway and associated hardware at all locations, in accordance with the specification where a surface mounted faceplate is required and no existing box or fishable wall is present and indicate such on the detailed Engineering Drawings.
26. Install faceplate and equipment labels in accordance with the specifications.
27. Install modular jack dust covers and 110 module "stuffer" caps as per manufacturer's recommendations and the specifications.
28. Insure that all faceplate assemblies, labels and associated raceway is properly aligned, centered and installed either perpendicular or parallel to the floor as required.
29. For those locations that utilize metal studs, install a bushing or grommet in the horizontal and vertical studs through which the cables pass to prevent damage to the cables when "fishing" the wall.
30. Maintain separation of data and telephone cables wherever possible, except in the vertical riser conduit from the workstation communication outlet to above the ceiling or joist space, or in furniture partition raceway.
31. Where cables must occupy the same raceway, maintain the maximum separation between cables as possible.
32. All items of voice and data equipment, including wires, cables, fibers and their respective terminations shall be identified according to EIA/TIA-606A standards and UT Standards (see Annex "A").
33. Wire and cable identification shall consist of self-laminating markers, and all other identification shall consist of high-performance materials.
34. These labels must withstand the requirements of UL 969 as outlined in the TIA Standard.

35. All horizontal and backbone subsystem cables shall be labeled at each end.
36. Label all 48-position patch panels with pre-printed labels enclosed in self-adhesive clear strips.
37. Patch panel labels shall be printed with the associated user data jack number per the UT Standard.
38. Install all patch panel, rear-mounted, 110 "stuffer" cap modules in accordance with manufacturer's recommendations.
39. Label all 66 connector blocks with pre-printed, color-coded labels, to be detailed on Engineering Drawings.
40. Install a permanent clear preprinted laminated label with black lettering (i.e. Brady Label #CL-311-621, LAT-7-722-10 or Owner approved equal) on each data/communication outlet faceplate.
41. The faceplate and cables shall be labeled with the "location identifier" as per the UT Standard as directed by the Owner. Reference EIA/TIA-606 Telecommunication Administrative Standard.
42. All labeling, nameplates, legend plates, etc. with proposed text, shall be submitted to the Owner for prior approval. "Dymo Tape Writer" labels, hand written labels, single digit tape markers, etc. are not acceptable.
43. Permanently install an engraved laminated phenolic nameplate on each distribution frame and other major equipment.
44. The nameplate shall be printed with the distribution frame designation number to be indicated on the Drawings. Gothic letter heights shall be 3/8" on distribution frames or Owner approved equal.
45. Permanently label all Data/Telecommunications Wiring Rooms with a permanently installed engraved laminated "phenolic" nameplate. The nameplate to be engraved with the room type and number.
46. The nameplate shall be placed at the entrance to the Wiring Room.
47. All 120 VAC rack mounted power strips provided on the distribution frames, relay racks or data cabinets or other designed power receptacles shall be provided with a permanently installed engraved laminated "phenolic" nameplate.
48. The nameplate to be engraved with the power distribution panel and circuit number that the receptacle is served from. Nameplate to be similar to above, with 1/8" gothic print letters.

49. The Associate shall locate and detail all backboards, racks, cabinets, connectors, cable, etc. for the voice/data system.
50. The voice Wiring Room shall contain the mechanical terminations for the horizontal workstation wiring system and the backbone wiring system.
51. The voice Wiring Room shall provide facilities (space, power, grounding, etc.) for the passive (cross connect, patching) and active devices used to interconnect the two systems.
52. The Data Wiring Room will contain data patch panels for the cross connection of the system. The Wiring Room shall provide facilities for the passive and active devices used to interconnect two or more portions of the backbone wiring system.
53. The data wiring closet will also contain the network electronics. These devices will be provided and cross connected by others.
54. The Voice Communication Wiring Room shall contain the sub, intermediate or main distribution frames. Rooms shall be laid out in logical sections, grouping cross connections or similar classifications together.
55. Sections may be as small as a single mounting frame or as large as multiple mounting frames. Sections are to be combined such that cross connect wire "flows" between areas and the length of cross connections is minimized.
56. In the Data Wiring Rooms, open bay, 19" wide, equipment racks should be installed such that rear access is available for installation and maintenance.
57. Racks and cabinets shall be bolted to the floor using anchors in concrete floors and toggle bolts through raised flooring.
58. The tops of the racks should be securely braced from the wall from behind or from structural steel from above.
59. Freestanding data cabinets shall be bolted to the floor using anchors in concrete floors and toggle bolts through raised flooring.
60. Wall mounted relay racks or data cabinets shall be mounted to the wall using concrete anchors or through bolts depending on the surface and structure.
61. All racks and cabinets shall be bonded to the communications system ground riser.
62. All cable trays shall be securely bolted and installed in accordance with manufacturer's recommendations.

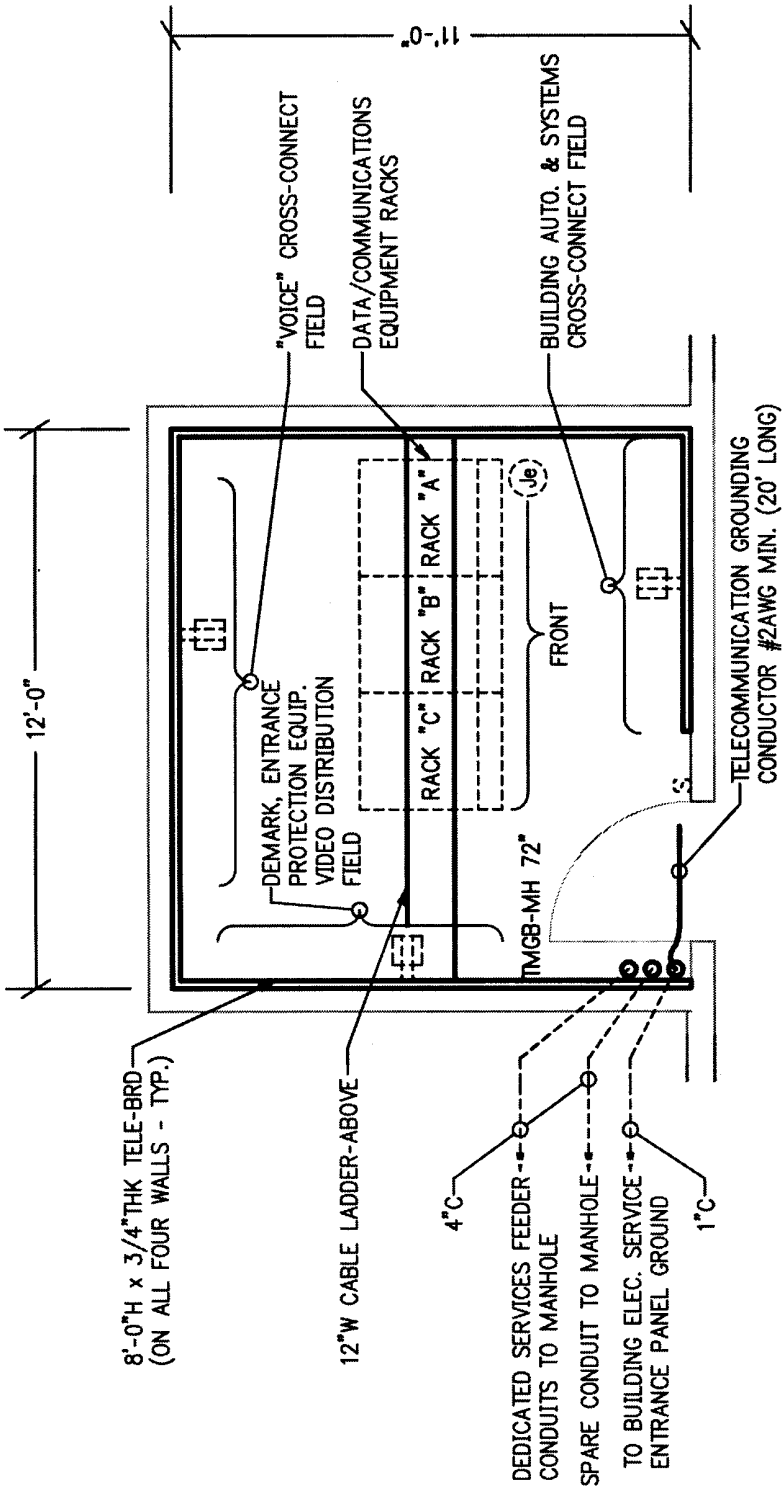
63. The Equipment Room/Wiring Room may include data and telecommunication service entrance equipment, surge protection, splice enclosures, private branch exchange (PBX) equipment, etc.
64. Provide a minimum of 12" clearance from the corner to the wall mounted 66M-block distribution frame, locate the top of the frame a maximum of 74" off the floor and the bottom of the frame a minimum of 34" off the floor.
65. All "voice" station cables, telephone riser and tie cables shall enter the wall mounted 66M-block distribution frame at the bottom left.
66. Cross connections to the 66M1-50 blocks shall be made following the standard AT&T procedure of routing the conductors between the posts and across the top of each group of pins, not down between pins.
67. All data racks for new installations shall be freestanding racks with a minimum of 36" working clearance on both sides (front and back).
68. Wall mounted data racks shall be used in retrofit applications only.
69. Data/Communication Rooms shall be laid out to allow rack space for the present cabling infrastructure requirement, present networking electronic equipment requirement, 50% future growth or space as required, equal to one (1) data drop per student per classroom, whichever is larger.
70. Associate to indicate all conduits and required installation hardware and note on detailed Engineering Drawings.
71. Wiring Room layout guidelines and recommended perimeters are to be described and illustrated in the detailed Engineering Drawings.

PART 9 – TESTING

- A. Upon completion of the cable installation, the Associate shall oversee, witness and supervise as required, complete cable certification testing as per the specifications.
 1. The Associate shall review and approve Contractor provided shop drawings and/or catalog sheets describing the proposed fiber optic and cable test equipment; and calibration procedures prior to beginning any testing as per specifications.
 2. The Contractor shall provide a minimum of 48-hour prior notice to the Associate before commencing cable testing.
 3. The Associate shall, at his discretion, observe any and/or all cable testing procedures.
 4. Cable testing procedures shall be acceptable to the Owner.

5. Cable certification readings shall be used to determine the acceptability of the installed cabling system. EIA/TIA-568B guidelines will be utilized.
6. Contractor to reproduce the sample test report included in the specification for the cable type, or an Associate accepted equal.
7. Test reports shall be completely and legibly filled out, dated and signed by the person performing the tests.
8. The completed forms shall be submitted to the Associate for review and acceptance.
9. The above described testing procedure is the minimum acceptable.
10. Each voice/data/CATV communication outlet and each backbone cable shall pass a complete "active" operational test as performed and accepted by the Owner.
11. Any outlet, cable or component not satisfactorily passing either the "static" cable tests or "active" operational tests or failing to meet quality installation standards as described in the specification, shall be repaired and/or replaced.
12. Prepare complete cable test reports for all installed cables for review and acceptance by the Associate prior to acceptance of the cabling system.
13. A copy of the final completed and reviewed cable test reports shall be enclosed in clear vinyl protective covers and posted in the wiring closet and/or as directed by the Owner for use and reference by the Owner.
14. **Submit for approval only tests performed on cables which have been completely installed, terminated and visually inspected.** All connectors are to be installed, conductors terminated, faceplates installed and mounted, cable routed, bundled, etc.
15. Submit for approval, only test reports which indicate full compliance with minimum acceptable standards and specifications. Marginally acceptable test results, as indicated by some test equipment manufacturers as within a 15% Fault Anomaly Threshold, or other notation will not be acceptable.
16. It shall be recognized that the available programmable micro-computer based automatic scanner test equipment for copper media, and the fiber optic power meter test equipment described is limited in its ability to completely test all pertinent parameters of an acceptable cabling installation and as such, **a "pass" test result will not be the determining criteria for acceptability of an installation which does not otherwise meet the standards and intent of this specification and the Engineering documents.**

17. Independent system certified testing may be required at the Contractor's expense in the event of non-performance of specified testing procedures and submittals or contested materials and/or installation procedures.
18. The need for independent testing shall be determined and arranged by the Associate.

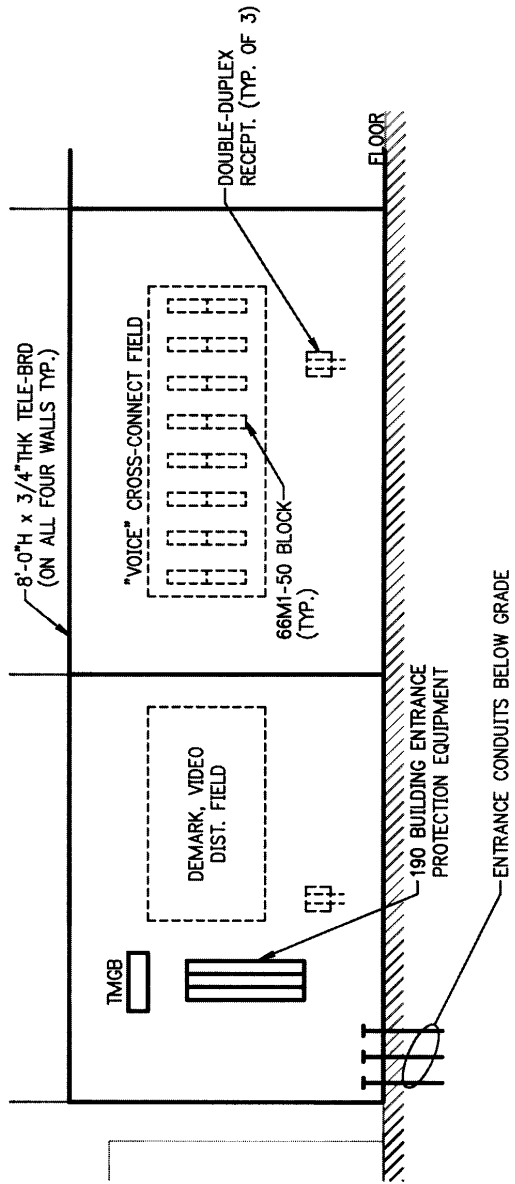
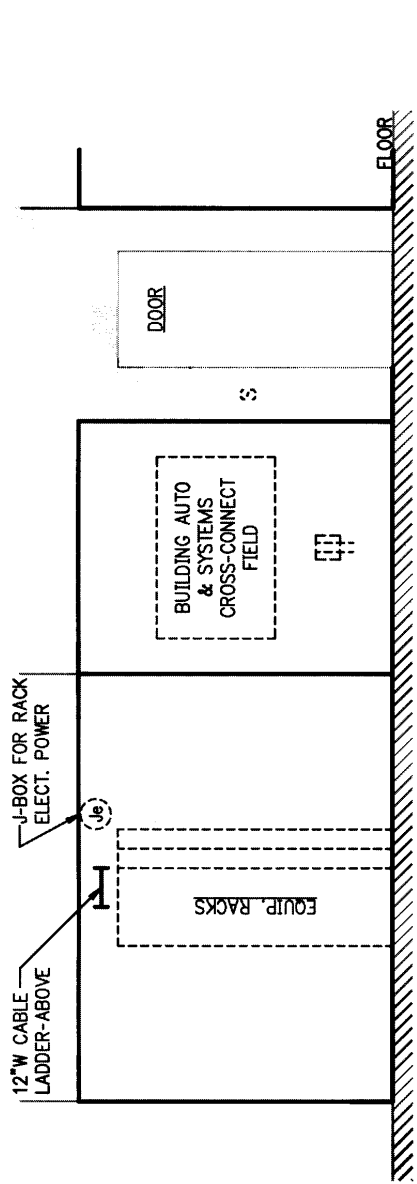


TYPICAL PLAN VIEW

INTER-BUILDING ENTRANCE FACILITY ROOM LAYOUT

FIGURE - 1a

SCALE: NONE
(SHEET 1 OF 2)

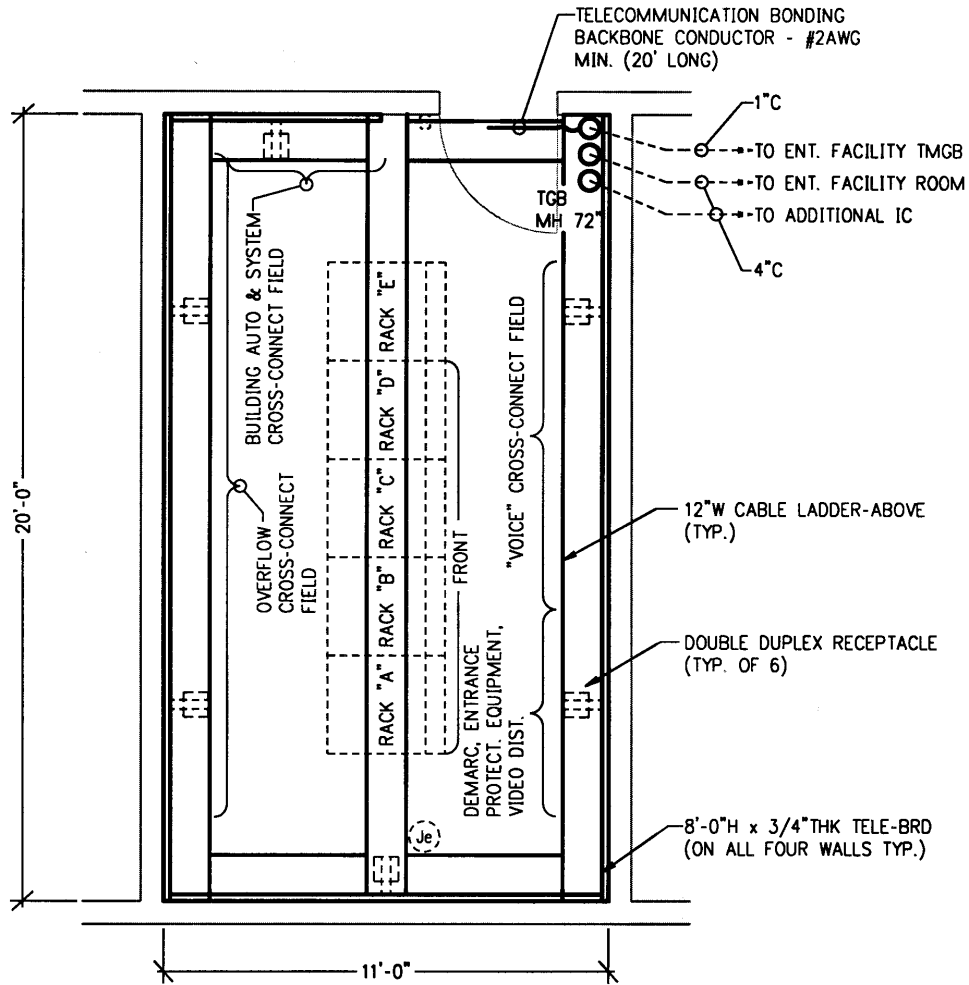


TYPICAL ELEVATION VIEWS

INTER-BUILDING ENTRANCE FACILITY ROOM

FIGURE - 1b

SCALE: NONE
(SHEET 2 OF 2)

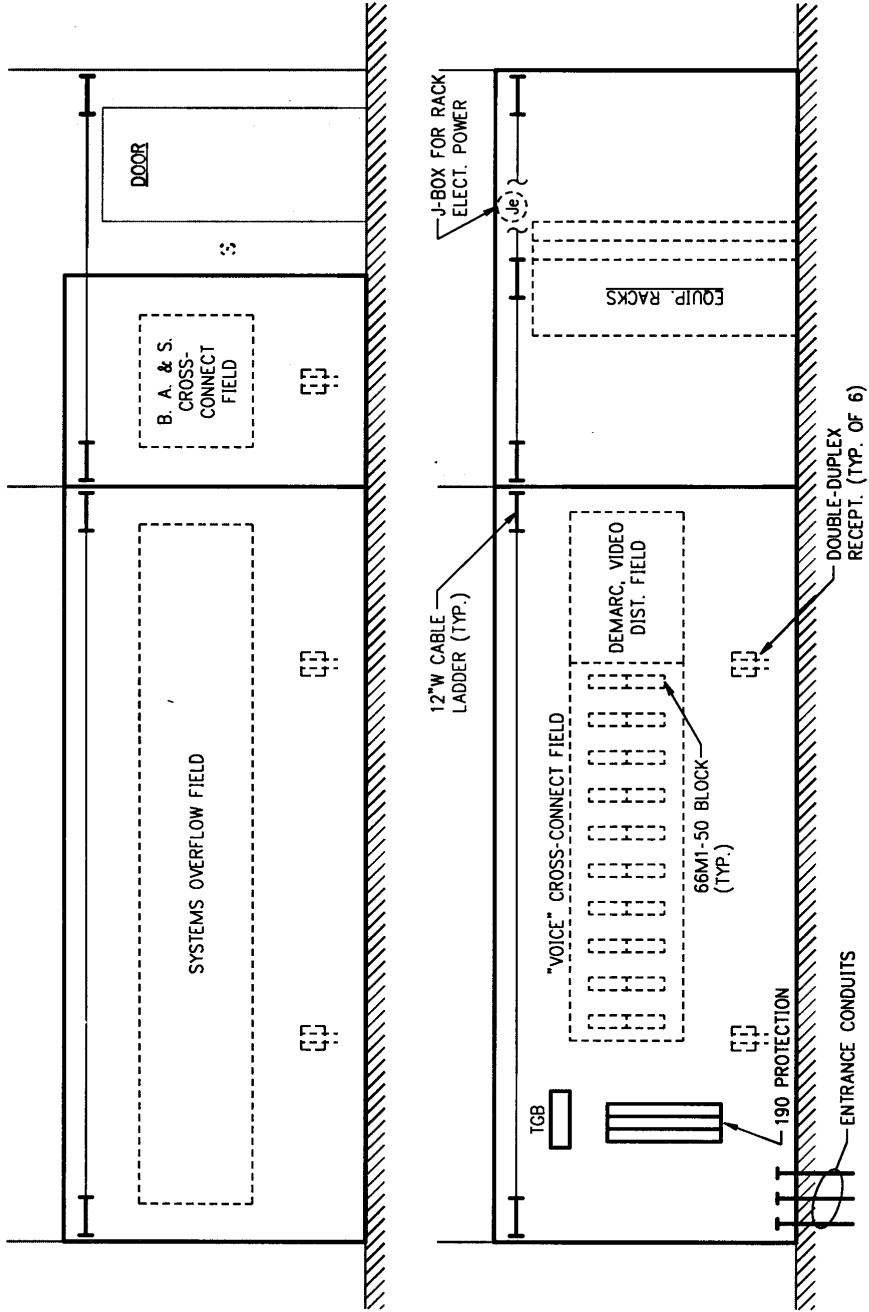


TYPICAL PLAN VIEW

INTER-BUILDING DATA/TELECOMMUNICATION ROOM

FIGURE 3a

SCALE: NONE
(SHEET 1 OF 2)



TYPICAL ELEVATION VIEWS

INTER-BUILDING DATA/TELECOMMUNICATION ROOM FIGURE - 3b

SCALE: NONE
(SHEET 2 OF 2)

END OF ANNEX "E"