CAMPUS TECHNOLOGY STANDARDS

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THE SEXTANT GROUP, INC.

AV ✦ IT ✦ Security ✦ Acoustics ✦ Lighting

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1. INTRODUCTION

This document provides information on Technology Standards for the College of the Desert. The information in this report has been developed through meetings, correspondence, and experience with administrative personnel, faculty, and staff from College of the Desert and EIS Professionals.

This document addresses the following items:

- Audiovisual Systems
- Digital Signage Systems
- Telecommunications Systems Design
- Structured Cabling Systems
- Surveillance
- WLAN
- Outside Plant
- Network Equipment
- Telecommunications Spaces
- Communications Pathways
- Labeling Conventions
- Grounding And Bonding
- Public Address

This document describes technology functional capabilities for anticipated facilities that will occur in multiple buildings spanning the entire District. While it is anticipated that each project will have specific circumstances and needs of the users, this document establishes the foundation of requirements. All areas of divergence must be discussed through the proper project channels and documented under the scope of work guidelines set forth for each project.

This document establishes standards for classroom and conference rooms to ensure consistency in the audiovisual (AV) systems across all space types. Consistency of AV systems will allow users to be immediately familiar and comfortable with using a standard audiovisual system, and allow the AV systems to serve as an instructional aide rather than an instructional obstacle or distraction. Consistency also aids significantly to the smooth operation, support, and maintenance provided by campus multimedia technology staff.

The room infrastructure design standards outlined in this document also ensure adequate flexibility to accommodate future expansion.

This document describes AV systems functionality for the following spaces:

- Typical Classroom
- Typical Dual Projection Classroom
- Typical Enhanced Media Classroom
- Typical Conference Room with Flat Panel
- Typical Conference Room with Projection

2. FACILITY CONSIDERATIONS

2.1. Technology Deployment

2.1.1. Infrastructure Requirements

The provision of the audiovisual dedicated infrastructure to support both "day-one" and future audiovisual systems represents the minimum level of audiovisual deployment. Audiovisual system infrastructure includes low-voltage cable containment, power and data requirements, equipment heat-load management, and lighting and structural support systems. Conduit infrastructure requirements for classrooms, conference rooms, and other presentation spaces are detailed below.

In addition to this infrastructure, projection screens are also provided to facilitate image display from mobile or installed projection devices.

2.1.2. Architectural Integration Guidelines for Multimedia Rooms

The information in this section is provided as reference for the project's architect, engineers and other consultants to help establish an initial understanding of how integrated technologies will impact architectural designs and construction. Specific equipment and architectural integration requirements will be identified separately in the Program documentation for the particular project.

2.2. Architectural

2.2.1. Room Types and Sizes

The technology standard for a typical classroom on campus is based upon a room approximately 750 – 900 square feet with seating for between 35 and 45 students. The minimum ceiling height for this type of space is 10 feet. Rooms that need to include more than this seat count can be accommodated with larger projection screens, brighter projectors, and additional overhead ceiling loudspeakers.

The technology standard for a typical conference room on campus is based on a room approximately 250 square feet and seating for between 8 and 10 persons. The minimum ceiling height for this type of space is 9 feet. Depending on the content being presented, either a flat panel display or a projection system will be preferred. Technology standards are provided for both configurations.

2.2.2. Support Structures for Equipment

Coordinate location of ceiling mounted projectors, projection screens, loudspeakers, etc. with other building systems (e.g., fire sprinklers, light fixtures, HVAC), structure and architectural features of ceilings. Blocking is to be provided at all locations where equipment is mounted at wall brackets (e.g., cameras, monitors, loudspeakers). Refer to equipment plans for specific locations.

Floor standing equipment racks will be equipped with casters to allow the racks to be pulled away from the wall for rear equipment service access. Any seismic bracing required will be removable to facilitate movement of the racks for service.

Recessed projection screens installed in the ceiling will require structural support. Depending on the specific screen used and applicable building codes, it may be necessary to build a fire-rated enclosure around the screen assembly.

2.2.3. Accessibility

Physical access to audiovisual facilities, including equipment and projection rooms, will be provided per requirements of the Americans with Disabilities Act (ADA) and other applicable codes and standards.

Facilities without electronically reinforced sound systems call for portable assistive listening system as part of campus and ADA requirements. Coordinate placement of assistive listening transmitters where they occur to ensure uninterrupted coverage of audience areas. Facilities with electronically reinforced sound systems require built in infrared style assistive listening systems. As a part of campus standards, all assistive listening receivers are to be checked out from the DSPS offices.

2.2.4. Architectural Finishes

Refer to the following section, *Acoustics*, for acoustic finish recommendations in audiovisual spaces.

In facilities using video cameras (Typical Enhanced Media Classroom), color, pattern and other characteristics of architectural finishes within camera view will critically impact camera performance and image quality.

On walls within the field of view of installed video cameras, avoid use of reflective materials, finishes with intensely saturated colors, detailed patterns and heavy textures, which can cause unwanted anomalies in video camera images.

Dark table surfaces are to be avoided in distance learning facilities. Light colored table surfaces will help reflect light up onto faces and improve lighting quality for camera imaging.

2.2.5. Acoustics

Acoustic conditions in audiovisual spaces will critically impact the performance and effectiveness of the audiovisual systems. Therefore, careful consideration must be given to such issues as wall construction, finish treatments, background noise levels (e.g., HVAC) and other factors that will affect the acoustic character and noise levels of the audiovisual facilities.

Instructional spaces must be designed to accommodate intelligible speech throughout the room, including the student seating area, to promote discussion and interaction. The desired acoustical performance of these rooms will have an impact on room geometry, ceiling construction, room finishes, and furnishings. Anticipated background noise levels may require mitigation or attenuation. Any classroom capable of two-way audio communications will require special attention to ensure that audio content is delivered and received at high levels of intelligibility.

Detailed acoustic requirements for audiovisual areas of the project will be as specified by the project's Acoustic Consultant. Audiovisual Consultant will review acoustic designs and recommendations related to areas to confirm compatibility with the audiovisual systems designs.

2.3. Electrical

2.3.1. Power Service & Grounding

Line voltage (i.e., 110/208/277 VAC) power service specified by the Audiovisual Consultant to support audiovisual equipment and related activities will be identified as Technical Power. Unless otherwise noted, Technical Power service will provide a dedicated ground with a separate insulated copper ground wire from each receptacle to a dedicated Technical Power ground bus bar at the electrical panel board. Technical Power receptacles must not be grounded to the building structure.

All construction documentation, including plans and specifications, describing electrical power service associated with the project's audiovisual program is to be engineered and documented by the project's Electrical Engineer. Documentation provided by the Audiovisual Consultant is to be for reference only.

2.3.2. Low Voltage Signal Distribution

All low voltage cabling for audiovisual systems will be routed through conduit, wire ways or cable baskets/trays. Plenum cabling is to be used as required. The project electrical contractor will be expected to install the conduit/raceways required for all audiovisual cabling. Pull wires are to be installed in the audiovisual conduit by the electrical contractor to facilitate later installation of the low voltage cable by the Audiovisual Contractor. All conduits specified to support the systems are to be EMT type. Flexible metal conduit is not to be used unless otherwise approved by the Audiovisual Consultant.

The depth of audiovisual connection boxes and conduit diameters may require non-standard wall depths in some locations. Such conditions will be identified at a future date. Flush floor power distribution outlets and signal connection boxes will be required at locations where connections cannot reasonably be made at wall outlets.

Flush floor electrical boxes will be required at designated locations for audiovisual signal and power connections. The size and density of cabling and connections will preclude the use of standard "poke- thru" type fittings. Recommended specifications for flush floor electrical boxes will be provided in the audiovisual drawings. Where oversized flush floor electrical connections are specified for audiovisual applications, consideration must also be given to the structural and other building design implications.

2.3.3. Low Voltage Remote Control Interfacing

Line voltage powered devices, such as projection screens, motorized window coverings and lighting control systems, that are to be operated by low voltage audiovisual control systems will require interface electronics

between line voltage power and low voltage switching. Such interface electronics are referred to in this document as Low Voltage Interfaces (LVI).

Where low voltage remote control interfaces are required per the Architect and Audiovisual Consultant's recommendations, such electronics are to be specified and documented for construction by the project's Electrical Engineer.

Wherever available, Low Voltage Interfaces are to be provided by the manufacturer of the line voltage device being controlled (e.g., projection screen interface by projection screen manufacturer). Where the manufacturer of a line voltage powered device does not offer a low voltage control interface, a third party interface or standard relay product may be used.

Wherever available, serial digital control interfaces operating on industry standard communications protocols (e.g., RS232, RS422) are to be utilized.

2.4. Lighting

2.4.1. Lighting for Video Cameras

Supplemental lighting is required where video camera systems are installed for use in applications such as video teleconferencing, distance learning and videotape recording. Illumination levels for video camera lighting are to provide illuminance in a range of 40 to 50 foot-candles at the vertical facial plane of the subject.

Provide illumination of background surfaces located behind camera subjects to enhance the separation of the subjects from the background in the camera's view.

Special caution must be taken in distance learning and video teleconference facilities to avoid conflicts between image displays and camera subject illumination. This issue is particularly difficult in distance learning where instructors like to move around the classroom while they lecture, often taking them in proximity to a projected image display.

2.4.2. Lighting for Projection

Where visual image display systems (e.g., monitors, projection screens) are utilized it is imperative that careful consideration be given to the design of room lighting and its impact on the image displays.

Lights in audiovisual spaces are to be circuited to allow fixtures adjacent to projection screens to be turned off during projection. Indirect architectural lighting is to be avoided in rooms with large screen image projection since increased ambient light levels on projection screens will decrease the intensity of projected images.

Light fixtures are to provide maximum directivity of illumination and minimal surface brightness to reduce the opportunity for glare and distribution of stray light onto image display screens.

2.4.3. Lighting of Presenters

Where it is appropriate to provide spotlighting of presenters in audiovisual areas, provide narrow beam lamps in adjustable fixtures. Lighting fixtures providing spotlighting of presenters in audiovisual facilities are to be dimmable.

Spotlighting of presenters should provide illumination from three lighting positions (minimum of two positions) to minimize shadows on the presenter. This is particularly critical where video cameras are being used.

Special precautions must be taken to control lighting where video cameras systems are used in association with projected image displays such as may occur in video teleconferencing and distance learning. Lamp color temperature for video camera lighting is to be in the range of 3,000 – 3,500 degrees Kelvin. All lamps used for video camera lighting within a given room are to be of the same color temperature specification.

2.4.4. Task Lighting

Where direct task lighting is provided in instructional areas and meeting rooms, such task lighting is to be designed to provide appropriate levels of illumination at the work surface with minimal diffusion onto adjacent surfaces in order to prevent deterioration of image display quality. This is particularly critical in facilities utilizing front projection display systems.

It is recommended that source fixtures that provide task lighting at lecterns and presenter stations are to be positioned on the furniture to minimize reflection onto presentation images.

2.4.5. Daylight Control

Where any opening such as windows and/or skylights allow exterior daylight or lighting from adjacent interior spaces into an audiovisual space, blackout window coverings are to be provided.

Standard blinds and sun shading devices are typically insufficient for controlling daylight intrusion in visual display environments. In facilities with direct sun exposure or where the highest degree of presentation quality is required, edge and bottom channels may be needed on blackout shades to prevent light leakage at shade perimeters.

Where a large number of individual blackout shades are provided or in more formal meeting rooms (e.g., boardrooms) or presentation environments, the window coverings can be motorized with remote control capability tied to the audiovisual system controls.

2.4.6. Lighting Controls

Where lighting is controllable through the audiovisual control system, redundant wall-mounted controls are to also be provided per Architect's specification.

Where designated, provide a Low Voltage Interface for remote switching of lights from the audiovisual system in designated audiovisual facilities. (See Low Voltage Remote Control Interfacing). Lighting control equipment and all associated installation, setup and programming is to be provided by the electrical contractor (not the Audiovisual Contractor) per electrical engineer's specifications. Coordinate system requirements and electrical interfaces with the Audiovisual Consultant.

2.5. Furniture & Millwork

2.5.1. Tables

The shape of conference tables are to take into consideration the necessity of viewing displays as well as the presenter and other participants at the table(s). To the greatest extent possible, orient the viewers directly toward the primary presentation area.

Tables used in video teleconferencing rooms are to be shaped to position the meeting participants directly facing the primary camera position. This generally limits the number of primary conference participants to less than eight (8) people. In applications requiring more than eight (8) participants, it is advisable to distinguish between primary participants, secondary participants and observers. This allows a hierarchy for positioning of videoconference participants relative to the camera with minimal compromise in capacity.

Tables must anticipate the need to distribute power and low voltage electrical between equipment used on the tabletop and remote equipment and systems (e.g., computer network, sound systems, controls, etc.). Connections may be provided in the floor below the table or may be extended up into the table.

Provide accessible cable pathways through tables when integrating and power connections into tables.

2.5.2. Lecterns & Presenter / Teaching Stations

Where lecterns or presenter / teaching stations are provided at the front of the room; connectivity may be required at either an adjacent side wall box or floor box to support integrated or portable devices and other presentation support equipment. Avoid teaching station and connection locations that result in cables being placed/ routed on the floor surface.

Lecterns and presenter / teaching stations may be fixed or movable. However, where more than one or two electrical (power or low voltage) connections are required, lecterns and presenter / teaching stations are to be fixed due to the risk of damage or improper connections when setting up and removing equipment. Where trained technical support is available to install and remove equipment, greater flexibility may be provided.

There are three teaching station options acceptable for deployment on campus. Refer to photos of each type of teaching station; option one through three, on the next page of this report. These photos are illustrative only. Note that certain teaching station options are not acceptable for all classroom types. The classroom types are defined in Part 4 of this document and refer to this section for acceptable teaching station options. In addition, a table defining acceptable teaching stations by room type is provided in this section.

Example Option 1

Example Option 2

Example Option 2 Adjustable

Example Option 3 Part 1 and Part 2

Note that certain teaching stations are not acceptable for certain room types. The room types are defined in Part 4 of these standards. Refer to the table below for acceptable teaching station options by room type.

	Typical Classroom	Typical Dual Projection Classroom	Typical Enhanced Media Classroom
Teaching Station Option 1			■
Teaching Station Option 2	■	■	
Teaching Station Option 2 Adjustable	■	■	
Teaching Station Option 3 Part 1	■	■	■
Teaching Station Option 3 Part 2	■	■	■

2.6. Warranty and On-Going Maintenance

At the time of Bid, the contractor will provide the Owner with a proposal to extend the Warranty to cover years 2 through 5 inclusive of operation. These offerings are to include all parts and all labor subject to terms and conditions as indicated in the bid specification.

3. AUDIOVISUAL SYSTEMS CONSIDERATIONS

While most of the classroom tools available today are familiar to readers, several topics may require some additional definition. The following section addresses several of these sub-systems.

3.1. Aspect Ratio

The audiovisual market is in the midst of a transition in the shape of its video display devices. In newer video displays, the standard “aspect ratio” – the relationship between the height and width of the displayed images – is transitioning from the legacy aspect ratio of 4:3 (4 units wide by 3 units high) to the new HDTV compliant aspect ratio of 16:9 (16 units wide by 9 units high). The later aspect ratio is commonly referred to as “widescreen”.

This impacts a myriad of communications devices such as computers, televisions, cameras, projectors and so on. While the initial transition began within the broadcast television market, the transition has now spread to laptop and desktop computers, computer monitors and video projectors. Now, all major manufacturers of laptops are offering widescreen displays, as users are demanding the additional screen real estate that this configuration offers.

Likewise, all major manufacturers of display devices (computer monitors, televisions, and video projectors) are offering widescreen units, which offer compatibility with anticipated source materials such as HDTV, Blu-Ray discs, and the aforementioned widescreen computers.

Unfortunately, there is little standardization in implementation among laptop manufacturers. For example, some of the IBM/Lenovo Thinkpad line of laptops have an integral widescreen display but only support the standard 4:3 aspect ratio when connected to a video projector. Apple laptops use the 16:10 aspect ratio rather than 16:9. In both cases, most 16:9 widescreen projectors are compatible with these computers, and will provide a superior choice to traditional 4:3 aspect ratio projectors; however the results may not always be optimal.

Further, there is still a premium for these widescreen projectors over standard aspect ratio projectors of the same brightness and feature set.

3.2. Front Projection Display

Projection systems that use ceiling-mounted projectors and projection screens are usually the most cost-effective solution for creating large, high-resolution images for group viewing. Therefore, front projection is the dominant visual display medium recommended throughout the classroom spaces.

Screens will be manually operated unless screen size or ceiling height warrant the use of a motorized screen. Screens should be installed so they easily accessible for repair or replacement.

Motorized lifts and other solutions exist to conceal projectors in the ceiling when not in use within high-finish areas; however, the units add complexity and cost that are not warranted in most classrooms. The projectors are planned to be exposed and static-hung with anti-theft devices near the ceiling.

3.3. Projection Technology

Three projection technologies dominate the projector market and merit consideration for the project. LCD projectors offer the true WXGA resolution (1366 x 768) and the most brightness per dollar. Projectors based on DLP (Digital Light Processing) and LCOS (liquid crystal on silicon) are reflective technologies, rather than transmissive such as LCD, and thus have several inherent advantages. Most of the benefits, however, are qualitative in nature and tend to be more valued in medical diagnostic and scientific research applications, video screening rooms, board rooms and so on. Also, the widescreen resolution for these projectors is typically 1280 x 720, which is optimized for HDTV video rather than conforming to the WXGA standard that PCs use, which is 1365 x 768. In addition, these projectors typically have a higher first cost than LCD projectors.

Projectors shall be chosen for their suitability to room size, course material, ambient lighting, and other criteria.

3.4. Dual Screen Projection

Dual screen projection, two separate projected images, allows for comparison and contrast between multiple full size images and offers additional visual persistence by allowing each image to remain viewable longer.

It also opens up possibilities to mixing and matching images from multiple inputs sources such as PC, laptop, DVD player, broadcast TV, and document camera. The two projectors can display the same image or two different images.

Dual screen projection may be needed with some room shapes and/or sizes.

The additional costs involved are beyond the second projection screen and projector and include additional routing electronics, interfacing, possibly a preview monitor plus installation materials and labor. In addition, the operation of the system is marginally more complex.

Dual screen visual display capabilities must be determined on a room by room basis for each project.

3.5. Lecture Capture

Lecture Capture is one of the most significant technology developments influencing higher education today.

Capture systems allow classroom activities to be recorded and stored as digital content. Capture systems almost always involve content being archived and accessed on-demand across the campus network or the Internet.

There are multiple ways to accomplish lecture capture. All solutions involve some combination of four elements - instructor audio (hearing the instructor's voice), instructor graphics (seeing any visual content used in a lecture or presentation), classroom audio (hearing the students in the classroom), and instructor video (seeing the instructor).

Information Captured	Audio Capture	Presentation Capture	Classroom Capture	Rich Media Capture
Instructor Audio	■	■	■	■
Instructor Graphics		■	■	■
Classroom Audio			■	■
Instructor Video				■
Resources Required	Low	Low - Medium	Medium	High

Lecture capture system capabilities must be determined on a room by room basis based on specific space/program requirements.

3.6. Distance Learning

Distance Learning refers to technology that allows classes to be conducted where the student is separated (by distance) from the instructor or other students and these participants are able to communicate synchronously (in real time) via bidirectional audio and video signals. Distance learning is increasingly being looked to by many institutions as an economical way of expanding their activities, widening opportunities for students to attend class, and leveraging personnel resources. In addition, many distance learning enabled institutions have created relationships with one another to conduct shared classes or virtual meetings.

Distance learning includes at least two sites: an origination room where the instructor teaches and a reception room where students are located. Typically there are also students in the origination room. There may be a class proctor in the reception room.

Distance learning sessions are fully interactive. That is, each site may be seen and heard at all times by the other site. The technology in the origination room transmits the instructor's voice, the instructor's image, the presentation graphics and student voices to the reception room. The technology in the reception room transmits the student voices, and the student image back to the origination room. Rooms outfitted as origination rooms can also serve as reception rooms.

The primary hardware component providing distance learning capabilities described above is a codec. The codec encodes the audio and video signals for transmission and decodes the received signals. The primary quality levels of codec available include standard definition and high definition (HD). Standard definition and high definition cameras should be provided respectively to the level of quality determined.

Distance learning system capabilities must be determined on a room by room basis for each project.

3.7. Meta-Control Systems

Room control systems will be integrated into a Meta-Control system to provide for Control System Monitoring and System Administrator capability. Meta-Control functionality shall include, but not be limited to the ability to view power status for A/V systems facility-wide, manually turn on/off power to any room, schedule room power on/off for individual rooms, and provide real-time status of video projector lamps and room audio volume. The system shall also generate an events log to record fault; error, maintenance and service notifications for the System Administrator and/or authorized service personnel.

The majority of classrooms in the District utilize SP Controls systems. The SP Controls Meta-Control System is called SmartView Monitoring Application. There are three primary component types that are required for each classroom system in order to interface with the campus SP Controls Meta-Control System:

CatLinc Net components, Network Room Controllers (NRC), and SmartPanels. All of these components must be provided as required by associated room by room descriptions.

Some classrooms in the District utilize AMX control systems. The AMX Meta-Control System is called Resource Management Suite (RMS). As of this writing, although all or most AMX system components are connected to the campus network, RMS is not deployed. The College of the Desert is considering deployment of an RMS system including the appropriate Microsoft Structured Query Language (SQL) server and the associated programming required for deployment. Consideration of AMX systems and RMS must be reviewed on a room by room basis. In general, AMX systems shall be limited to the Typical Enhanced Media Classroom.

Refer to audiovisual room by room descriptions for additional control system requirements.

4. AUDIOVISUAL ROOM BY ROOM DESCRIPTIONS

The audiovisual standards for each space are described for each room category. However, these AV system descriptions can be applied to any room type or size with very little variation. For example, a Lecture Hall or Auditorium could have the same AV capabilities as a Typical Classroom; the only difference would be the size of projection screen, brightness of the projector, and the number of loudspeakers.

This section includes AV systems functionality for the following spaces:

- Typical Classroom
- Typical Dual Projection Classroom
- Typical Enhanced Media Classroom
- Typical Conference Room with Flat Panel
- Typical Conference Room with Projection

4.1. Typical Classroom

The Typical Classroom accommodates instruction with multimedia presentation. The seating is envisioned to offer flexible arrangement, but when the projection system is in use, it will be necessary for the students to face towards the projection screen.

4.1.1. Visual Display

The room will feature a single projection system including a ceiling-mounted projector and manual projection screen. The projection screen is to be flush mounted into the ceiling and will have a widescreen aspect ratio. The projector is to be pipe-mounted to the ceiling over the student area. The projector will have a native resolution with a wide screen aspect ratio. The projector will be capable of displaying full HD video and shall support closed captioning.

The instructor's computer, laptop, or auxiliary video source can be displayed on the projector. Computer and video source devices will include a dedicated Owner Furnished PC with Blu-Ray drive in HD format, connection for a portable laptop, and auxiliary inputs for portable audio and or video sources such as a document camera. Portable devices beyond a document camera are not included within the room installed system and will be provided by the College or users as needed.

Room lighting will be zoned to enable simultaneous activities such as front projection and note taking.

4.1.2. Audio Systems

Program audio will be provided by wall-mounted loudspeakers. Program audio is the audio associated with a video or multimedia presentation.

Speech reinforcement will be provided by ceiling-mounted loudspeakers and a wireless lavaliere microphone. This microphone will facilitate input for the speech reinforcement system and an assistive listening system. A hardwired microphone input integrated into the teaching station with the auxiliary inputs will be provided for back up purposes only.

An assistive listening system will be accomplished with wall-mounted infrared emitters and receivers to meet the needs of the hearing impaired and comply with ADA regulations. All receivers shall enable the use of custom headphones as requested by College of the Desert Disabled Students Programs & Services (DSPS).

4.1.3. Audiovisual Control

Control of the entire system will be from a control panel mounted on or near the teaching station. The standard control system for this classroom category shall be by SP Controls. The system shall be based on the Pixie Pro series and include a Network Room Controller for connectivity with the campus network and programmed to operate with the campus SP Controls Meta-Control system. The control panel may be table or wall-mounted. This will be determined on a room by room basis.

4.1.4. Teaching Station

There are several teaching station options that may be appropriate for this room category. No AV equipment may be integrated into moveable furniture. Note that the size and location of the teaching station must be planned such that an instructor standing behind it will not block projected images.

Refer to the table in Part 2.5.2 for acceptable teaching stations for this room type.

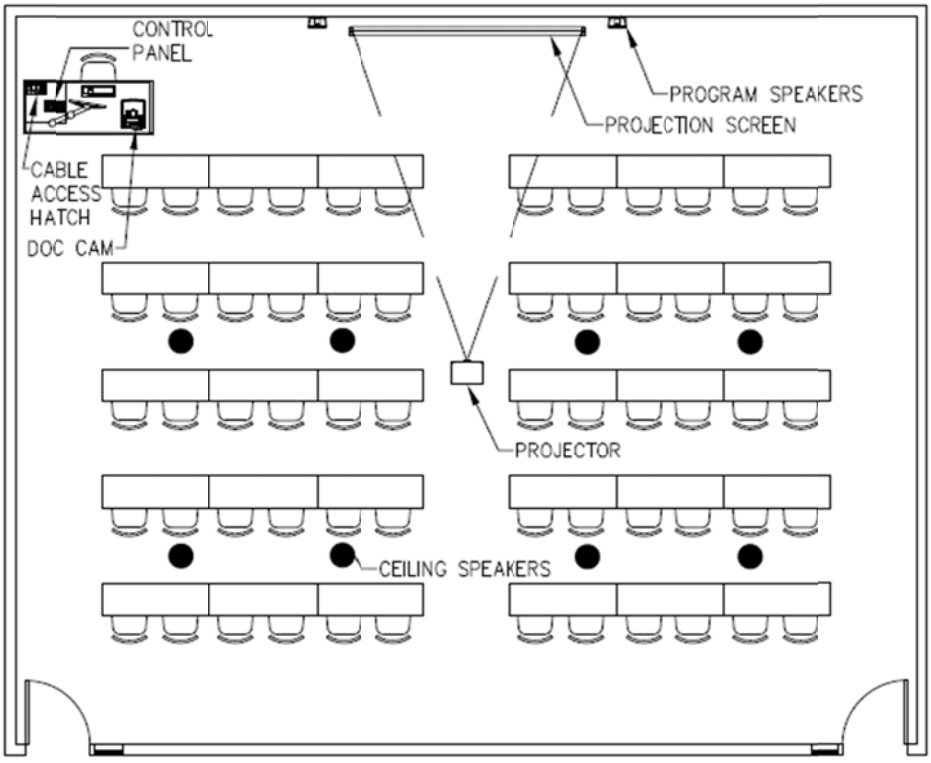
4.1.5. Equipment Location

All audiovisual equipment will be housed in a rack integrated within a fixed AV cabinet or within a teaching station. The AV furniture will have a dedicated and fixed location and shall be positioned clear of the projection light path, doorways, and glass walls. The AV furniture shall be located in close proximity to a wall perpendicular to the projection screen wall where cables connecting the AV equipment to the room can be made without creating a tripping hazard.

4.1.6. Primary Components

- One manual front projection screen
- One ceiling-mounted projector
- Two wall-mounted loudspeakers for program audio
- Speech reinforcement system including ceiling-mounted loudspeakers and a wireless lavaliere microphone
- Assistive listening system with two receivers
- Teaching Station
- Two computer inputs will be accommodated: one for a dedicated, Owner Furnished Contractor Installed PC, and the second for a portable, user provided laptop. An auxiliary input panel will be integrated into the teaching station for portable AV devices such as the user provided laptop.
- Audiovisual control system and control panel
- Infrastructure, specific to the audiovisual systems, will be required to support audiovisual functionality. This includes conduit, wall/ceiling junction boxes, floor boxes (in select areas), and/or backing at audiovisual equipment locations.

4.1.7. Figure 1



ROOM LAYOUTS FOR ILLUSTRATIVE PURPOSES ONLY, ACTUAL QUANTITIES, SIZES AND LAYOUTS MAY VARY

4.2. Typical Dual Projection Classroom

The Typical Dual Projection Classroom accommodates instruction with dual-screen multimedia presentation. The decision to implement a dual projection classroom is primarily driven by room geometry. In essence, when

the wider wall of the classrooms is used for projection, it is necessary to provide two screens to enable acceptable viewing for all participants. All aspects of the Typical Classroom shall be fulfilled. The seating is envisioned to offer flexible arrangement, but when the projection system is in use, it will be necessary for the students to face towards the projection screens.

4.2.1. Visual Display

The room will feature a dual projection system including two ceiling-mounted projectors and manual projection screens. Dual projection usually requires that the room seating be arranged such that the wider wall is used for projection. And, care must be taken such that a teaching station can be located adjacent to the projection wall such that an instructor standing behind the teaching station would not obstruct the projected images. All other aspects of the Typical Classroom visual display shall apply.

4.2.2. Audio Systems

All aspects of the Typical Classroom audio system shall apply. Note that the control system configuration governs which source the audio system amplifies. There are two options for this selection which must be determined on a room by room basis as part of the system design:

Option 1: The audio system will amplify the source selected for Projector 1.

Option 2: The audio system will amplify the source last selected for either Projector 1 or Projector 2. For example, if the user first selects the Computer to Projector 1 and the Laptop to Projector 2, the audio system will amplify the Laptop audio. In contrast, if the user first selects Laptop to Projector 2 and then Computer to Projector 1, the audio system will amplify the fixed Computer audio.

4.2.3. Audiovisual Control

Control of the entire system will be from a control panel mounted on or near the teaching station. Just as in the Typical Classroom, the control system for this classroom category shall be by SP Controls and be based on the Pixie Pro series and include a Network Room Controller for connectivity with the campus network and programmed to operate with the campus SP Controls Meta-Control system. The control panel may be table or wall-mounted and this will be determined on a room by room basis. The primary difference of the controls for this classroom category will be a second set of projector and source buttons. The controls shall provide unique “Projector 1” and “Projector 2” source and routing controls. Projector 1 and Projector 2 may display either the same sources or different sources – whichever is selected. All other aspects of the Typical Classroom audiovisual control shall apply.

4.2.4. Teaching Station

All aspects of the Typical Classroom teaching station shall apply.

Refer to the table in Part 2.5.2 for acceptable teaching stations for this room type.

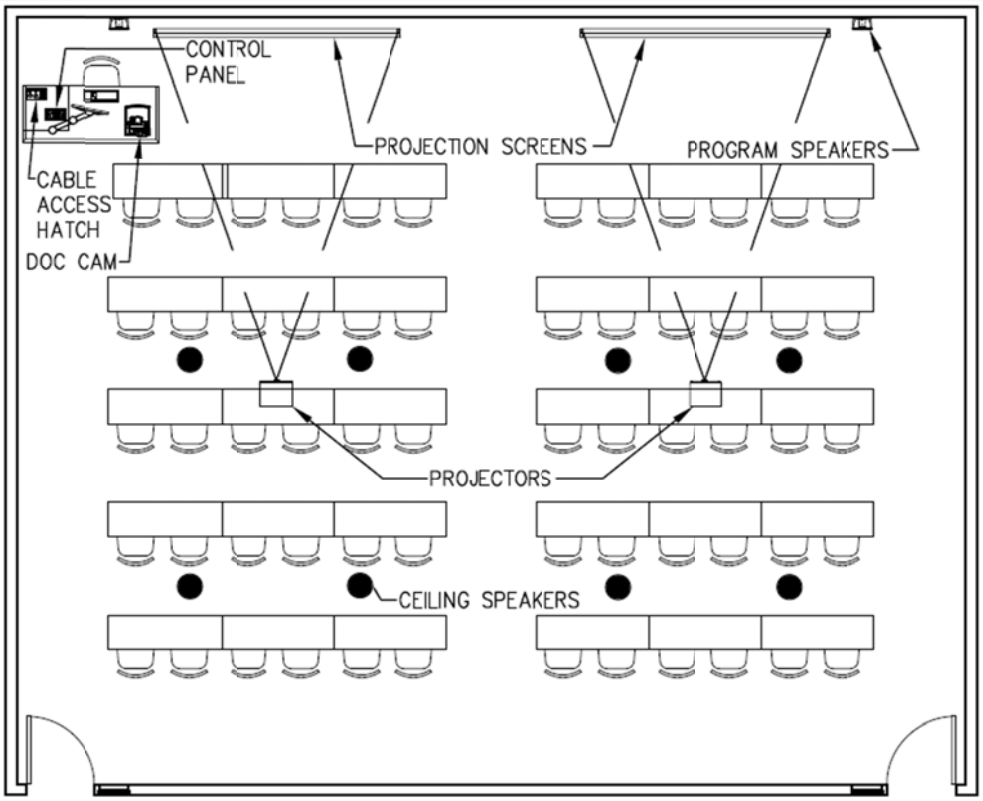
4.2.5. Equipment Location

All aspects of the Typical Classroom equipment location shall apply.

4.2.6. Primary Components

- Two manual front projection screens
- Two ceiling-mounted projectors
- Two wall-mounted loudspeakers for program audio
- Speech reinforcement system including ceiling-mounted loudspeakers and a wireless lavaliere microphone
- Assistive listening system with two receivers
- Teaching Station
- Two computer inputs will be accommodated: one for a dedicated, Owner Furnished Contractor Installed PC, and the second for a portable, user provided laptop. An auxiliary input panel will be integrated into the teaching station for portable AV devices such as the user provided laptop.
- Audiovisual control system and control panel
- Infrastructure, specific to the audiovisual systems, will be required to support audiovisual functionality. This includes conduit, wall/ceiling junction boxes, floor boxes (in select areas), and/or backing at audiovisual equipment locations.

4.2.7. Figure2



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4.3. Typical Enhanced Media Classroom

The Typical Enhanced Media Classroom accommodates instruction with either single or dual-screen projection and will also include lecture capture and/or distance learning capabilities. The seating is envisioned to offer flexible arrangement, but when the projection system is in use, it will be necessary for the students to face towards the front of the room to view the projection screens.

4.3.1. Visual Display

- For single projection rooms, all aspects of the Typical Classroom visual display shall apply.
- For dual-projection rooms, all aspects of the Typical Dual Projection Classroom visual display shall apply.

4.3.2. Audio Systems

All aspects of the Typical Classroom audio system shall apply.

Classroom audio capture (student voices) for either Lecture Capture or Distance Learning sessions must be determined on a room by room basis as discussed in Part 3.5 and 3.6 of these standards. At time of writing, most enhanced media classrooms will receive 'walk-up' or 'pass around' hand-held wireless microphone provisions for classroom audio capture versus hard-wired distributed microphones at student seating.

4.3.3. Lecture Capture

The dedicated instructor PC will also be used to support lecture capture. A software-based system will allow audio of the instructor's microphone and PC based graphics used during class to be recorded on the instructor PC's hard drive. Class sessions will be posted to a remotely located server for storage and student access after class.

4.3.4. Distance Learning

Pan/tilt/zoom (PTZ) cameras will be provided for capturing the images of the instructor and the students for distance learning. The quantity and location of cameras will be determined on a room-by-room basis.

A multisite codec will be used for distance learning. It will take the camera video, audio and presentation graphics feeds and provide interaction with remote classrooms. The codec will also in turn receive camera video, audio and presentation graphics from remote classrooms.

4.3.5. Audiovisual Control

Control of the entire system will be from a control panel mounted on or near the teaching station. The control system for this classroom category shall be by AMX and will utilize a touch screen control panel. The control panel may be table or wall-mounted. This will be determined on a room by room basis. In dual projection rooms, the controls shall provide unique "Projector 1" and "Projector 2" source and routing controls. The system shall also enable user friendly controls of lecture capture and/or distance learning. For distance learning rooms, a minimum 8" touch screen is required.

4.3.6. Teaching Station

All aspects of the Typical Classroom teaching station shall apply. For some rooms, where the amount of AV equipment dictates, a fixed AV desk or a fixed AV lectern may be required to house all equipment.

All teaching stations with integrated AV equipment must be fixed, and connections must be provided within 6" of the fixed position of the teaching stations. Therefore, wall box or floor box connections must be provided according to these positions.

Refer to the table in Part 2.5.2 for acceptable teaching stations for this room type. The location and configuration of Teaching Stations for Typical Enhanced Media Classrooms should be determined on a room by room basis based on the specific space/program requirements.

4.3.7. Equipment Location

All aspects of the Typical Classroom equipment location shall apply. For some rooms, the following additional options may be considered in the design:

- Provide a dedicated AV equipment closet in the room to enable one or more full-height audiovisual equipment racks.
- Provide a dedicated control room to enable appropriate operator controls and monitoring if desired or required.

The quantity, location, and configuration of equipment racks and/or a control room must be determined on a room by room basis based on the specific program requirements.

4.3.8. Primary Components

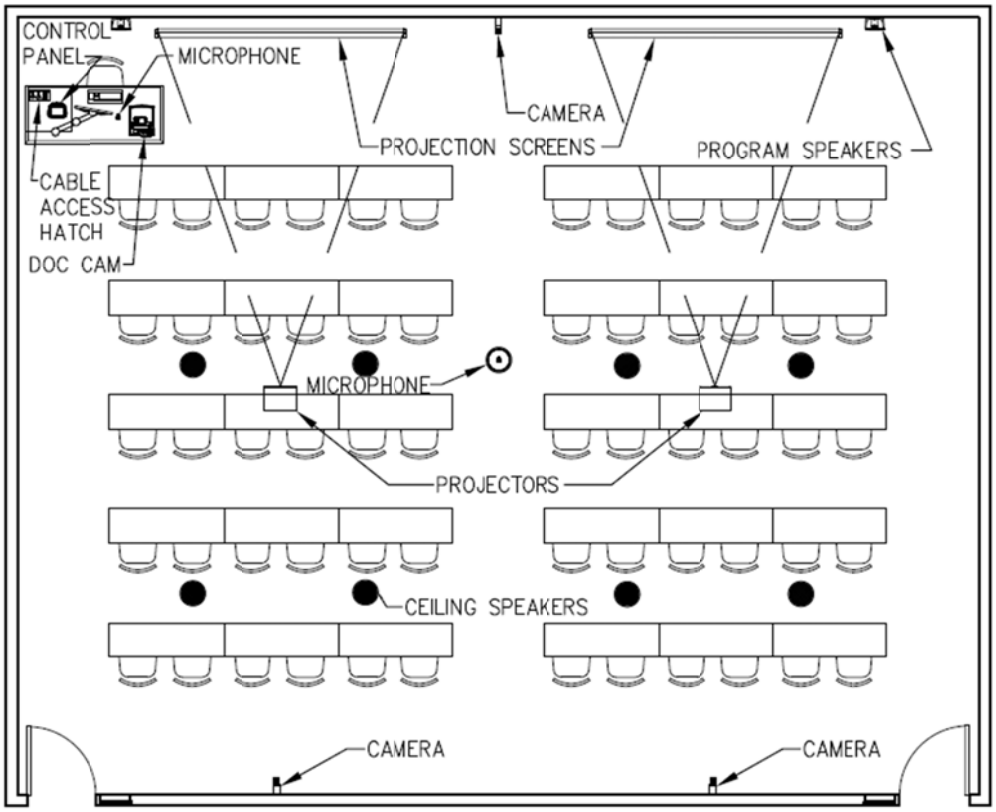
- One or two manual front projection screens (single or dual projection to be determined for each space)
- One or two ceiling-mounted projectors (single or dual projection to be determined for each space)
- Two wall-mounted loudspeakers for program audio
- Speech reinforcement system including ceiling-mounted loudspeakers, a wireless lavaliere microphone for the instructor, and a wireless handheld microphone for students
- Assistive listening system with two receivers
- Teaching Station
- Two computer inputs will be accommodated: one for a dedicated, Owner Furnished Contractor Installed PC, and the second for a portable, user provided laptop. An auxiliary input panel will be integrated into the teaching station for portable AV devices such as the user provided laptop.
- Audiovisual control system and control panel
- Infrastructure, specific to the audiovisual systems, will be required to support audiovisual functionality. This includes conduit, wall/ceiling junction boxes, floor boxes (in select areas), and/or backing at audiovisual equipment locations.

4.3.9. Component Variables

- Lecture Capture
  - Elements to be captured
  - Software-based instructor audio and instructor graphics capture
  - Media content management storage, distribution, and streaming
- Distance Learning

- Minimum two video cameras
- Multisite codec
- Floor microphone for student questions

4.3.10. Figure 3



LAYOUTS FOR ILLUSTRATIVE PURPOSES ONLY, ACTUAL QUANTITIES, SIZES AND LAYOUTS MAY VARY

4.4. Conference Room with Flat Panel Display

The conference room with flat panel display accommodates simple instruction and/or group meetings with multimedia presentation. The seating is envisioned to be arranged around a conference table and the room size and viewing distance supports utilizing a wall-mounted flat panel display. Display of high resolution formats and small fonts may require a projector and screen instead of a flat panel.

4.4.1. Visual Display

The flat panel display shall be capable of displaying closed captioning and full 1080p HD video and shall support typical PC resolutions such as 1024x768, 1280x800, and 1680x1050. This flat panel display monitor will be sized to accommodate the anticipated viewing distance and typical font size and content resolution to be presented in the room.

Presentation sources within the conference room will include connections for portable audiovisual sources such as an owner provided laptop computer or a portable document camera. This will be provided from an auxiliary input panel located in a floorbox beneath the table that will allow the output of the portable source devices to be displayed on the flat panel. These portable devices are not included within the room and will be provided by the users as needed.

The system may also have connections to support simple videoconferencing equipment as determined on a room by room basis.

4.4.2. Audio Systems

Audio within the conference room will be via speakers attached to the sides of the flat panel display monitor. An assistive listening system will be accomplished with wall-mounted infrared emitters and receivers to meet

the needs of the hearing impaired and comply with ADA regulations. All receivers shall enable the use of custom headphones as requested by College of the Desert Disabled Students Programs & Services (DSPS). Audio conferencing will be accomplished with a standard owner-furnished speaker phone.

4.4.3. Audiovisual Control

Control of the flat panel will be from the remote supplied with the unit

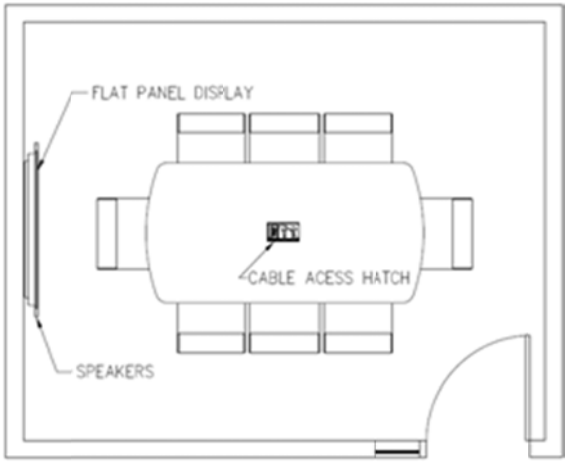
4.4.4. Primary Components

- One flat panel display with attached speakers
- One tabletop speakerphone to support audio conferencing
- Assistive listening system
- An auxiliary input panel will be available in the floorbox for portable AV devices such as the user provided laptop.
- Infrastructure, specific to the audiovisual systems, will be required to support audiovisual functionality. This includes conduit, wall/ceiling junction boxes, floor boxes (in select areas), and/or backing at audiovisual equipment locations.

4.4.5. Component Variables

- Videoconference capabilities
  - Simple self-contained video conference unit

4.4.6. Figure 4



ROOM LAYOUTS FOR ILLUSTRATIVE PURPOSES ONLY, ACTUAL SIZES AND LAYOUTS MAY VARY

4.5. Conference Room with Projector

The conference room with projector accommodates simple instruction and/or group meetings with multimedia presentation. The seating is envisioned to be arranged around a conference table and the room size and viewing distance supports utilizing a ceiling mounted projector.

4.5.1. Visual Display

The projector shall be capable of displaying closed captioning and shall support typical PC resolutions such as 1024x768, 1280x800, and 1365x768. The projector and projection screen will be sized to accommodate the anticipated viewing distance and typical font size and content resolution to be presented in the room.

The projection screen is to be flush mounted into the ceiling and will have a widescreen aspect ratio. The projector is to be pipe-mounted to the ceiling over the conference table. The projector will have a native resolution with a wide screen aspect ratio. The projector will be capable of displaying full HD video and shall support closed captioning.

Presentation sources within the conference room will include connections for portable audiovisual sources such as an owner provided laptop computer or a portable document camera. This will be provided from an auxiliary input panel located in a floorbox beneath the table that will allow the output of the portable source

devices to be displayed on the projection system. These portable devices are not included within the room and will be provided by the users as needed.

Room lighting will be zoned to enable simultaneous activities such as front projection and note taking.

4.5.2. Audio Systems

Audio within the conference room will be via the speaker system built into the projector. Please note some room sizes may require an auxiliary audio system. This will be determined on a room by room basis.

There will be an Assistive Listening System built into the room. One ALS emitter panel permanently mounted to the wall above the flat panel display monitor. ALS stethoscope style receivers will be available from the DSPS offices. Audio conferencing will be accomplished with a standard owner-furnished speaker phone.

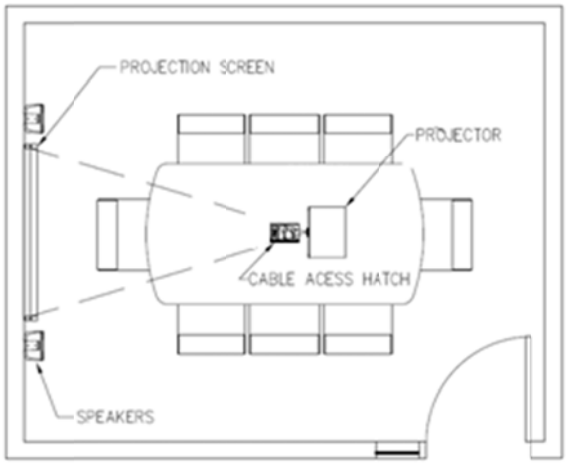
4.5.3. Audiovisual Control

Control of the flat panel will be from the remote supplied with the unit.

4.5.4. Primary Components

- One manual front projection screen
- One ceiling-mounted projector
- One tabletop speakerphone to support audio conferencing
- Assistive listening system
- An auxiliary input panel will be available in the floorbox for portable AV devices such as the user provided laptop.
- Infrastructure, specific to the audiovisual systems, will be required to support audiovisual functionality. This includes conduit, wall/ceiling junction boxes, floor boxes (in select areas), and/or backing at audiovisual equipment locations.

4.5.5. Figure 5



ROOM LAYOUTS FOR ILLUSTRATIVE PURPOSES ONLY, ACTUAL QUANTITIES, SIZES AND LAYOUTS MAY VARY

5. DIGITAL SIGNAGE SYSTEMS

5.1. Location

Digital Signage implemented on campus is typically located within main traffic corridors. Signage displays are ceiling mounted or wall mounted on fixed brackets. ADA guidelines are to be followed regarding mounting locations and heights for all display monitors, dependent of type and function of display.

5.2. Power / Data / Lighting

One duplex power outlet and one data outlet with a minimum of two connections is to be located in a specialty recessed wall box where the signage display will be located. The specialty wall box must enable the flat panel display to be mounted flat on the wall with proper cable management and connectivity for duplex power, data (with a minimum of two connections), and all required audio / video low voltage signal cables. Lighting within the areas are to be parabolic non-glare and/or suspended indirect lighting fixtures.

5.3. Audiovisual

5.3.1. Image Display

The standard digital signage display on campus will make use of a flat panel display monitor capable of displaying closed captioning and full HD video. This flat panel display monitor will be at least 40” diagonal, or 21” high by 36” wide. The image display will have embedded Microsoft Windows 7.

5.3.2. Audio Reproduction

Audio for the signage system will be via stereo loudspeakers attached to the sides of the flat panel display monitor.

5.3.3. Audio/Video Source Equipment

Playback sources for the digital signage system will be determined on a departmental basis during the specific project programming phase.

5.3.4. System Control

Methods and locations of the control of the digital signage sources and displays will be determined on a departmental basis during the specific project programming phase.

6. TELECOMMUNICATIONS SYSTEMS DESIGN

6.1. Overview

The purpose of this section is to define campus-wide standards for telecommunications systems that include both inter-building and intra-building technologies; to establish standards, for both new construction and renovation projects, to ensure consistency in the telecommunications systems throughout the campuses.

This document can be used as a reference by all persons involved with facilities on The College of the Desert campuses. Such persons can include, but are not limited to, administrators, user-groups, faculty, staff, construction managers, general contractors, subcontractors, trades-people, and suppliers.

Architects, engineers, contractors and other consultants can use this document as a guide for an initial understanding of how integrated telecommunications technologies will impact design and construction for all projects on campus.

This document addresses minimum guidelines for the design of Technology Rooms, pathways (inter-building and intra-building), and structured cabling systems.

The College of the Desert expects a high quality, standards based telecommunications infrastructure on campus. The design of telecommunications infrastructure for new or remodeled facilities shall be engineered by a qualified Registered Communications Distribution Designer (RCDD) actively affiliated with the Building Industry Consulting Services International (BICSI) organization. Further engineering designs must meet all applicable Federal, State and local codes and standards, and must be designed in accordance with these design standards.

6.2. Uses of Telecommunications Standards

The College recognizes that each project will have its individual character and unique requirements. Renovation projects may limit the Project Teams ability to achieve some of the stated goals due to the existing circumstances within the building or surrounding site. For both new and renovated buildings, there will be trade-offs required to fulfill programming imperatives and to respect budget limitations.

It should be clearly understood by all persons using these standards that they are not specifications, nor are they procedures for construction and installation. They do not replace the due diligence of needs analysis and design documentation for each project. This should continue to be completed by a design professional in collaboration with College of the Desert team members. The means, methods, techniques, and procedures for construction and installation are indicated in design documentation but remain the Contractor's responsibility.

7. STRUCTURED CABLING SYSTEMS

7.1. Overview

A Structured Cabling System (SCS) is a set of cabling and connectivity products that are constructed according to standardized rules to facilitate integration of voice, data, video and other building systems. Use of a Structured Cabling System (SCS) provides benefits in terms of rationalization of infrastructure costs and facilitating predictable performance.

The College of the Desert defines a Structured Cabling System (SCS) as the horizontal, intra building riser, and inter building backbone sub-systems with all associated cabling connecting hardware, terminations, patch cords and work area cords.

The Structured Cabling System will be based on the following design guidelines:

- The structured cabling system will be standards compliant (EIA/TIA 568-B)
- The structured cabling system will provide a high level of interoperability, maintainability and scalability
- The structured cabling system is to include high performance category 6E copper cabling tested to 550 MHz for Gigabit Ethernet applications
- The structured cabling system is to include high performance 50/125 micron multi-mode optical fiber cabling and single mode fiber optic cable.
- The structured cabling system will require a plenum jacket construction
- Communication outlets will be provided throughout the facility. Each outlet will support voice, data and digital media connectivity

7.2. Horizontal Cabling Subsystem

The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the BDF or IDF telecommunications room. It consists of the telecommunications outlet/connector, the horizontal cables, and that portion of the cross-connect in the telecommunications room serving the horizontal cable.

The Horizontal Subsystem will support Category 6E application through the use of Category 6E UTP cabling and performance matching termination equipment.

7.3. Intra Building Riser Cable

The intra building riser cable is the portion of the telecommunications cabling system that extends from the BDF to each IDF in a building it consists of multi pair copper cable and multi strand multi-mode and single mode fiber optic cable.

The intra building riser copper cable will support 100 ohm Category 3 multi pair copper cable and be a minimum rating of CMR or CMP as required by the local authority having jurisdiction (AHJ). The intra building riser fiber cable will support 50/125 micron OM3/OM4 multi-mode and 9 micron OS1 single mode fiber optic cable and be a minimum OFNR or OFNP as required by the local authority having jurisdiction (AHJ)

7.4. Inter Building Cabling

The inter building cabling is the portion of the telecommunications cabling that extends from the Main Cross Connect (MC) located in the campus data center to the BDF of each campus building. It consists of multi pair copper cable and multi strand multi-mode and single mode fiber optic cable ran through the campus underground ductbank system. Direct burial of inter building cabling is not allowed.

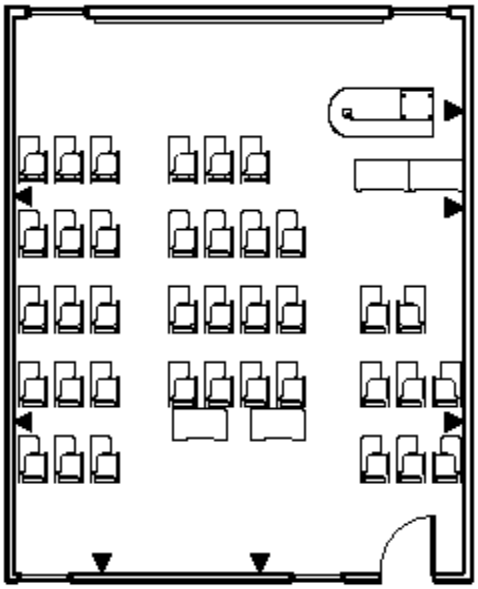
The inter building cabling will support 100 ohm Category 3 multi pair copper cable and be a minimum rating of CM, CMG OSP cable with a water resistant flooding compound and jacketed with UV resistant polyethylene. The inter building fiber optic cable will support 50/125 micron OM3/OM4 multi-mode and 9 micron OS1 single mode fiber optic cable and be a minimum rating of OFN, OFNG OSP cable with a water blocking compound and jacket with UV resistant polyethylene.

7.5. Standard Communication Outlet Configurations

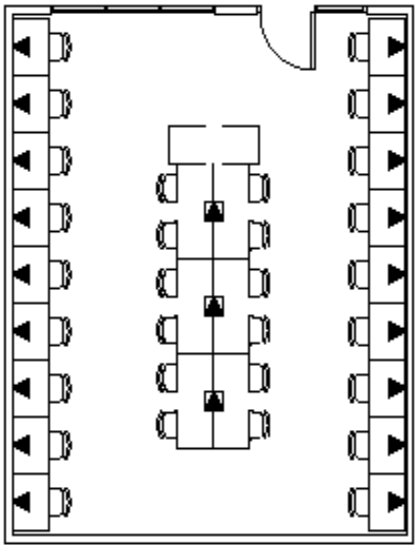
Standard Wall Mounted Outlet	Standard wall mounted outlets will be the typical outlet configuration throughout the campus facilities. Standard wall mounted outlets will consist of three Category 6E UTP cables terminated on RJ45 connectors at the faceplate. Standard height for wall mounted outlets will be 18" above finished floor, unless otherwise directed by the architect.
Wall Mounted Phone Outlets	Wall mounted phone outlets will consist of one Category 6E UTP cable terminated to a RJ45 connector at the wall mounted faceplate. The wall mounted phone outlet faceplate will be mounted 48" inches above the finished floor, unless otherwise directed by the architect.
Floor box / Poke - through	In areas that require communication outlets in the floor, the typical floorbox and poke-through will consist of four Category 6E UTP cables terminated on RJ45 connectors in the floor device.
Audiovisual Communications Outlets	Instruction or presentation locations that require communication outlets will consist of six Category 6E UTP cables terminated on RJ45 connectors at the faceplate. If no audiovisual system exists at the instruction or presentation locations, two Category 6E UTP cables terminated on RJ45 connectors in a wall mounted faceplate or floor device are required.
Ceiling Mounted Outlets	At the video projection locations ceiling mounted outlets will consist of one Category 6E UTP cable terminated on RJ45 connector at the faceplate mounted in the accessible ceiling tile or mounted on the surface as applicable.
Wireless Access Point (WAP)	Communication outlets supporting Wireless Access Points (WAP) will be placed in ceiling locations. In other areas, wall mounted 1' above accessible ceiling or 1' below inaccessible ceiling. The communication outlets supporting the Wireless Access Points will consist of one Category 6E UTP cable terminated on RJ45 connector at the faceplate.
IP Surveillance Camera's	Communication outlets supporting IP Surveillance Camera's will be located at ceiling locations. At area where ceiling is inaccessible mount 1' below inaccessible ceiling. The communication outlet supporting the IP Surveillance Camera will consist of one Category 6E UTP cable terminated on a RJ45 connector at the faceplate.

7.6. Standard Communication Outlet by Room Type

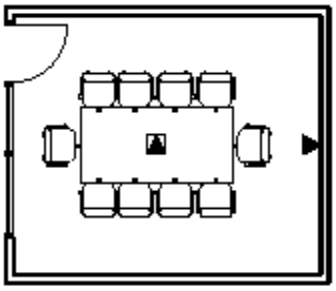
Standard Classroom	A standard classroom will require two individual standard wall mounted outlet configuration on three interior walls, and one wall mounted phone located near instructors teaching station.
Standard Conference Room	A standard conference room will require one standard wall mounted outlet configuration, and one standard floor outlet configuration supported by the floor device.
Standard Office (80-120 sq.ft)	A standard office will require one standard wall mounted outlet configuration.
Standard Executive Office (120 to 160 sq. ft.)	A standard executive office will require two standard wall mounted outlet configurations.
Standard System Furniture Workstation	A standard system furniture workstation will require one standard wall mounted outlet configuration. * System furniture may require OEM specific faceplate.
Standard Computer Classroom	A standard computer classroom will require one communications outlet per seat. The communications outlet will be placed in either a floor-box configuration or a standard wall mounted outlet configuration depending on the furniture layout.



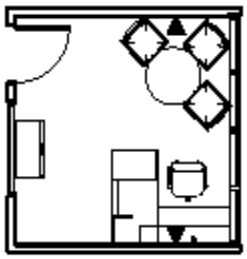
CLASSROOM



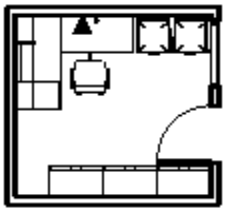
COMPUTER LAB



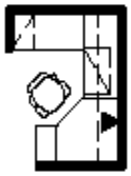
CONFERENCE ROOM



EXECUTIVE OFFICE



OFFICE



WORKSTATION

8. SURVEILLANCE

8.1. Overview

The video surveillance system will be IP based with the capability to integrate with existing analog cameras through encoders. The IP video surveillance system will be considered a converged system to the campus LAN. The designed system will allow for a concentration of IP based video signals to a single monitoring station. The configuration of the monitoring station and monitors will allow the ability of duplex viewing per monitor. The video signals will be processed to a network video recorder (NVR) where recording and remote playback capabilities will occur. The surveillance system will consist of the following components:

8.2. Exterior

Exterior fixed network cameras will be outdoor-ready day and night and will be located at certain building exteriors for the purpose of viewing activity on campus grounds, and the call for assistance units that will be located at the parking lots. The fixed network cameras will be mounted at either the parapet, or no greater than 20' feet above grade on a structural façade to allow for maintenance purposes. Each camera will be esthetically pleasing utilizing a dome configuration. Domes are to be of a vandal resistant type for protection against damage.

Each unit will have a TCP/IP network output. Cable type to process video signal will be Category 6E UTP cable. Category 6E UTP cable for exterior cameras will be green in color so as to be identifiably as "IP Camera" cable. Power for exterior fixed cameras will be PoE using the Category 6E cable with no need for separate low voltage power supplies. When an external camera distance exceeds the allowable Ethernet standard a outdoor rated fiber optic cable will be deployed incorporating a media converter for optical to electrical conversion.

Exterior fixed network cameras will incorporate a color camera with day/night-low light capacity to include an integral zoom lens. The lower portion will be fitted with a dome liner to allow for a smoke dome outer shell.

Exterior fixed network camera minimum specifications: Ultra-discrete fixed dome design; Progressive scan for clearer images; Power over Ethernet (IEEE 802.3af); Day and night functionality for increased light sensitivity; Simultaneous Motion JPEG and MPEG-4 streams; Up to 30/25 (60/50 Hz) frames per second in resolution up to 4CIF; P-Iris Control; Weatherproof casing minimum outdoor rating IP66; Temperature range -40 degree Celsius to +45 degree Celsius; Active tampering alarm.

8.3. Interior

Fixed cameras incorporating a color camera with sufficient auto-iris control will be provided to allow changes in external light conditions to exist. Cameras will be housed in either a standard or small dome configuration with the lower dome portion to be a smoked finish. Each unit will have a TCP/IP network output.

Fixed cameras will be located within structures at most entrances, areas of public assembly, and at all point of sale locations. Fixed cameras placed at entrances and areas of public assembly will be VGA 640x480 pixels. Fixed cameras placed at point of sale locations will be a minimum of 1 megapixel High Definition Resolution camera.

Cable type to be process video signal will be Category 6E UTP cable. Category 6E UTP cable for interior cameras will be green in color so as to be identifiably as "IP Camera" cable. Power for interior fixed cameras will be PoE using the Category 6E cable with no need for separate low voltage power supplies.

Interior fixed camera minimum specifications: Ultra-discrete fixed dome design; Progressive scan for clearer images; Power over Ethernet (IEEE 802.3af); Active tampering alarm. Fixed VGA Camera: Simultaneous multiple H.264, MPEG-4 and Motion JPEG streams, up to 30 frames per second in all resolution. Fixed Mega Pixel Camera: Simultaneous multiple H.264 and Motion JPEG streams, up to 30 frames per second in all resolutions, including 1 Mega Pixel.

8.4. Network Video Recorder

Network Video Recorder (NVR) units will allow for up to 64 network cameras, and be located at a central location with a minimum of 1TB of storage capacity. The unit will have video motion as a feature allowing a change in status in pixels to generate alarm condition. The unit will run its application software over the operating software in order to record video scenes according to programming. NVR's will allow for fiber optic transmissions from cameras through the COD campus LAN network..

8.5. Remote Equipment

A remote notebook using current version of Windows operating system will be required. Residing on the notebook will be application software compatible with the NVR selected to control camera scenes as necessary using client software. This unit will have the ability to allow remote viewing with the use of the current campus WLAN system for remote video capture and control.

9. WLAN

9.1. Overview

COD campus and building wireless access point deployment will consist of 802.11n standards using 802.3af PoE unit power requirements. Every WLAN / WAP deployment is unique to its environment. In renovated buildings projects a site survey will be completed to review building size, construction materials, and interior divisions that will establish wireless access point coverage. The site survey will be conducted by the IT consultant or WLAN / WAP certified integrator. New building construction WLAN / WAP design will be determined by the buildings construction documents.

9.2. Requirements

Wireless Access Points (WAP) require one Category 6E UTP cables. Category 6E cable will be terminated in the nearest telecommunication room as per the telecommunications standards. Category 6E UTP cable for Wireless Access Points will be yellow in color so as to be identifiably as “WAP” cable.

Wireless Access Point minimum performance specifications: 802.11n version 2.0 compliant; Controller based or stand-alone deployment option; Clean Air Technology; Secure Connections; Dynamic Frequency Selection 2; UL2043 plenum rated for above ceiling installation; Integrated antenna 2.4GHz/5GHz; 10/100/1000Base-T autosensing; Management console port; 128MB DRAM; 802.3af PoE.

10. OUTSIDE PLANT

10.1. Design Criteria for Inter-building Communication Ductbanks and Transition Structures

Inter-building Communication Infrastructure Ductbanks are to be installed to carry communication cables between campus building locations. The duct is to be constructed of contiguous segments of PVC conduit. The ductbanks are to be encased in slurry.

Transition Structures, manholes, are to be installed as required to allow technicians access to cable and splices to perform maintenance or to modify distribution configurations. The size of the transition structures is to be selected for installation by the number of ducts and potential cable count the structure must contain.

The following provides general requirements for all Inter-building Communication Duct Banks and Transition Spaces as components of the overall communication cable system infrastructure.

10.2. Inter-building Communication Ductbanks

Inter-building Communication Ductbanks are to be designed to provide a permanent and durable pathway system which is available for the delivery of entrance cable from the campus connection point.

10.3. Configuration

There is to be minimum of (4) 4” conduits between the Campus Buildings and the Campus connection point. When more than (4) 4” conduits are required the ductbanks are to be configured in arrays, with several rows stacked together, such as 1 x 4, 2 x 2, 3 x 4, and are to correspond to the arrangement of duct openings in pre-cast concrete vaults and manholes where transitions occur.

10.4. Construction Materials and Methods

Ductbanks are to be encased in slurry. Where ductbanks share underground pathways with other underground infrastructure components such as water lines, gas lines, sanitary systems, it is critical that the communications infrastructure be installed with the highest level of durability.

The duct material itself is to be Trade Size 4 (4-inch diameter), PVC Schedule 40 or equal, and suitable for contact with concrete. Conduits are to be cut square, with the cut ends reamed and deburred. Plastic bushings are to be installed over the each end of every conduit.

Place a ¼”nylon or polyethylene pull rope in each conduit from end to end. Install conduit plugs in each empty outside plant conduit to prevent the introduction of noxious gases or water into the building.

10.5. Ductbank Placement

Duct routing is to be coordinated with the Campus Master Plan Infrastructure, with consideration for distance between Transition Structures and difficulty of cable pulls, particularly when high-count multi-pair copper cables are necessary.

10.6. Slurry-Encased Ductbank Dimension Guidelines

Ground Cover	Minimum of 24" inches
Top Level of Slurry	Minimum 3" inches above top duct
Slurry on Outer Sides of Ductbank	Minimum 3" inches
Slurry Between Ducts	1.5" inch (above, below and to each side)

Bottom Level of Slurry	Minimum of 3 inches

10.7. Ductbank Marking

A metallic warning tape, detectable with magnetic location equipment, is to be buried directly over the path of the Ductbank approximately 18” below the surface.

10.7.1. Ductbank Termination at the Building

Communication Ducts are to be terminated with bell-end connectors, flush with the inner surface of the wall.

10.7.2. Communication Transition Structures

Ductbank Transition Structures are to be provided to allow access to cable installed within underground ductbanks. The transitions structures are to provide a location for the storage of splice cases and slack loops of cable. The transition structures are to facilitate the distribution of cable to multiple locations by providing a junction point for ducts radiating in several directions.

10.7.3. Selection of Transition Structure Type

The type of structure chosen for installation is to be dependent on the number of ducts in the span. The ductbank transition structure is to be preformed concrete structures with weight-bearing cover/lid capacities that range from light pedestrian traffic to deliberate heavy vehicular traffic. The appropriate rating is to be selected based on the anticipated exposure of the structure to these differing traffic types.

10.7.4. Placement of Transition Structures

Structures are to be placed after 180 degrees of directional change has been affected in the ductbank route. In straight or relatively straight runs, there is to be no more than 400 feet between structures. Structures are not to be used as the apex of 90-degree change in duct direction. Sweeps and structures are to be planned such that the sweep occurs outside of the structure, allowing straight cable pulls through the structure itself.

10.7.5. Transition Structure Accessories and Equipment

Transition structures require the following equipment:

- A sump, or gravel drainage in the case of small hand holes
- Corrosion-resistant pulling eyes
- Cable racking
- Grounding cables installed per applicable codes or practices
- Ladders and steps
- Watertight duct plugs

11. NETWORK EQUIPMENT

11.1. Overview

The COD network systems end to end approach will allow technical staff to manage the network centrally. With the ever changing campus environment a scalable solution providing incremental additions and upgraded and new release equipment is required. The network equipment must provide secure, unconstrained connectivity between employees, students and information delivering quality and real-time applications, such as voice data and video, on a converged network platform.

11.2. Network Equipment Requirements

The COD complete system is to include all interfaces and software. All network devices are to be SNMP enabled. The network electronics are to also support Voice over Internet Protocol (VoIP) telephony system currently used on campus. Network Electronic System:

- VLAN 802.1Q
- PoE 802.3af, 802.3at
- Port based network access control 802.1x
- Spanning tree protocol 802.1D
- Multiple spanning trees 802.1S
- Rapid reconfiguration of spanning tree 802.1w
- Class of Service 802.1p
- H.323
- Wireless network management module/appliance

11.3. Network Power Requirements

Provide individual branch circuit serving a single load from the feeder panel directly to a branch circuit receptacle (for cord- and-plug connected equipment), or equipment power terminal (for hardwired equipment). Each branch circuit will require isolated ground. Provide branch circuits for equipment power that are protected and wired for 120V, 20A and 120V, 30A and 208V, 30A circuits.

As a minimum, provide (1) 120V, 20A (NEMA L5-20R), (1) 120V, 30A (NEMA L5-30R), and (1) 208V, 30A (NEMA L6-30R) dedicated circuits.

11.4. Backup Power

Because of the “mission- critical” nature of the COD network equipment, backup power must be provided with a standalone UPS at each network element supporting a minimum of 1 hour battery capacity at full load is to be provided. Network power will be on building emergency power circuit where available.

12. TELECOMMUNICATIONS SPACES

12.1. Design Criteria for the BDF

The BDF is a telecommunications acronym for Building Distribution Frame, in the context of this document the main Technology Room for the building is the BDF. The BDF will act as the entrance facility for connection to the campus copper facilities, optical fiber and data network backbone. The BDF will support the termination of backbone and campus cabling and house centralized communications and server equipment supporting the entire building.

The BDF will also support other building information systems such as media distribution and security, and in most cases function as an IDF supporting the connection point between backbone and horizontal cabling infrastructure.

12.2. Architectural and Building System Requirements in the BDF

12.2.1. Room Size

The Minimum space allocated to the BDF is to be 160sq. ft. with a minimum dimension of 16 feet in one direction.

12.2.2. Room Location

If the BDF supports the outside cabling connections, it is to be located on the ground floor and located so that it can support two physically separate points of entry. The BDF is to be accessible for the delivery of large equipment throughout its useful life. Ideally, the BDF will be stacked directly under the IDFs to support the distribution of services between the rooms.

Do not locate BDFs in any place that may be subject to water infiltration, steam infiltration, humidity from nearby water or steam, heat (e. g., direct sunlight) or any other corrosive atmospheric or adverse environmental conditions. Avoid locations that are below water level unless preventive measures against water infiltration are employed. If the BDF is below ground, provide a separate Building Service Entrance facility to transition conduit to prevent ingress of water from the conduit infrastructure.

Locate the BDF far enough away from sources of EMI to reduce interference with the telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, radio transmitters, radar transmitters, and induction heating devices. As BDFs are frequently occupied by technicians and sensitive electronic equipment, the room location is not to be adjacent to sources of constant, excessive, low or high frequency noise, such as air-handling equipment, pumps, generators, etc.

12.2.3. Room Use

The BDF is to be dedicated solely to Technology and related facilities. Equipment that does not support the BDF (e. g., pipes, duct work, distribution of building power) is not to be located in or pass through the BDF.

12.3. Architectural Requirements

12.3.1. Ceiling Height

The minimum ceiling height is 9 ft. above the finished floor with ceiling protrusions (e. g., sprinkler heads - dry only) placed to assure a minimum clear height of 8 ft. clear of obstructions, to provide space over the equipment frames for cables and suspended cable trays. To permit maximum flexibility and accessibility of cabling pathways, false ceilings are not permitted in the BDF.

12.3.2. Doors

BDFs are to have lockable doors that are at least 3.5 ft. wide and 6.5 ft. tall. Since large equipment is often located in the BDF, a double door 6 ft. wide by 7.5 ft. tall is recommended. Door sills are not recommended because they impede the movement of equipment.

NOTE: Doors that open outward provide additional usable space and reduce constraints on BDF layout.

12.3.3. Flood Prevention

Locate BDFs above any threat of flooding. Avoid locations that are below or adjacent to areas of potential water hazard (e. g., restrooms and kitchens).

12.3.4. Wall and Floor Requirements

BDF walls are to extend from the finished floor to the structural ceiling (e. g., the slab). The BDF is to not have windows installed, nor is it desirable to locate BDFs on perimeter/curtain walls where windows comprise the majority surface of the wall. Floors, walls and ceiling shall be treated to eliminate dust and static electricity. Finishes shall be light in color to enhance room lighting. Floor covering shall be sealed concrete.

12.3.5. Backboard

Provide AC-grade plywood, 8 ft. high with a minimum thickness of 0.75 inches around the perimeter of the room. Plywood is to be either fire-rated or treated on all sides with at least two coats of fire- resistant paint. The bottom of the plywood is to be mounted 8 in. AFF (above finished floor).

12.4. Structural Requirements

The floor rating under distributed loading must be greater than 4.8 kPa (100 lbf/ ft. 2) and the rating for concentrated loading must be greater than 8.8 kN (2000 lbf) in areas that will support telecommunications equipment such as batteries and UPS equipment. If access flooring is used in the BDF, it must be rated accordingly.

12.5. Electrical Requirements

12.5.1. Lighting

Provide adequate and uniform lighting that provides illuminance of 50 foot-candles at a horizontal plane 30” above the finished floor level. Locate light fixtures a minimum of 8.5 ft. above the finished floor. Locate light switches near the entrance to the BDF. Emergency lighting systems which operate on trickle-charge storage batteries are desirable as a safety precaution in the event of an inadvertent power outage.

Coordinate the lighting layout with the equipment cabinet layout, especially overhead cable trays, to ensure the light is not obstructed. Power for the lighting is not to come from the same circuits as power for the technology equipment.

12.5.2. Electrical Service Panels

Electrical service panels located in the BDF will serve only the BDF IT/AV electrical needs. The electrical service panel ground bar will not be shared with any other equipment than IT/AV equipment located in the BDF.

12.5.3. Bonding and Grounding

Provide a copper signal ground busbar in each BDF. The ground conductor is to be a 1/0 copper cable, cad-welded directly to the Under Ground or Main Building Entrance Ground, or building steel.

12.5.4. Conduit Sleeve Penetrations

Provide horizontal conduit sleeves into the BDF for the distribution of the horizontal cable from the cable tray. Conduit sleeves consist of a minimum of (4) 4” conduit sleeves stubbed into the BDF extended 6 in. on both sides.

12.5.5. Fire Suppression

Fire protection of the BDF shall be provided per applicable code. Telecommunication rooms will be equipped with a dry-pipe sprinker systems with sprinkler heads in wire cages to prevent accidental operation. Coordinate the layout of fire protection systems with the equipment layout to avoid obstructing sprinklers, access to the alarm, or other protective measures.

Mount portable fire extinguishers (with appropriate ratings) in the BDF as close to the entrance as possible.

12.5.6. Convenience Power

Provide separate duplex 120 V, 15A convenience outlets (NEMA 5-15R) for tools, test sets, etc., located at least 18 in. above the finished floor, placed at approximately 6 ft. intervals around perimeter walls and identified and marked as such.

12.6. Design Criteria for the IDF

The IDF, Intermediate Distribution Frame is the room type that supports the connection point between backbone and horizontal distribution cable and network edge devices. IDFs are generally considered to be floor-serving (as opposed to building or campus- serving) spaces.

Locate the IDF far enough away from sources of EMI to reduce interference with the telecommunications cabling, including EMI from electrical power supply transformers, motors, generators, radio transmitters, radar transmitters, and induction heating devices. As IDFs are frequently occupied by technicians and sensitive electronic equipment, the room location is not to be adjacent to sources of constant, excessive, low or high frequency noise, such as air-handling equipment, pumps, generators, etc.

12.7. Architectural and Building System Requirements in the IDF

12.7.1. Room Size

IDFs are to be approximately 100 to 120 sq. ft. depending on the size of the serving area the room is supporting. Floor serving areas with less than 10,000 sq. ft., will require a minimum of 10'x10' room. Floor serving area with more than 10,000 sq. ft. will require a minimum of a 10'x12' room.

There must be at least one IDF per floor. Multiple rooms per floor are required if the cable length between the IDF and the telecommunications outlet, including slack, exceeds 295 ft.

12.7.2. Room Use

The IDF is to be dedicated solely to Technology and related facilities. Equipment that does not support the IDF (e. g., pipes, duct work, distribution of building power) is to not be located in or pass through the IDF.

12.7.3. Ceiling Height

The minimum ceiling height is to be 9 ft. above the finished floor with ceiling protrusions (e. g., sprinkler heads) placed to assure a minimum clear height of 8 ft. clear of obstructions, to provide space over the equipment frames for cables and suspended cable trays. To permit maximum flexibility and accessibility of cabling pathways, false ceilings are not recommended in IDFs.

12.7.4. Doors

IDFs are to have lockable doors that are at least 3.5 ft. wide and 6.5 ft. tall. Door sills are not recommended because they impede the movement of equipment. NOTE: Doors that open outward provide additional usable space and reduce constraints on IDF layout.

12.7.5. Flood Prevention

Locate IDFs above any threat of flooding. Avoid locations that are below or adjacent to areas of potential water hazard (e. g., restrooms and kitchens).

12.7.6. Wall and Floor Requirements

IDF walls are to extend from the finished floor to the structural ceiling (e. g., the slab). The IDF is to not have windows installed, nor is it desirable to locate IDFs on perimeter/curtain walls where windows comprise the entire surface of the wall. Floors, walls and ceiling shall be treated to eliminate dust and static electricity. Finishes shall be light in color to enhance room lighting. Floor covering shall be sealed concrete.

12.7.7. Backboard

Provide AC-grade plywood, 8 ft. high with a minimum thickness of 0.75 in. around the perimeter of the room. Plywood is to be either fire-rated or treated on all sides with at least two coats of fire- resistant paint. The bottom of the plywood is to be mounted 8 in. AFF (above finished floor).

12.8. Structural Requirements

The floor rating under distributed loading must be greater than 4.8 kPa (100 lbf/ ft. 2) and the rating for concentrated loading must be greater than 8.8 kN (2000 lbf) in areas that will support telecommunications equipment such as batteries and UPS equipment. If access flooring is used in the IDF, it must be rated accordingly.

12.9. Electrical Requirements

12.9.1. Lighting

Provide adequate and uniform lighting that provides illuminance of 50 foot-candles at a horizontal plane 30" above the finished floor level.. Locate light fixtures a minimum of 8.5 ft. above the finished floor. Locate light switches near the entrance to the IDF. Emergency lighting systems which operate on trickle-charge storage batteries are desirable as a safety precaution in the event of an inadvertent power outage.

Coordinate the lighting layout with the equipment cabinet layout, especially overhead cable trays, to ensure the light is not obstructed. Power for the lighting is not to come from the same circuits as power for the technology equipment.

12.9.2. Electrical Service Panels

Electrical service panels located in the IDF will serve only the IDF IT/AV electrical needs. The electrical service panel ground bar will not be shared with any other equipment than IT/AV equipment located in the IDF.

12.9.3. Bonding and Grounding

Provide a copper signal ground busbar in each IDF. The ground conductor is to be a #2 AWG copper cable, pressure connector or cad-welded directly to the IDF ground bar from the BDF TMGB or Preceding IDF TMB.

12.9.4. Conduit Sleeve Penetrations

Provide vertical conduit sleeves from the IDF if stacked above to support the distribution of backbone cables. A minimum of (4) 4” conduits will be required between floors extend 6” on both sides.

12.9.5. Fire Suppression

Fire protection of the IDF shall be provided per applicable code. Telecommunication rooms will be equipped with a dry-pipe sprinkler system with sprinkler heads in wire cages to prevent accidental operation. Coordinate the layout of fire protection systems with the equipment layout to avoid obstructing sprinklers, access to the alarm, or other protective measures.

Mount portable fire extinguishers (with appropriate ratings) in the IDF as close to the entrance as possible.

12.10. HVAC

Provide BDF/IDFs with either dedicated HVAC equipment, or access to the main HVAC delivery system. Technology equipment requires the HVAC system to function 24 hours per day, 365 days per year. If a building’s HVAC system cannot ensure continuous operation (including weekends and holidays), provide a stand- alone HVAC unit with independent controls for the BDF/IDF. If an emergency power source is available in the building, connect it to the HVAC system that serves the BDF/IDFs..

The HVAC system that serves the BDF/IDFs is to be tuned to maintain a positive air pressure differential with respect to surrounding areas with a minimum of one air change per hour in the BDF/IDFs. Provide equipment to control humidity and air quality if needed.

Provide:

- Temperature 70 degrees F +/- 10 degrees
- Relative humidity 50% +/- 20%

Estimated Heat Loads: 5,000 to 7,500 BTU per equipment cabinet. UPS and stand-alone air conditioning systems produce additional heat, if present.

13. COMMUNICATIONS PATHWAYS

13.1. Ladder Rack

Provide Ladder Rack within the BDF and IDF rooms to route cable to or from sleeves, risers, ducts, cable trays to termination fields within equipment racks or mounted on walls. This cable ladder system is to be contained within the confined rooms.

13.1.1. Ladder Rack Materials and Applications

Cable ladder may be mounted horizontally or vertically on walls and over equipment cabinets and racks. Vertical ladder will be used to support riser cable from floor to ceiling as it passes between floors. The Cable runway system is to be mounted to walls, the top of equipment rack, or hung with threaded rods for bracing and support. Refer to California Building Codes for additional seismic bracing for code compliance.

13.1.2. Ladder Rack Bonding and Grounding

The ladder rack system is to be bonded to the Telecommunications Ground Bus with 6AWG stranded copper wire.

13.2. Equipment Racks

Provide a minimum of (3) equipment racks in a standard BDF rooms and (2) equipment racks in a standard IDF rooms.

13.2.1. Size and Construction

Each rack is to consist of a modular EIA 19'' mounting frame, with a minimum of 84'' (45RU) space for equipment in the vertical plane.

The rack is to be manufactured from steel with a minimum load-carrying capacity of 1000 lbs. (450 kg.). The rack will meet NEBS zone 4 seismic certified requirements and will be EIA-310-D compliant.

Each rack will have both horizontal and vertical cable management. Provide side-mounted vertical cable management on both sides of each rack.

Provide strain relief and cable management at the rear of each rack to ensure tidy routing of all feeder and horizontal cables.

13.2.2. Installation Requirements

Provide all mounting components and accessories to securely fix racks to floor and supporting walls. Provide appropriate seismic transverse and longitudinal bracing per any California Building Codes and the current NUSIG (National Uniform Seismic Installation Guidelines), and fix each rack to the overhead ladder.

Provide cable bend management fixtures to maintain the proper bend radius as the cables drop into the rack. Do not allow cables to be unsupported as they run from conduit or cable tray to equipment cabinets.

13.2.3. Bonding and Grounding

The equipment racks are to be bonded to the Telecommunications Ground Bus with 6AWG stranded copper wire.

13.3. Communication Cable Distribution Infrastructure

The horizontal communication cable distribution infrastructure includes the pathway and support hardware which concentrates, supports and protects horizontal cable between its origination point in the IDF or BDF and the workstation outlet location. It also provides a permanent pathway that facilitates the addition or replacement of cable over time. Horizontal support hardware is further defined as continuous, (e.g. Conduit, Cable Tray) and non- continuous (e.g. J-Hooks, Bridle Rings).

13.4. Communication Distribution Cable Tray

Distribution cable tray is to be installed above the accessible ceiling and used as a main pathway for the management of high volumes of cable through corridors, and for access and egress to BDF and IDFs.

13.4.1. Construction

Cable tray is to be the wire basket type manufactured of ASTM A510 high strength steel wires or equal, and comply with NEMA VE1 or the proposed IEC 61537 standards. The cable tray is to be UL (Underwriters Laboratory) listed.

13.4.2. Dimensions

The cable tray is to be a minimum of 12 in. wide, with a depth of 4 in. Wider or narrower cable tray may be used for locations with higher or lower volumes of cable.

13.4.3. Support Requirements

A trapeze-style support is to be used along the span of the cable tray. The trapeze is to be constructed of channel stock (i.e.Unistrut) and 5/8 in. threaded rod. The trapeze support elevation is to allow a minimum of 12 in. between the top edge of the cable tray and the slab above. Appropriate threaded rod anchors are to be selected and approved by the Project Structural Engineer. Trapeze supports are to be placed a minimum of every 5 ft. and at 24 in. from all cable tray intersections and terminations.

Seismic bracing for the cable tray as required by code, is to be installed along cable tray routes. Coordination of lateral and oblique bracing locations are to be coordinated with the other disciplines whose equipment and systems share the area above the suspended ceiling. Ceiling panels, support channels (T-bars), and vertical supports are not approved supports.

13.4.4. Bonding and Grounding Requirements

The cable tray is to be bonded to the Telecommunications Grounding Bus Bar in the BDF/IDF(s) on the same floor. All non-contiguous segments of the Cable tray is to be bonded together using 6AWG stranded copper wire, with crimp-on lugs bolted to each segment of the cable tray to ensure ground and bonding continuity throughout the length of the cable tray system.

13.4.5. Firestopping Requirements

Cable trays that penetrate fire-rated walls are to be equipped with wall penetration sleeves at each location, and have appropriate fire-stopping materials installed after the placement of cable has been completed.

13.5. Communication Cable System Conduit

Provide communications cable conduit in locations where access to cable tray is unavailable or where portions of the pathway span are inaccessible (i.e. embedded in walls or inaccessible ceilings). Provide conduit for small quantities of cable where cable tray is impractical. Conduit materials may be used to house non-rated cables between end points to ensure NEC Code compliance.

Conduits serving individual workstation outlets are to be a minimum of 1 in. The 1 in. conduits are to be connected to double-gang, deep device boxes (2-1/2 in. deep), equipped with a single-gang mud ring at the outlet location. Individual workstation conduits are to be dedicated to only one outlet box each, and are not to be “daisy- chained” together.

The following conduit type is to be utilized as described below:

13.5.1. Rigid Galvanized Steel (RGS)

Rigid conduit is to be used in areas exposed to the outside elements above ground and used for the containment of non-rated cable as specified in the NEC.

RGS is to be installed using threaded couplers and fittings.

13.5.2. Thinwall Electrical Metallic Tubing (EMT)

EMT is to be used for installations within the confines of an environmentally-controlled building. EMT conduit is not acceptable for non-rated cable installations. EMT conduit may be used, however, to carry riser-rated cable and innerduct in vertical and horizontal cable applications. EMT conduit may be used as sleeves for wall penetrations, and for floor core riser penetrations.

EMT conduit connectors and fittings are to be installed using “Set- Screw” type or air-tight “Compression” type fittings.

13.5.3. Flexible Conduit (“Flex”)

Flexible conduit is not to be used for communication cable installation when EMT conduit is available. Flex conduit may be used for connections into modular furniture or similar applications. When using flex conduit,

increase the diameter of the flex by one trade size over what the requirement would be using smooth-wall conduit. Flexible conduit runs may not exceed 5 feet.

13.5.4. Plastic Conduit/Polyvinyl Chloride (PVC)

Plastic and PVC conduit is to be used for underground duct construction between buildings and vaults. PVC conduits are not to be used within buildings per NEC Code and UBC (Uniform Building Code).

The PVC conduit is to be a minimum of Schedule 40 PVC Plastic.

13.6. Conduit Installation Guidelines

13.6.1. Support Requirements

Conduits are to be installed with support systems such as channel stock/threaded rod trapeze supports. Individual conduits may be supported using threaded rods with clamps. Conduits may be attached to the underside of cable trays and affixed to walls where practical. Seismic bracing is to be installed as required by California Building Codes, DSA, and NUSIG (National Uniform Seismic Installation Guidelines). Accommodations for lateral and oblique bracing struts must be coordinated with the other disciplines that vie for critical ceiling space.

13.6.2. Bonding and Grounding

Bonding of conduits to the Telecommunications Grounding System is required. At the termination of conduit runs within technology rooms, attachment of a ground wire between the Telecommunications Ground Bus to grounding rings installed on conduit box connectors is to be accomplished to ensure electrical continuity of the conduit system.

13.6.3. Firestopping

All partially filled and empty conduits that pass through fire-rated walls or through floors are to be fire-stopped in accordance with Local Fire Codes. Material is to be flexible firestopping putty or pillows.

13.6.4. Innerduct

Innerduct may be installed when space requirements allow to establish multiple pathways in a larger conduit or provide a pathway across a cable tray. Innerduct is to be used for the protection of fiber optic cabling, but copper cabling may be installed in the innerduct to prevent tangling with other cables already present. Innerduct is to be used to protect fiber optic cabling in cable trays, exposed areas in ceilings, IDFs, and BDFs.

13.7. Communication Cable System Pull Boxes

A pull box is to be installed in conjunction with conduit installations to provide access to cables at appropriate locations for distribution to tributary locations, and to facilitate cable installation.

13.7.1. Materials

For indoor use, use NEMA Type 1 pull boxes. For areas exposed to heavy moisture, chemicals or weather elements, NEMA Type 3 or 4 pull boxes are to be installed.

The pull box is to be equipped with hinged covers, or removable covers which are screwed or bolted on. The pull boxes are to have hardware for supporting and securing cabling and pulling eyes to facilitate cabling installation.

13.7.2. Placement

A pull box is to be installed after 100 feet of conduit has been placed, and/or after 180 degrees of directional change in the conduit pathway has been affected. The installation of a pull box is not to be used for directional change.

13.7.3. Support Requirements

Pull boxes are to be attached directly to the ceiling slab, or suspended by 4-point threaded rod supports anchored to the ceiling. Pull boxes will require seismic bracing in order to comply with applicable California Building Codes. Seismic bracing is to be installed as required by local building codes, DSA, and NUSIG (National Uniform Seismic Installation Guidelines). Accommodations for lateral and oblique bracing struts must be coordinated with the other disciplines that vie for critical ceiling space.

13.8. Horizontal Cable Support Hardware (Non-Continuous)

Horizontal Cable Support Hardware such as J-Hooks are to be used in locations where the communication cable is not supported by continuous systems such as cable trays or conduit.

Provide J-Hooks every 36”-48” at a minimum, attached to threaded rod or ceiling hangers to provide support for cable bundles or innerduct.

The J-Hooks are to be metal stampings configured in a “J” form providing a broad cradle or saddle for supporting for of cable.

14. LABELING CONVENTIONS

14.1. Overview

COD campus labeling standard are derived from ANSI/TIA/EIA-606-A, Administration Standards for the Telecommunications Infrastructure of Commercial Buildings. The objective of the labeling standard is to provide a uniform and consistent labeling convention throughout the entire telecommunications system. COD requires that an approved system label be used to deliver the required identifying information. Labels specifically manufactured for telecommunications administration labeling applications is the accepted industry standard and the COD standard. All labels shall be printed. Handwritten labels, in any format, are not acceptable.

14.2. Work Area Outlet Labeling

Each telecommunication jack will be individually provided with a 3/8 inch tall label consisting of one line of text of black ink on white background. The label will be placed in/on the work area outlet faceplate window.

14.2.1. Labeling Convention

The convention for the telecommunication jack identifier is:

BDF/IDF Room Number – Equipment Rack Number/Patch Panel Number – Patch Panel Port Number

Examples: BDF 120-1A-01 or IDF 220-1A-01

14.3. Equipment Rack Labeling

Floor and wall mounted equipment racks will be individually provided with a 3/4 inch tall label consisting of one line of text of black ink on a white background. The font type and size will be selected so that letters and numbers are clearly visible from a distance of three feet. Labels will be placed at the top front and top rear of each equipment rack.

14.3.1. Labeling Convention

The convention for the equipment rack identifier is:

BDF/IDF Room Number – Rack Number

Examples: BDF 120-1, 120-2 or IDF 220-1, 220-2

14.4. Patch Panel Labeling

Each patch panel will be individually provided with a 1/2 inch tall label consisting of one line of text of black ink on a white background. Labels will be placed on patch panels to be readable and in a consistent vertical plane.

14.4.1. Labeling Convention

The convention for the patch panel identifier is to begin with the first patch panel at the top of the first equipment rack receiving an “A” designation, the second patch panel receiving a “B” designation and continuing in sequence for all patch panels.

Examples: Panel – A, Panel – B, Panel – C… Panel – F, etc.

14.5. Fiber Optic Panel Labeling

Each fiber optic panel will be individually provided with a 1/2 inch tall system label consisting of two lines of text of black ink on white background. Labels will be placed on the FOC at a readable position.

14.5.1. Labeling Convention

The convention for the fiber optic identifier is:

Line 1: Building Name and Room Number of Far End Fiber Optic Cable Termination Point

Line 2: Equipment Rack Number of Far End Cable Termination Point- Fiber Number - Type of Far End Cable Termination Point - Fiber Panel Designation of Far End Cable Termination Point

Example: Classroom Bldg. Rm # 137

BDF 120-1 - 12MM - Panel A

14.6. Network Equipment Labeling

COD network switches, routers, servers and all other network appliances will be individually provided with a 3/4 inch tall label consisting of one line of text of black ink on white background. Labels will be placed on COD Network equipment at a readable position. Consult with COD IS Department for specific label position.

14.6.1. Labeling Convention

The convention for each piece of network equipment identifier is:

Name of the Network Appliance/ IP Address (IPA)/Card and Port Number of Building or Equipment Served

Example: Network Switch/IPA XXX.XXX.XX.X/Card 1 Port XX

14.7. Pathway Labeling

All campus pathways will be will be provided with a one inch tall system label consisting of one line of text of black ink on white background. The label shall be affixed to all conduits or surrounding borders, either individually or by group, so that pathway end points are clearly identified. The label will be placed in a visible location not to be blocked by incoming or outgoing cable.

14.7.1. Labeling Convention

The convention for the pathway identifier is to indicate the pathway location name: Hand Hole (HH), Pull Box (PB), Vault (V) or Maintenance Hole (MH), and number.

Examples: HH4, PB19, V2, MH9

Entrance conduits in telecommunications rooms will be provided with a one inch tall system label consisting of one line of text of black ink on white background. The label shall be near the entrance conduit location.

14.7.2. Labeling Convention

The convention for the entrance conduits is to identify the first outside connection point to the campus infrastructure system.

Example: ENTRANCE CONDUITS TO MH20

15. GROUNDING AND BONDING

15.1. Overview

COD campus grounding and bonding standards are derived from ANSI/TIA/EIA-607, Grounding and Bonding Requirements for Telecommunications Commercial Buildings. The objective of the grounding and bonding standard is to protect safety of personnel and COD electronic equipment.

Each Entrance Facility and Telecommunications Rooms must have a connection point to the Telecommunications Grounding System to allow for bonding of equipment systems, metallic cable baskets and trays, metallic water pipes, metallic floor tiles, equipment racks and equipment cabinets. These connection points should be sufficiently close to provide low impedance bonding.

15.2. Telecommunications Bonding Backbone

The primary function of the Telecommunications Bonding Backbone (TBB) is to reduce or equalize electrical potential differences between telecommunications systems. The TBB is an insulated copper conductor that connects the telecommunications main grounding busbar (TMGB) to the telecommunications grounding busbar (TGB) located on the floor farthest away. The TBB interconnects all TGB's with the TMGB. The TBB starts at the TMGB and extends throughout the building using telecommunications backbone pathways. The TBB connects to TGB's in all telecommunication rooms and the equipment room.

15.3. Telecommunications Bonding Backbone Interconnecting Bonding Conductor

The Telecommunications Bonding Backbone Interconnecting Bonding Conductor (TBBIBC) is a conductor used to interconnect telecommunications bonding backbones.

15.4. Telecommunications Main Grounding Busbar

The Telecommunications Main Grounding Busbar (TMGB) is a busbar bonded to the service equipment (power) ground by the bonding conductor for telecommunications. The TMGB serves as a dedicated extension of the building grounding electrical system for the telecommunications infrastructure. It also acts as the central connection point for TBBs and other equipment. The TMGB should be placed in a location that is convenient and accessible.

The TMGB must be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing for the type and size of conductor being used TMGBs are a minimum of 6 mm (0.23 in.) in thickness, 100 mm (4 in.) wide and of variable length.

15.5. Telecommunications Grounding Busbar

The Telecommunications Grounding Busbar (TGB) is located in a telecommunications room or equipment room, it serves as a common central point of connection for telecommunications systems and equipment in the area served by that TR or equipment room. Bonding conductors used between a TBB and TGB must be continuous and routed in the shortest, straight-line path possible.

When a panelboard for telecommunications is located in the same room as the TGB, bond the panelboard's ACEG bus (when equipped) or the enclosure to the TGB Bond the TGB to the TBBIBC where required.

The TGB must be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing for the type and size of conductor being used TMGBs are a minimum of 6 mm (0.23 in.) in thickness, 100 mm (3 in.) wide and of variable length.

15.6. Bonding Conductor For Telecommunications

This conductor is used to bond the TMGB to the service equipment (power) ground which is in turn connected to the grounding electrical conductor. The copper core conductor must be insulated and be at least No. 2 AWG in size. Whenever possible these conductors should not be placed in metallic conduit. If this cannot be avoided, the conductors must be bonded to each end of the conduit if the run is longer than 1m (3 ft.) in length.

15.7. Bonding For Telecommunications Room Equipment

Equipment residing within the Telecommunications Room will be bonded to the respective Telecommunications TMGB or TGB using a minimum #6 AWG copper conductor. A separate #6 AWG bonding conductor will be pulled and terminated to each cabinet or rack. Daisy chained bonding is not acceptable. Equipment to be bonded to include but not limited to all cabinets, equipment racks metallic

optical fiber panels, and cable tray. Each cabinet or equipment rack will have a suitable connection point to which the framework bonding conductor can be bonded.

16. PUBLIC ADDRESS

16.1. Overview

Public Address System allows users the ability to broadcast voice messages or audio programming across a network of speakers that are typically mounted on walls or in the ceiling.

16.2. Building Distributed Amplified Speaker System

The distributed amplified paging system is a one-way constant voltage system. The components required include amplifiers, zone controllers, speakers and transformers.

The amplifier is to be rack mounted in the BDF or IDFs. One amplifier is required per floor. The amplifier is to be sized so not to exceed 80% of the combined speaker tap settings.

The zone controller is to be rack mounted in the BDF or IDFs. One zone controller is required per floor. The zone controller provides an IP addressable connection to the campus LAN for distributed paging messages.

Speaker wire will be 18 gauge, 2 conductor non-shielded, CL2 rated stranded with a plenum cable jacket. Speakers are to be wired in series from the amplifier to the last speaker in the line configuration.

16.3. Speaker Placement

Speakers are to be located throughout a building in a way that provides even coverage at the lowest level possible so that the reverberant sound is not audible. Speakers are required in all support spaces including bathrooms.

16.4. Speaker Selection

Wherever possible, lay-in ceiling speakers are to be incorporated in the building design. Where ceiling obstructions do not allow for lay-in speakers, recessed wall-mount or ceiling speakers are to be used.