

**APPENDIX 3T**  
**LECTURE ROOM REQUIREMENTS**

Please see attached.

PURPOSE This Appendix sets out more detailed specifications and requirements, in addition to those generally listed for Multimedia rooms in Section 7.10.15 of the Statement of Requirements, for the design and construction of the lecture room.

1. Lecture Room (Type 4 Multimedia) Overview

- a. Primarily a large videoconference room or lecture hall with an audience of 100 participants the room is anticipated to have a maximum occupancy of 140 people for non multimedia events.
- b. As the room has a flat, non-raked floor a low stage is required at the front, to maximize sightlines from presenters to/from audience members and from all participants to video cameras and projection screens.
- c. The Type 4 room will be equipped with permanently installed Audio Visual (AV) and Video Conferencing (VC) systems. The VC system will have two VC projectors facing two, fixed, side by side projection screens for the simultaneous display of electronic images including video, document camera, computer based digital slides text and images, computer based presentations, broadcast television signal feeds, as well as multimedia image/sources from remote locations.
- d. There will be a portable presenter's lectern on the stage, which will be one of three AV and building systems control points, the others being a wall mounted touch screen on the rear wall near the equipment racks, and a wall mounted touch screen on the front wall for when the lectern is present or not in use. The lectern provides a work surface for presenters. It will house components that include a blu-ray player, a computer interface, microphones, a systems control touch screen and a document camera. The lectern will also have a "write on" surface providing electronic annotation capabilities. This will provide the presenter with the ability to annotate the computer-generated image displayed on the local and the remote location video screens.
- e. Additionally, there will be two LCD preview/confidence monitors to provide presenters with the ability to move freely about the stage while still seeing the selected sources and remote conference participants.
- f. The lecture room will sometimes be used for purposes that do not require AV and Video Conferencing. Therefore, the stage, stairs, lectern, tables, chairs, power and data multi-cable "snakes" for the lectern, microphones and other non-fixed multimedia components are to be of a type that enables an easy disconnection, removal and transport for storage in a corner of the room and in secure millwork/cabinets, leaving the room as a large, clear, flexible event space with no obstructions or impediments. Those moveable items must be easy to transport, re-assemble and reconnect in the Type 4 room when it is converted back and setup for multimedia purposes
- g. The room's audio systems perform two key functions: playback of multimedia material from various sources, and capture, processing and playback of local live audio. There will be wired and wireless presenter microphones. One push-to-talk table-top microphone will be shared between each pair of audience seats. These microphones will be wired, push-to-talk gooseneck type microphones placed on the mobile tables in the audience.
- h. Project Co. is to provide suitable tables that can be easily transported for storage, have lockable wheels, and a cable management system for routing mic cables from floor boxes to microphones and power cables from users laptops and other devices to the

floorboxes during videoconferences and other multimedia sessions to protect the cables and prevent tripping hazards.

- i. The lecture room will house two ceiling mounted video/data projectors
  - j. Multimedia source equipment and controls and AV equipment storage will be located in secure, tamper proof racks and cabinets located at the rear of the lecture room
2. Multimedia Equipment and Control
- a. The AV and VC playback systems will use loudspeakers flanking the large screen displays located on the front wall with further reinforcement in the ceiling as necessary to provide even stereo audio playback levels throughout the room. The centrepiece of the audio systems will be a centralized Digital Signal Processor (DSP) and matrix mixer/router system that will allow the various microphone and AV source inputs to be sent to the appropriate signal paths with suitable signal processing. Automixers will be used to mix all microphones to manage feedback and will be simultaneously mixed and processed with automatic gain control and digital echo-cancelling. This process will also be used for the video conference feeds. The AV source inputs will be routed to the AV playback speakers, video conference sends and archival feeds as required. The DSP will also handle equalization, signal delays, compression, limiting, level adjustment and other required audio functions.
  - b. The control system will integrate the function of the many devices in the room's AV and VC systems. This will also be connected to the LAN using the control system web interface. All of the required remote-controllable devices will be connected to central processors, allowing control to be from three Crestron touch screens.
  - c. For the purpose of connecting to remote sites, the room will be equipped with full HD videoconferencing capability, allowing simultaneous transmission of up to two video and two graphics channels. This will be accomplished locally via two videoconferencing CODECs and one KVM VNC server collaboration application data link (or similar).
  - d. It is critical that there be a clear projection path between the projectors and the projection screens at the front wall. For example, location of lighting fixtures, ducts, sprinkler heads or other ceiling devices in the lecture room must be taken into account.
3. Control racks
- a. Provide at the rear of the lecture room all multimedia equipment racks, in cabinets with lockable front and back doors for housing audio and video monitoring equipment, inbound and outbound signals routing, playback devices, processing equipment, patching matrixes, input and output devices, and other controls equipment.
  - b. Provide lockable metal AV cabinets for storing all batteries, microphones, cables, adapters and connectors, spare parts, spare projection bulbs and similar items that form part of the AV and video conferencing systems.
  - c. The control racks and cabinets may also house equipment racks and the processors, switches and other multimedia equipment for the Type 2 rooms.

- d. Cabinets and racks must be seismically mounted. Front and rear doors are to be hung in a gull-wing pattern so that two racks can be accessed simultaneously.
- e. Provide a millwork shelf on the rear wall near the AV racks, suitable for a technician to sit and operate a laptop, with lighting, and power and data connectivity
- f. Control racks lighting
  - 1. Provide front and back led lighting at the front and back of each AV cabinet. Lights can be gooseneck, or pull-out, and are to illuminate the front and rear interior of the racks without interfering with or distracting presenters or others on stage
  - 2. Provide a wall mounted dimmable gooseneck task light at the technicians position on the back wall.

#### 4. Electrical

- a. Two 54mm rigid conduits will connect the lecture room equipment racks with the Facility's low voltage cable tray.
- b. The equipment racks will have substantial power and heat loads for the audiovisual and videoconference systems. The electrical and mechanical design and supply is to anticipate at a minimum:
  - a. The AC load requirement for the equipment racks is typically 4,500 watts per rack in operation and 1200 watts at idle.
  - b. The AC load requirement for the ceiling mounted projectors is typically 1,200 watts per projector in operation and 200 watts at idle
- c. Provide the following power receptacles for the support of the audiovisual systems:
  - a. One 15-amp Dual AC receptacle, with its own 120V/15amp circuit, ceiling mount near the left projector location in the lecture room.
  - b. One 15-amp Dual AC receptacle with its own 120V 15Amp circuit ceiling mount near the left projector location in the lecture room.
  - c. Two 15-amp Quad AC receptacles (per rack), with one 120V/15Amp circuit per quad receptacle, mounted either above or inside the AV equipment racks at the rear of the room.
  - d. Allow for a minimum of four data outlets to be terminated inside each AV rack. Provide more if the AV design requires it
  - e. Two 15-amp Dual AC receptacles on a 120V 15Amp circuit wall mounted for use by technicians or operators on the rear wall of the lecture room
  - f. Provide: Three data outlets at the operators position on the rear wall.
  - g. One 15-amp Dual AC receptacles on a 120V 15Amp circuit wall mounted for each of the AV equipment cabinets for charging batteries and other devices
  - h. All AC receptacles to be utilized for the AV systems will have a very low impedance connection to the ground plane of the building.
  - i. All AC receptacles for the AV equipment racks require the provision of a ground point termination bar.

## 5. Architectural

- a. The lecture room will be a single contiguous space, with unobstructed sightlines, and will not be sub-dividable.
- b. The room dimensions shall provide for a maximum occupancy of 140, with the minimum required audience size of one hundred (100) audience seats with microphones on worktables when in videoconference mode.
- c. For acoustical purposes the floor and ceiling must not be parallel with each other and the side walls must not be parallel with each other. Offset should be a minimum of 6% for each surface, or 12% overall. The Design-Builder is to confirm actual required offset percentage of each opposing surface with the acoustical consultant.
- d. The front/back to side walls layout aspect ratio of the lecture room will be as close to 1:1.2 as possible to maximize the functionality of the space for videoconferencing and reduce additional AV and VC equipment costs necessitated by compensating for the drawbacks of long narrow rooms.
- e. The ceiling height at the front wall from the top of the stage to the underside of the finished ceiling must be high enough to accommodate projection screens of a sufficient size, and at an elevation that provides comfortable, unobstructed views from all seats and leaving a small clearance above the screens.
- f. In a flat floor scenario, a stage across the front presentation wall, at a height sufficient to provide clear sightlines from the presenter(s) to all seated participants in the room, and from all seated participants in the room to standing or seated presenters will be required.
  - i. The stage must have a ramp for wheelchair access with a code compliant rise. Any steps must have a handrail if code requires it.
  - ii. In order that the audience is presented with a finished surface and not an open void the stage is to have a front skirt.
  - iii. In order that the wheeled lectern and other wheeled devices don't roll off the stage an edge bumper is required
  - iv. The stage requires two flush floor boxes on the centreline containing 120v power outlets, 4x network data drops, and connections for 6 wired microphones.
  - v. The required minimum clearance of the front wall from the top of the finished stage to the bottom of the projection screens will be no less than 2000mm.
- g. Placement of screens and cameras will provide unobstructed sightlines from seats to screens and to video cameras.
  - i. The lecture room must have projection paths clear of any obstructions or items suspended from the ceiling between the projector locations to the front wall, with the bottom of the projection path to be a minimum of 2000mm AFF (above finished floor) at any point along the path, including the stage.
- h. The room will be used with differing furniture layouts. As the sightlines from cameras to microphones is critical and must never vary the floor is to have permanent markings as part of the pattern indicating exactly where the table legs for each row are to be placed for a variety of layouts

- i. Provide all necessary structural support for the wall and ceiling mounted equipment in the lecture room.

## 6. Acoustics

- a. Design and construct the lecture room with appropriate acoustical conditions to make the room functional for large meetings, multimedia AV presentations, and video conferencing.
- b. Ambient noise including HVAC and electrical or mechanical noise will be controlled, and appropriate acoustical treatment will be installed to control reverberation, minimize reflections, flutter echo and other acoustical issues that may adversely affect the microphones pickup.
- c. Hard reflective wall or ceiling surfaces within 2500mm of lectern or table top microphones will be avoided, and may require the addition of absorption or diffusion materials as the reflections from these surfaces will create audible artefacts or lower feedback thresholds.
- d. Carpet is always preferred in large conference rooms as it absorbs unwanted sounds well. If the lecture room can not have carpet the flooring material is to be a cushioned vinyl of a type with highest absorption coefficient and least acoustical reflection properties
- e. Project Co. is to provide stackable chairs with padded seats and padded backs to absorb sound and minimize acoustic reflections. Confirm colour and finish with the Authority for approval prior to procurement. Chair bases must not be of a type that will damage mic or power cables that connect to the floorboxes
- f. Provide fabric covered medium density fibreglass panels at 1000 mm AFF and extending to 2500 mm AFF on the two sidewalls and rear wall. The panel construction will be:
  - 1. Minimum 50 mm thick pre-finished acoustic panels on the rear wall. Minimum Noise Reduction Coefficient (NRC) 0.95 rating.
  - 2. Minimum 25 mm thick pre-finished acoustic panels on the side walls. Minimum NRC 0.85 rating.
  - 3. Contiguous application over certain areas as may be required to meet the requirements of this Appendix.
- g. An acoustic ceiling is required. It will have a minimum NRC rating of 0.70 and a minimum Ceiling Attenuation Class (CAC) rating of 35. In addition, the ceiling will be back loaded with batt insulation (bagged, if necessary) to broaden the sound absorbing range.
- h. Concave curved wall and ceiling surfaces focus sound and are to be avoided. Any concave curved surface must be treated with suitable broadband acoustic treatment to absorb or diffuse the sound wave front.
- i. The 100% occupied reverberation time will not exceed 0.6 seconds (mid-band), and the 70% occupied reverberation time will not exceed 0.7 seconds (mid-band), in the room.
- j. Background Noise
  - i. Noise control measures will be undertaken to achieve a background noise criterion of NC25 for the Type 4 room in order to provide good speech intelligibility for both local and remote listeners. This includes noise from active HVAC.

- ii. To reduce the noise generated by the airflow of the HVAC system, a maximum airflow of 1.52 metres per second at the face of the diffusers and 1.8 meters per second at the face of the return air grilles will be allowed for, diffusers selected for low noise levels, and open diffusers with no dampers (or the dampers placed upstream of the diffuser by at least 3m) and the duct downstream of the dampers lined with fibreglass duct liner. Dampers will never be closed down to less than 80% of the maximum opening to prevent excess turbulence-generated noise.
- iii. Selection of noise rating of the HVAC diffusers will be based on the actual design airflow, and the Design-Builder will not presume that they will meet their noise rating at any airflow. The Design-Builder will take into consideration the total number of diffusers understanding that each doubling of the number of diffusers increases the overall noise level by 3dB. Diffusers must be selected to be 10 NC points lower than the NC rating for the room.
- iv. Care will be taken in locating return air elbows in systems that are not ducted. Acoustically lined return air elbows must be located in non-critical acoustical walls (i.e. walls with doors, typically), must contain minimum 25 mm thick acoustic insulation and must be designed to block the acoustic “line of sight” through the elbow.
- v. The return air grilles in the rooms will be located an optimum distance from the return air elbow to reduce the potential for cross-talk.
- vi. It is essential that all noise-producing HVAC equipment including mixing boxes, fan powered mixing boxes, and fan coil units be located outside the room and not within ceiling plenum spaces.
- vii. Sound Isolation – Adjacent Spaces
  - 1. One of the key objectives is achieving adequate sound isolation between the Type 4 room and adjacent spaces. Such adjacent spaces might include but are not limited to offices, storage spaces, lobby spaces, meeting rooms, washrooms, corridors etc.
  - 2. To meet low ambient noise levels requirements, the Type 4 room will not be located adjacent to mechanical or electrical rooms, exercise areas, washrooms, or elevators.
  - 3. In order to achieve the proper sound isolation, all perimeter walls of the Type 4 room must achieve a Sound Transmission Class (STC) rating of STC 55. The laboratory STC ratings of all such perimeter walls must meet the requirements of ASTM E9009: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- viii. Noise Isolation - Doors and other Entryways
  - 1. Where a single door (non-vestibule) opens to a noisy corridor, lobby or waiting area, a single width purpose-built acoustic door with a minimum STC 50 rating will be used.
  - 2. For all other situations (including vestibule doors):
  - 3. Use solid core wood or filled metal doors.

4. Ensure use of properly selected acoustic seals equal to or better than Pemko Type Silicon Seal S-88 plus Pemko Type 350 around the perimeter.
  5. Install automatic drop down threshold closers equal to or better than Pemko Type 430.
  6. Install all such doors/door systems so that light will not pass through the doors/door systems.
- ix. Noise Isolation – Floor/Ceiling.
1. The location of the Type 4 room is important not only from a horizontal noise perspective, but also in terms of the floor/ceiling acoustic performance.
  2. The airborne noise isolation between vertically stacked spaces will meet minimum STC 50 rating.
  3. Impact noise including footfall noise, movement of goods or equipment, chair scraping etc. can have a significant impact to the room acoustics. Where there is occupied space above the Type 4 room it may be necessary to include a full acoustic ceiling in the room to help control impact noise.
- x. Noise Isolation – Exterior Noise Impact
1. The maximum noise level due to exterior noise will be 35 dBA.
  2. To the extent possible, the Type 4 room will not be located next to exterior walls adjacent to busy roadways, transit routes, helicopter pads, major exterior equipment (such as cooling towers, chillers, emergency generator sets), or below floors which contain major equipment in order to avoid sonic or subsonic vibration.
- k. Lighting
- i. 3500 degrees Kelvin colour temperature is required. Different lights/colour temperature are not to be mixed.
  - ii. Lighting shall be LED, no fluorescent light ballasts will be used.
  - iii. The lighting dimmer controller will provide remote control access capability via serial or Ethernet protocol to control lighting ON/OFF and preset recall control from the AV control system.
  - iv. For videoconferencing and AV modes the stage at the front of the room directly in front of the projection screens and approximately 2000mm deep is to be a low light area. The light level in these areas will be as low as possible to avoid washing out the image of the presenter. Such areas will be on a separate control group. During panel discussions, this area requires full illumination.
  - v. Light reflecting off projection screens and video display surfaces must be avoided.
  - vi. Lighting style and colour temperature will be carefully designed, such that the overhead lighting has an angle of incidence to eliminate “raccoon eyes” and dark shadows under the chin/nose and achieve the proper reproduction of skin tones in the video images.



- vii. For videoconferencing, perception (visibility, intelligibility and comfort) becomes an important factor of the design. Instructors/presenters will not feel comfortable in an overly illuminated or glaring environment and where they cannot see easily.
- viii. The AV lighting system will be zoned on separate circuits and controls from the regular room lighting system.
- ix. The reflected light from the walls will be slightly less than that from the faces of the individuals on camera. This is to provide some contrast while not creating exposure level difficulties for the camera.
- x. The room lighting that falls on projection screen surfaces or video display surfaces will be separately switched.
- xi. The presenter will have an illuminated level of 80 foot candles at face level, with lighting reflecting off the lectern surface at an approximate 15 – 20-degree angle, and will be dimmable on a separate switch.
- xii. The audience lighting areas will have illumination requirements of 50 – 60 foot candles at face level with lighting reflecting off the table surfaces at an approximate 15 – 20-degree angle. The lighting will be dimmable, with multiple zones for each of the seating layouts.

#### I. Interior Design

- i. The colour of the walls will be either grey or blue to provide visual definition to the presenter relative to the background. The purpose of the solid colour is to avoid adding unnecessary bandwidth to the video conferencing signal, and to avoid the reflected light from the background affecting colour quality of the images. Provide samples of the proposed paint colours for the Authority's review.
- ii. The colour of the table and lectern surfaces will be either antique white or a light grey colour to allow the 45-degree light to bounce off the surface and reflect upward. This helps to illuminate the faces of the presenters and eliminate the dark shadows under the chin/nose.
- iii. The cameras require wall and/or ceiling positioning for appropriate image angles, and for complete visual coverage for all different usage scenarios and furniture layouts. Specific, designated positions in the walls are required to accommodate the cameras. The cameras also require appropriate housing for protection from theft and damage.
- iv. Two permanently-mounted, side-by-side video conference projection screens located at the front wall will be made of Level 5 drywall plaster with a smooth finish. The projection surfaces will be even and clean.
  - 1. The two fixed projection surfaces will be coated with a suitable projection paint, providing a matte white finish and a light reflection of a minimum 1.1.
    - i. Shop drawings or data sheets for the projection paint are to be provided for the Authority to review prior to procurement that provide the following:
      - 1. Gain

2. Grey level neutrality
  3. Sheen level
  4. Composition (acrylic vs latex etc)
  5. Suitability for bright, 4k projection systems
  6. Means of application,
  7. Priming requirements and number of coats
  8. dry time
2. All projection screens and all display monitors will have a 16:9 aspect ratio.
  3. The two fixed projection screens will be at a vertical angle of approximately 5 degrees (tilting down to the audience on the flat floor), with the angle to be confirmed as part of the design process. The projection screens will be aligned to be parallel with the projector lenses.
  4. The horizontal distance from the projection screens to the closest viewer seated in the front row will be greater than 1.05 times the single image screen width.
  5. Ratio of the distance from the projection screens to the most distant viewer in the room to screen height will not exceed a factor of 6.7 (distance to most distant viewer, MDV, divided by a single screen height, SH) for 95% of all seats. A maximum of 5% or six seats may be at a maximum MDV to SH factor of 7.2.
  6. The horizontal viewing angle will be up to a maximum of 85 degrees of axis for 95% of all audience seats. Up to 5% or six seats may be up to a maximum of 100 degrees horizontal viewing angle.
  7. The vertical viewing angle will be up to a maximum of 30 degrees for 95% of all audience seats. Up to 5%, or six audience seats may be up to a maximum vertical viewing angle of 37 degrees.
- v. The front wall will provide a minimum of 1200mm to the left and the right of the two fixed projection screens for the wall mounted playback speakers. Speaker placement will be coordinated with the Authority as part of the design process.
  - vi. The wall mounted playback speakers will be mounted at approximately 4000mm AFF. The mount locations will be equipped with plywood backing of a minimum of 1200mm x 1200mm in size, to support a minimum of 200 pounds.
  - vii. Provide a portable lectern on the stage that meets or exceeds the requirements described in Section 7.10.15.14.
    1. The Design-Builder will submit shop drawings of the lectern for review by the Authority prior to fabrication or procurement.
    2. The lectern will be located to the right (stage right/house left) of the room's centre line.
    3. The distance from the front wall to the lectern will be no less than 1600mm.
    4. The distance from the lectern to the front row of audience seating/tables will be a minimum of 2400mm.
    5. Connection "snakes" for the lectern are to enter from the stage right side of the lectern. When used on the stage (typical) the snakes are to run under the stage to the front wall. If used on the flat floor the snakes

can run on the floor. Cable snakes are to be wrapped for protection with braided expandable polyester sleeving.

6. A mock-up of the proposed lectern will be provided if requested by the Authority to verify sightlines and cable routing.
  - viii. The architectural design will allow for 3 audience cameras to be located on the front wall. The camera location will be at the bottom of the projection screens
  - ix. The back wall will accommodate a wall-mounted presenter camera near the midpoint of the lectern and centre stage.
  - x. The 2 confidence monitors, on mounts with lockable wheels, are to be used in two positions to provide unobstructed views of the monitors without blocking the sightlines from the audience to the presenter and vice-versa.
    1. For a presenter at the lectern the monitors will be located on the left side of the lectern
    2. For a presentation, demonstration, or panel discussion at centre stage the confidence monitors are to be located to stage right of the centre line
    3. AV and power cables are to feed through holes in the stage to connection boxes on the front wall keeping the stage clear of tripping hazards and obstructions for wheelchairs and other wheeled conveyances
7. AV Systems Electrical Infrastructure Minimum Requirements
- a. The Type 4 room will be equipped with a suitable conduit/cable-tray and back-box infrastructure to support the low voltage AV system connectivity requirements.
  - b. Four 27mm conduits and two 54mm conduits will connect the front wall boxes for the lectern with the projection and control equipment rack location (home run). Provide one empty conduit 54mm with pull string for future use.
    - i. One 27mm conduit will connect each audience camera location at the front wall with the projection and control equipment rack location (home run). The conduit end at the camera location will terminate into a recessed, 87mm deep single gang box.
    - ii. Three 54mm rigid conduits will connect the confidence monitor backbox/plate location with the projection and control equipment rack location (home run). The conduit end at the confidence monitor box location will terminate into a recessed, 87mm deep four gang box mounted on the front wall
    - iii. One 27mm conduit will connect the presenter camera location at the back wall with the projection and control equipment rack location (home run). The conduit end at the camera location will terminate into a recessed, 87mm deep single gang box.
    - iv. Two 27mm conduits will connect the playback speaker locations at the front wall with the projection and control equipment rack location (home run). The conduit end at the playback speaker location will terminate into recessed, single gang boxes mounted at approximately 4000mm AFF at the front wall. The playback speaker back boxes will be located 1000mm to the left and to the right of the projection screen locations.
    - v. One 21mm conduit home run will connect the projection and control equipment rack location to each ceiling loudspeaker zone. All zones will be laid out in the same direction as the audience seating/tables in video conference mode. The conduit will connect the speakers for a total of up to eight speakers per zone.

- vi. Install suitable sized loudspeaker cable to connect the audio amplifier mounted in the AV equipment racks located in the projection and control equipment racks to all speakers.
- vii. Two 54 mm rigid conduits will connect the projection and control equipment rack with a data/communication closet on the same floor as the Type 4 room.
- viii. Where possible, adequately sized basket cable tray may be used to combine individual conduit runs. Any such cable trays must provide suitable compartments to separate video, audio and control signal wiring.
- ix. Conduit runs with more than 90 degree turns require cable pull boxes to be inserted in the proper locations.
- x. All conduits require being equipped with pull-strings.
- xi. Provide the following power receptacles for the support of the audiovisual systems:
  - 1. Two 15-amp Quad AC receptacles with one 120V 15Amp circuit per quad receptacle, mounted inside the lectern.
  - 2. One 15-amp Dual AC receptacle with its own 120V 15Amp circuit, mounted at the lectern face plate.
  - 3. Two 15-amp Quad AC receptacles with one 120V 15Amp circuit per quad receptacle, mounted inside the floorboxes closest to the confidence monitor lectern and centre stage locations.
  - 4. One 15-amp Dual flip-open AC receptacle with powered USB receptacles for each pair of audience seats. These receptacles will be recessed into the floor boxes which are to be located under the front edge of audience tables when the room is configured in video conference mode - classroom style.
  - 5. Two 15-amp Quad AC receptacles with one 120V 15Amp circuit per quad receptacle, each mounted inside a flush floor box on the centreline of the stage. Access via access hatch in the stage.
  - 6. All AC receptacles to be utilized for the AV systems will have a very low impedance connection to the ground plane of the building.
- c. Videoconference System Data and Telephone Outlet Minimum Requirements
  - i. Provide network data drops at the lectern as follows:
    - 1. Two for the presenters' PCs.
    - 2. One for VNC remote access.
    - 3. One AV Control System.
    - 4. One for a VOIP phone .
    - 5. One for audio network.
    - 6. One for document camera.
    - 7. One auxiliary.
  - ii. Provide network data drops at the technicians position on the rear wall
- d. Speakers
  - i. Videoconference acoustic echo cancelling relies on minimizing the number of loudspeakers in the room.
  - ii. Loudspeaker positioning will be based on providing optimum uniformity and coverage. There will be speech reinforcement loudspeakers distributed in the ceiling to provide uniform speech levels for general presentation purposes. This is necessary to eliminate the problem of having excessive sound levels at the front of the room in order to achieve adequate sound levels at the back.

- iii. The flush mount ceiling speakers will be at locations determined during the design process based on Project Co's approved acoustical modeling of the architectural design and table layout.
  - iv. Speaker grilles or covers must be acoustically transparent and free of obstructions larger than 19mm square as these create shadows in the coverage and their colour must match the background
- e. Mechanical Protection from Water Damage
- i. These lecture room will be designed and constructed to protect the contents and equipment from damage caused by plumbing failures and condensation.
  - ii. Multimedia equipment racks must not be located directly beneath plumbing lines. Racks and equipment will be shielded from any potential non-sprinkler related water damage.
- f. Heat Load. There is a significant amount and variety of equipment used in AV and VC systems, such as projectors, computers, video displays, amplifiers, switching units, and other signal processing equipment. This equipment generates a substantial heat load.
- 1. Accordingly, the Project Co will provide independent heating, ventilation, and air-conditioning (HVAC) systems for the lecture room that is sized to handle the occupational and equipment loads of the rooms and meet the required operating parameters of the equipment.