# APPENDIX G

# Telecommunications Building & Network Standards

# Telecommunications Building & Network Standards

## 1. Expectations

1.1. This set of standards outlines the requirements new building constructions and building remodel projects as it pertains to Telecommunications and its related components.

1.2. The City's MIS department will be the subcontractor for providing all communication services to new construction and remodeling projects. The NetComm Operations Manager or their designate will serve as the subcontractor MIS project manager. It is expected that all decisions pertaining to communications for new and existing facilities will be addressed through the MIS project manager. The MIS project manager will be a member of the design team for any project involving telecommunications. The MIS project manager will be kept informed of all timeline changes as they occur.

1.3. It is understood that remodel projects may have construction constraints not found in new construction. Such things as pre-existing walls, conduits and wiring and other constraints may make the adherence to these Standards difficult. All exceptions to these Standards will be addressed through the MIS project manager.

## 2. Definitions

2.1. Telecommunications – Includes systems that are used to transmit voice, data, and video.

2.2. Station Outlet – The jack or outlet that is used to connect a printer, server, desktop computer or other end-user device.

## 3. Contractor Requirements

3.1. Contractors responsible for the design, construction and/or installation of telecommunications systems, cabling and infrastructure shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to, data, voice and video network systems. The Contractor shall, at a minimum, possess the following qualifications and abilities.

3.1.1. Registered Communications Distribution Design (RCDD) certified.

3.1.2. The telecommunications distribution design, architecture and rooms will follow the latest BICSI Standards (ANSI/TIA/EIA – 526, 568A, 569, 606, 607, 758). See www.bicsi.org for more information about BICSI and related standards.

3.1.3. Siemon's trained, authorized and certified installers and technicians for Siemon's cabling systems will be used for projects.

3.1.4. The designer(s) and installer(s) shall submit proof of current certifications as part of an RFP proposal response package. Should the RCDD and Siemon's certified installers assigned to a project change during the course of the project, the new designer(s) and installer(s) will need to submit their appropriate certifications.

3.1.5. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques will be used, if such work is required on a project. Personnel must have experience using a light meter and OTDR.

# 4. Design Elements

There are two major aspects of a good telecommunications design: spaces and pathways. Each of these two aspects consists of multiple components as defined below.

## 4.1. Spaces

The term "spaces" refers to the specific rooms dedicated to telecommunication services and/or equipment. These spaces are the Building Service Entrance, Telecommunications Closets and Data Centers. Each has a specific function; however all are very inter-dependent.

### 4.1.1. Building Service Entrance

4.1.1.1. This is the room in which voice, data and video distribution media systems enter the building. These include internal sources such as inter-building connections as well as external sources such as PRPA, Qwest and Comcast. The room is dedicated solely for network infrastructure and associated equipment. This room often serves the dual purpose of being a Building Service Entrance Room and a Telecommunications Closet.

4.1.1.2. The Building Service Entrance is a room utilized to terminate and interconnect outside cable/fiber with the backbone (data and/or voice) cable and/or fiber used throughout the building. It provides facilities for large splice containers, cable termination mounting, and possibly electrical protectors. This space is in addition to any space required for network switching equipment or active system components.

4.1.1.3. This space should be located on the lower level. Design and location of the room should also take into consideration the route and placement of the City's fiber and copper backbone to and from connecting buildings. The room needs to be within 50' of an exterior wall.

4.1.1.4. The minimum floor space requirements are 10 feet x 10 feet. Additional space may need to be provided than what is specified above if this room is expected to double as a Building Service Entrance and a Telecommunications Closet, The MIS project manager will determine if additional space is needed during the design phase of the project.

4.1.1.5. The door to the Building Service Entrance room needs to open outwards.

### 4.1.2. Telecommunications Closet

4.1.2.1. The Telecommunications Closet is used to house telecommunications equipment intended to service users throughout the building. This type of equipment

commonly includes phone systems, network equipment, video distribution systems, racks, patch panels and cabinets. The Telecommunications Closet is the space that also supports the cable, fiber, and the equipment necessary for transmission between the building's backbone system and the station outlets.

4.1.2.2. Although this space may incorporate the space requirements of the Building Service Entrance by increasing the size of the room, it must be designed as a true equipment room in terms of its support environment. The optimum temperature of this space is 70°F. It is important to note that some of the telecommunications equipment, which may be placed in this space can only function in an environment that is between 60°F and 72°F with a relative humidity range of 10% to 85%, non-condensing. Anything outside of these ranges will cause damage to those units. It is important to work with the MIS project manager to determine the exact specification required for this space as equipment can vary from one closet to another.

4.1.2.3. The air handling system for equipment rooms must be designed to provide positive air flow and cooling 24x7 including times when the building air system is shut down or turned down during non-business hours. This may require separate air and/or cooling systems. If this room is to be used as a central communications hub, then the air handling system should be connected to the buildings backup power generation system.

4.1.2.4. The size of this room can vary depending on the communication requirements of the building but are typically 10' x 10'. The actual dimensions will be determined by the MIS project manager.

4.1.2.5. The Telecommunications Closet should be located near the center of the building, but no farther than 290 feet (horizontal cable pathway distance) from the furthest station outlet. The average distance should be in the 100 to 150 foot range. There may be a need for more than one Telecommunications Closet per floor based on the design of the building.

4.1.2.6. The Telecommunications Closets must be located directly above one another in a multiple story building. If the entire space cannot be located in-line, space will need to be provided for the in-line placement of backbone (riser) conduits. If a multi-story building requires two or more rooms on every floor, each series of rooms must be stacked one above the other. Multiple rooms located on the same floor must be interconnected with conduits or cable tray.

### 4.1.3. General Requirements – Building Service Entrance and Telecommunications Closets

4.1.3.1. The room must be equipped with ceiling space that does not contain water pipes, air conditioning ducts, drainage pipes or other utilities crossing through. The exception to the water pipes are those pipes installed in conjunction with a multi-stage pre-action fire suppression system where the water lines are typically dry as well as air conditioning ducts for cooling this room.

4.1.3.2. Limit the possibility of flooding by configuring the surrounding floor area to drain accidental leaks before the telecommunications closet becomes involved.

4.1.3.3. Utilize a pre-action fire suppression system for coverage of this space. This should be linked to the equipment electrical panel to disconnect power in the event of system activation. All related water lines are to be dry by default.

4.1.3.4. Locate the equipment room away from potential sources of interference such as electrical power supply transformers, motors, generators, elevator equipment or other such devices that has the potential for creating electromagnetic fields.

4.1.3.5. Equipment rooms must be dedicated rooms and are not to be shared with other functions such as a janitorial closet, electrical closet or storage room. Fire and other alarm equipment must be located in a separate room. Placement of any non-telecommunications equipment or room sharing in these rooms must be approved by the MIS project manager.

4.1.3.6. One wall must be covered with 3/4" A-C plywood, painted with white fire-retardant paint (not fire retardant plywood unless required by code) mounted vertically starting 2" above the finished floor and secured to the walls. All plywood panels must be mounted in contact with one another leaving no gaps between the sheets. The MIS project manager will designate the location of these panels.

4.1.3.7. Sufficient overhead lights shall be installed to provide a minimum of 540 lux (50 foot candles) illumination measured 3' above the finished floor. These lights must be separately switched within the room and must be mounted a minimum of 8.5' above the finished floor.

4.1.3.8. The door to the room must be a minimum of 36" wide by 6'8" high and must use a key lock that is keyed to the MIS Telecom Primus Grand Master. Electronic locks are to be used when the facility is wired and equipped to support electronic door locks. The door will need to open outward.

4.1.3.9. An electrical ground as defined by building codes must be provided on a 6" bar mounted 6" above the finished floor. This grounding bar should be connected to building steel (main building ground electrode), a separate concrete-encased electrode, or a buried ring ground with 00 copper wire using a short feed to the actual ground. It should be noted that NEC stipulates that communications cable shields be grounded as close as possible to the entrance into the building (NEC Article 800-4).

4.1.3.10. A minimum of two 20 Amp, 110 volt AC quad electrical outlets, each on separate circuits, shall be installed in each room. At least one of these dedicated circuits will feed power that is located on the Telecommunications racks. Circuits providing power to the racks will need to be suspended from the ceiling above the racks or installed into the rack or cabinet as designated by the MIS project manager. Additional quad port power outlets will be placed in the wall and/or in racks or cabinets in quantities and locations designated by the MIS project manager. The MIS project manager will determine current loads and design how

many circuits are needed.

4.1.3.11. All conduits entering the building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room. All conduits leaving the entrance room for other portions of the building will be fire-stopped after the installation of cable.

4.1.3.12. The room shall be equipped with a constant positive air flow sufficient to provide a minimum of two air changes per hour. If a room serves as both the building Service Entrance and a Telecommunications Closet, it may need to be equipped with a separately controlled HVAC. Once the design of the building is known and customer requirements have been fully developed, the MIS project manager can determine whether additional HVAC equipment will be required.

4.1.3.13. Rooms will need to have anti-static vinyl compositional tile. The tile should be light in color. A sealed cement floor is also acceptable. At no time is carpeting to be installed.

4.1.3.14. Do not install a suspended acoustical tile or other false ceiling.

4.1.3.15. The permanent walls of the room need to extend to the rafters of the hard ceiling in order to prohibit access to the room by climbing over walls from an adjoining room.

4.1.3.16. Data Center

4.1.3.17. Data Centers will house various computer systems including servers, storage and other devices in addition to network, voice and video related equipment and systems. Their HVAC systems are sealed and separate from the rest of the building. Data Centers will also have independent power service to the room along with room-based UPS systems. Multi-stage pre-action fire suppression systems utilizing gas and water are used.

4.1.3.18. There will be situations where a department may house computer systems in rooms in their work areas. These rooms do not constitute data centers and are not to be considered as such.

4.1.3.19. General Requirements

4.1.3.19.1. The data center room should not have any windows on exterior walls.

4.1.3.19.2. Designers and installers of the data center are to be certified as being skilled and knowledgeable with data center design and construction. All data center designs and requirements are subject to the approval of the MIS project manager.

4.1.3.20. Security Requirements

4.1.3.20.1. Access to the data center is done via key and electronic lock. The key is not to be a part of the building master key system and is also separate from the

MIS Telecom Primus Grand Master key.

4.1.3.20.2. An electronic lock using fob's are used on all doors leading into the data center.

4.1.3.20.3. The data center is to be considered a restricted access facility. As such, control of the master key needs to be strictly controlled. Access to the master key needs to be maintained in coordination with the MIS project manager during the course of the project and then to the designated person within MIS once the project is completed.

4.1.3.20.4. The access control list for the electronic lock including additions, deletions, and logging needs to be accessible by MIS.

4.1.3.21. Floor & Ceiling Requirements

4.1.3.21.1. All floors are constructed using raised flooring using 24" x 24" tiles with a minimum of 10" in the plenum space beneath the tiles.

4.1.3.21.2. The tiles are to be capable of supporting a minimum of 1000 pounds per tile.

4.1.3.21.3. The ramp from the base floor to the raised floor is to be capable of supporting a minimum of 2000 pounds.

4.1.3.21.4. There is to be a drain in the low point of the base flooring to remove any water that may accumulate beneath the raised floor.

4.1.3.21.5. There is to be a minimum of one slotted or vented floor tile for each ton of cooling. The vents need to be adjustable in order to control the floor of air through the tile.

4.1.3.21.6. There isn't a preference of whether or not the ceiling is a suspended ceiling or not.

4.1.3.22. Fire Suppression

4.1.3.22.1. A multi-stage, pre-action fire suppression system that is isolated to the data center is to be configured and installed. This includes a gaseous fire suppression system as well as water suppression.

4.1.3.22.1.1. The water lines are to be dry water lines until the third stage.

4.1.3.22.1.2. The sprinkler zones are to be isolated to each individual sprinkler head.

4.1.3.22.2. The first stage is to initiate visual and audible signals that sensors have been triggered. This is also connected to the building's main fire panel and alerts PFA.

4.1.3.22.3. The second stage is to change the visual and audible signals to indicate that a second sensor has been activated.

4.1.3.22.4. The third stage is the discharge of a gaseous fire suppression agent 30 seconds after the second stage has been reached.

4.1.3.22.4.1. This stage will change the visual and audible signals to indicate that the gaseous fire suppression agent is being discharged.

4.1.3.22.4.2. The gaseous fire suppression agent is to be certified for occupied spaces.

4.1.3.22.4.3. The water fire suppression system is altered to allow for the flow of water into the water lines. These water lines were previously "dry" lines.

4.1.3.22.4.4. The power to the data center is to be terminated at the commencement of the third stage.

4.1.3.22.5. Due to fire suppression requirements, the data center room HVAC and air handling systems need to be sealed off and separate from the rest of the building.

4.1.3.22.6. Detection sensors, such as photo and ion, are to be located in the ceiling and in the plenum space beneath the raised floor.

4.1.3.22.7. There needs to be manual fire suppression discharge options as well as manual override options inside the data center.

4.1.3.23. Electrical Requirements

4.1.3.23.1. The power supplying the data center is fed through an uninterruptible power supply (UPS) that provides continuous power in the event of a general power failure.

4.1.3.23.2. The UPS is also configured to filter and stabilize the power from the primary source.

4.1.3.23.3. The UPS is also supplemented by an independent power generator such as a diesel generator.

4.1.3.23.4. The battery racks for the UPS do not have to be in the data center. The battery racks should be located in a room where the floor is at grade. The batteries can be of very significant weight, in the range of several tons. The building structure where the battery racks are to be housed needs to take into consideration the initial battery capacity plus the potential for expansion.

4.1.3.24. HVAC Requirement

4.1.3.24.1. The data center has to be kept to a temperature of 68$^{o}$F with the average temperature in the 66$^{o}$F to 68$^{o}$F range. The size of the room, the equipment that will occupy the room, and anticipated growth will determine the tonnage

required.

4.1.3.24.2. Relative humidity needs to be maintained between 48% and 52% non-condensing at all times.

4.1.3.24.3. The data center HVAC system is a system that is independent from the rest of the building.

4.1.3.24.4. HVAC systems are to be designed and configured to include alerting capabilities for temperature, humidity and system failure events. The alert systems need to be able to send pager and e-mail notifications as well as audible alerts within the data center.

4.1.3.24.5. The design and layout of the data center including the HVAC unit will need to take into consideration the location of equipment cabinets. The cabinets will be arranged to create hot and cold alleys. The HVAC unit will need to be located in such a way as to optimize airflow and the cooling of equipment.

## 4.2. Pathways

Pathways refer to the facilities and supporting structures used to transport telecommunications media from one location to another. It is important to think in terms of pathways as more than simply conduit and to properly design these portions of the distribution system.

### 4.2.1. Inter-Building Distribution System

4.2.1.1. This distribution system includes the conduit, tunnel system and related support structures between buildings.

4.2.1.2. The designer must consider where the distribution system originates and determine what is required to make it meet the needs of the new construction.

4.2.1.3. Although most design projects for individual City buildings do not specifically address communications outside the building, care must be taken in developing plans for making these connections. In some cases a separate construction and/or installation contract might be required to provide adequate pathways up to the point at which the building project can be interconnected. In general, the following points should be observed when developing plans for communication feeder facilities:

4.2.1.3.1. Anywhere from four to nine conduits ranging in size from 1.5” to 4” are required to feed an average building. These conduits will be used for City fiber optic and copper cabling as well as third party cables such as Comcast and Qwest.

4.2.1.3.2. The numbers, size and location of conduits will be determined by the MIS project manager, Utilities fiber manager and the cabling needs of third parties such as Comcast and Qwest.

4.2.1.3.3. All telecommunications conduits entering the building will terminate outside the building in one or more telecommunications vaults. The number,

placement, and type of telecommunications vaults will be determined by the Project Manager and will depend upon which utilities are involved, the total number of conduits entering the building, the landscaping or hardscaping around the building, and other factors specific to a given site. Ideally, the vault will be located in a grass or landscaped area. By example, a typical fiber optics vault would be 30"x48"x18" deep constructed of polymer concrete and mounted flush with the ground. The bottom area of the vault would be bare ground covered with pea gravel or a similar covering. All conduits would enter from under the bottom of the vault and extend approximately 4"-6" above the gravel ground cover. All conduits will contain mule tape and will be capped to prevent debris or animals from entering the conduits. The vault cover will be made of polymer concrete, traffic rated to 20,000 pounds, non-skid surface, with corner bolts or some other type of locking mechanism. Other vault types or configurations may be substituted at the discretion of the Project Manager. The area around any vault will be filled and tamped to prevent erosion, sinking, or washout, and will then be landscaped to blend in with the surrounding area. If the vault is located in a vehicle traffic area, a 6"-12" space surrounding the vault will be filled with concrete to a depth of 18" to further stabilize the vault. If the vault is located in a pedestrian area, care must be taken to avoid any trip hazards (raised edges). Specific utilities such as telephone or cable TV may have their own vault requirements.

4.2.1.3.4. The entrance conduits must be designed to allow the placement of various types of cables including large copper cables, fiber optic cable (within inner duct), and coaxial cables.

4.2.1.3.5. Conduits can have no more than two $90^{o}$ bends with a minimum bend radius of 2 feet. Fiber optic cabling may require a larger radius, typically ten times the outside diameter of the fiber cable.

4.2.1.3.6. The entrance conduits should enter the service entrance spaces either directly from outside, perpendicular to the outer wall at a level above 8’ or through the floor parallel with the outer wall keeping the conduit bend radius greater than 48”. Variances from the 8’ requirement will need to be approved by the MIS project manager. The entrance conduits must be protected from potential water damage and from vehicles running into them. Below grade building entrances with sufficient conduits are much preferred as that avoids the poly-to-steel conduit transition at the side of the building, a box on the building and conduit exposed to view and possible vandalism.

### 4.2.2. Building Backbone Raceway (Riser and Tie)

4.2.2.1. The risers are pathways which connect all telecommunications rooms and space throughout an individual building. They may consist of conduit, cable trays, or sleeves to allow for cabling to enter and exit the telecommunications rooms.

4.2.2.2. The term “backbone raceway” replaces both the term “riser” and “tie” conduit to reflect the need for both horizontal and vertical pathways in a building distribution system. In general, this is the path used for placement of

telecommunications media between the Service Building Entrance room, the Telecommunications Closets, and the station outlets. These pathways must typically support copper, fiber optic, and coaxial cables serving equipment and should be cross-connected to station outlets located on each floor of the building. At no time are "j-hooks" to be used.

4.2.2.3. All backbone conduits and sleeves must be 4" in diameter. Conduits must be designed with no more that two $90^{o}$ bends. The minimum number of vertical backbone (riser) conduits is 5. However, that number can change as the building customer requirements become known.

4.2.2.4. General Requirements:

4.2.2.4.1. Pathways shall be designed and installed to meet applicable building and electrical codes or regulations including the applicable TIA/EIA Telecommunications standards.

4.2.2.4.2. Grounding and bonding of pathways shall comply with applicable codes and regulations.

4.2.2.4.3. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.

4.2.2.4.4. The number of cables placed in a pathway shall not exceed manufacturer specifications nor will the geometric shape of a cable be affected.

4.2.2.4.5. Pathways shall not be located in elevator shafts.

4.2.2.4.6. Sleeves are to be used in backbone vertical pathways. Sleeves should extend a minimum of 2" above the floor space. If the room is equipped with a raised floor then the 2" shall be above the base floor and not the raised floor. The sleeves are also to be 4" below the true ceiling in rooms where conduit is running from a room on the floor above. All sleeves are placed to provide short and straight pathways between floors.

4.2.2.4.7. Conduits used to interconnect the Building Service Entrance and/or Telecommunications Closets should be placed above the ceiling with no more than a total of two $90^{o}$ bends. Do not angle these conduits down into the termination space. Fix the conduit 4" to 6" inside the room at a right angle to the wall. All metal conduits must be fitted with a collar or end bushing to eliminate damage to the cables during pulling.

4.2.2.4.8. Pull boxes shall be placed in conduits runs which exceed 100' or in situations which require more than two $90^{o}$ bends. Such pull boxes must be located so as to provide free and easy access in straight sections of conduit only and must be installed to allow cable to pass through from one conduit to another.

4.2.2.4.9. Two 2" conduits must be dedicated from a sealed junction box on the roof of the building in a direct line to a specified Telecommunications Closet for use as an antenna access point. In addition, a separate earth ground must be provided at the roof junction box point and the antenna conduit must be

grounded separately from the isolated ground in the equipment room. A 1" conduit terminating in a weatherproof duplex box must be provided from the roof to the closest electrical panel for electrical power.

4.2.2.4.10. All riser sleeves must be fire stopped and sealed following code and manufacturers instructions.

### 4.2.3. Horizontal Cabling

4.2.3.1. The horizontal pathways between the Telecommunication Closet and the station outlet locations receive the heaviest usage and the most complaints of any component of a telecommunications distribution system. It is an area with a significant number of alternatives and one which frequently fall victim to budget cuts. When working on this issue, the building designer should identify methods for placing and supporting both the initial station cable and future cable additions.

4.2.3.2. The designer should assume the City will install plenum rated station cables because of the minimal cost difference over non-plenum rated cable, improved electrical characteristics, and the increase flexibility of not installing fixed "home run" conduits to each station outlet.

4.2.3.3. Every Telecommunications Closet must provide a minimum of twice the amount of horizontal pathway access as is required to support the initial installation.

4.2.3.4. Any outlet separated from the main horizontal support system, such as a tray, by a fire or smoke partition must be provided a rated pathway such as a sleeve which can be fire-stopped after cable is installed or an enclosed conduit or raceway directly from the outlet to the tray side of the partition.

## 5. Design Issues

5.1. The subsection provides an overview of the minimum telecommunications infrastructure requirements in specific area of new constructions. It is intended to be used during program planning.

### 5.2. Office Spaces

5.2.1. Office spaces range from the standard one-person space to multi-room office suites and all need to be suitably equipped to access various City telecommunication resources. All offices must be designed to support multiple voice and data outlets situated to allow changes in furniture layouts.

5.2.2. Newer buildings and installations may be using data lines for voice connectivity and this will alter the combination of outlets in office spaces. The MIS project manager will determine the number of station outlets required during the design of the facility.

5.2.3. All offices must be equipped with a minimum of 2 duplex communication outlets, preferably on opposite walls and near electrical outlets. Larger offices and open suite areas should have multiple communication outlets with an average of 2 per 75 square feet

of floor space. There should be no less than one at every other electrical outlet. There may also be staff and office locations that will need to be provided with an additional video or coaxial outlet. Smaller offices or rooms may need fewer outlets. The MIS project manager will work with the customer to determine locations and the number of station outlets.

5.2.4. The furniture plan has to consider its location in reference to station outlet locations. Furniture should not be placed in such a way as to prevent access to station outlets and nearby electrical outlets.

## 5.3. Station Outlets

5.3.1. New construction or remodel projects where new walls are being installed will require that telecommunications station outlets be installed similar to electrical outlets with an outlet box mounted in the wall and vertical conduit going up the wall ending above the false ceiling space. In areas with a hard ceiling, the conduit should be extended to an appropriate pull box or false ceiling location. The telecommunications cabling will then be installed through the conduit to the station outlet.

5.3.2. New construction will require that wall outlets be installed at the same height as electrical outlets. Exceptions could include lab areas that may require outlets above work surfaces. Wall phone units may also need to be installed according to ADA regulations. This section also applies to remodel projects where new walls are being constructed.

5.3.3. In remodeling projects that include the installation of new station cabling in existing walls without pre-existing conduit, an outlet box will be installed and the cable fished down the inside of the wall as appropriate.

5.3.4. Vertical drops and exterior cable raceways on the walls will not be used in new construction unless dictated or approved by the Facilities project manager and the MIS project manager. Remodel projects may require exterior cable raceways due to problems with existing construction and will need to be approved by the Facilities project manager and the MIS project manager.

5.3.5. Locations where the station outlets are to be installed in office furniture or cubicles need to be identified. The MIS project manager, cabling installer and the Facilities project manager will need to ensure that proper outlets, furniture interfaces, and cable length are provided for proper termination in the furniture.

5.3.6. Sometimes it is not possible to reach station outlet locations via the wall or ceiling and may need to be installed via the floor. This is especially common in cubicle areas. In these cases, appropriate size and quantity of conduit will need to be installed in the floor and in the case of the ground floor, installed before the slab is poured. An alternative to conduit in the floor is a raised floor office area.

## 5.4. Conference Rooms

5.4.1. Conference rooms should be equipped with a minimum of 1 duplex voice/data outlet per wall, two video outlets on opposite walls.

5.4.2. The MIS project manager will work with the customer to determine the optimal number of station outlets and where they will be located. These locations may include the wall, floor or terminated in furniture such as conference room tables.