

4.2 Room Acoustics

4.2.1 General

The intent of these guidelines is to ensure that the acoustic environment is conducive to teaching, learning, administrative work and is compatible with the needs and comfort of students, faculty and staff.

Every instructional space should be designed for the attainment of high speech intelligibility.

Do not locate instructional spaces adjacent to or below areas that generate high sound or impact levels such as mechanical rooms, large open staircases, galleries, washrooms, lunch rooms, assembly areas, gymnasiums, music rooms, etc.

An acoustic consultant shall be engaged for all major capital projects, major renovations to instructional spaces and any other projects deemed by Campus Architecture to be of a critical nature acoustically.

4.2.2 Definitions

The following are definitions of parameters used in this document to describe the acoustic characteristics of building environments, materials and assemblies:

Sound Transmission Class (STC)

A single number rating of the sound transmission loss properties of a wall, floor, window or door. A good reference for wall and floor STC ratings is the Alberta Building Code.

Ceiling Attenuation Class (CAC)

A single number rating that indicates how well suspended ceiling systems attenuate airborne sound between two rooms having a common plenum.

Noise Reduction Coefficient (NRC)

A single number rating of the sound absorptive properties of a material ranging from 0.01 (negligible absorption) to 0.99 (very high absorption) rounded to the nearest 0.05. Manufacturers of ceiling boards, wall panels and various sound absorptive finishes will usually list the NRC rating in their product information.

4.2.3 Classrooms/Computer Labs/Lecture Halls

It should be assumed that any classroom will eventually, if not regularly, be used for the showing of films/video, and that the noise level should be appropriately contained. Accordingly, appropriate acoustic design and materials should always be incorporated in classroom construction.

In larger group lecture rooms or multi-media classrooms a stepped ceiling which disperses sound may enhance the acoustical setting. Care should be taken to assure that projection lines, and viewing or sightlines are not obstructed by stepped ceilings. Avoid curved walls and ceilings, which may focus sound or cause unexpected echoes.

Do not locate doors in common wall between classrooms. Where this is necessary consider double doors or a sound-lock vestibule with full perimeter acoustic seals.

Wall baffles, and/or acoustic treatment of ceilings and walls should be considered for large group rooms.

Isolate classrooms and lecture theatres through the use of full height walls. Provide a complete air seal at metal deck, piping, ductwork and conduit junctions and penetrations.

Projection rooms should be isolated from lecture rooms – two entrances should be considered for projection rooms: one from the outside corridor, and one into the lecture room from the projection room. Door between projection room and lecture hall should be solid core with full perimeter seals.

4.2.4 Offices

Reference office spaces 6.4 for office types and their acoustic ratings. Standard STC rating for offices is STC 45. Offices which require full speech privacy should have a minimum STC 50 or better rating. This rating will require a more expensive construction whereby walls should be full height and sealed to structure. Where this is not possible a ceiling with a CAC 40 must be provided.

Where speech privacy is required interior windows require a STC similar to the walls. This will typically require double glazing with sealed units and/or air spaces that are larger than normal.

4.2.5 Common Areas

Locate student gathering areas away from instructional areas and close to other noise generating activities such as open stairwells, major building centers.

Partitions are to be full at least to U/S of ceiling.

STC rating to reflect adjacent area requirements.

4.2.6 Washrooms

Provide a double plumbing wall between washrooms and instruction space. Ensure structural separation is maintained and piping is attached **ONLY** to washroom side of the double wall.

Where washroom doors are not provided, provide sound absorption materials to walls (minimum NRC 0.85) and indirect view lines at entry.

4.2.7 Mechanical Considerations

1. Locate rooftop equipment over corridors or other non-critical areas; avoid placing equipment over instructional space.
2. Locate mechanical rooms and main air handling equipment away from noise sensitive areas such as instructional spaces.
3. Avoid locating duct shafts in lecture rooms.
4. Maintain adequate spacing between duct wall and the nearest wall(s): the clearance should equal 10% of the duct's larger dimension or 150 mm, whichever is larger.
5. Use masonry construction for large mechanical shaft walls that are common to occupied areas.
6. Whenever possible, design the system layout so that any medium velocity ducts and terminal boxes are in non-instructional areas such as corridors.
7. Select terminal box on basis of both in-duct and radiated noise level. Manufacturer's VAV box noise data often assumes the equipment is located above a mineral fibre suspended ceiling and assumes the use of acoustically lined duct. Ensure that design conditions correspond with these requirements.
8. Suspend terminal box and other similar equipment independently from deck above (do not permit to rest on suspended ceiling grid).
9. Plan separate supply feeder duct into each room from main supply trunk over corridor (one common trunk-duct directly above rooms with short take-off(s) into each room is unacceptable).
10. Select diffusers/air outlets so that the combined sound from all diffusion in a room meets the design criterion. Noise from a single diffuser will typically need to be 6 - 10 dB lower than RC(N) criteria.
11. Locate balancing damper at least 2 meters upstream of diffuser/outlet.
12. Provide at least 600 mm of straight duct ahead of diffuser inlet.
13. Where classroom doors are located immediately adjacent (along a corridor) or directly opposite (across a corridor), keep ceiling-mounted return-air grilles within the rooms as far apart as feasible.

14. Where a wall between a classroom (or office) and a corridor continues above the ceiling to the roof-deck, openings in the wall above the ceiling for return air need not be directly adjacent to the return air grille in the classroom/office ceiling. Even distribution along the corridor is suggested. For particularly noise-sensitive areas, include a sound trap (Z- or L-shaped) in this opening; there should not be line-of-sight through the sound-trap.
15. Where perimeter heating cabinets are planned, ensure the use of non-continuous cabinets that terminate at intersecting walls. Discontinue use of fins at all wall junctions and provide for a complete airtight seal where the heating pipe passes through the wall.

4.2.8 Acoustic Mitigation

Renovations and alterations to instructional spaces, offices and common areas occur on a regular basis which may impact acoustic qualities and sound attenuation. The acoustic aspects of renovation projects may require upgrading the noise isolation of the building envelope, changing room acoustics of interior spaces, and/ or improving the noise generation characteristics of HVAC systems. Improvements may require consideration of interior geometry, surface treatments, wall construction, sound masking systems, and building system noise control. In all cases, acoustic treatments should consider minimal intervention as the first course of action. Many acoustic issues can be solved simply and cost effectively.

4.2.8.1 Electronic Sound Masking

In most instructional spaces, offices and common areas the background noise is set by the air conditioning system in the building. Electronic sound masking systems should be installed to provide an optimized sound masking spectrum with level control and a more even background noise level throughout the space appropriate for the use of the space. This solution is the most cost effective way of improving speech privacy and significantly reducing other distracting noises.

4.2.8.2 Demountable Partitions

Demountable partitions allow for flexible re-organization of space. However, acoustical leaks are common to these systems. Demountable wall systems are limited in their noise isolation ability by their mass, thickness, and construction and are typically not equivalent acoustically to insulated steel stud and gypsum board partitions. If acoustical privacy is a high priority, the use of demountable partitions systems must be carefully evaluated.

4.2.8.3 Demising Partitions

The noise isolation achieved by a demising partition is dependent on the wall construction, the presence of doors or glazing in the partition, the suspended ceiling construction, and the noise flanking paths such as at partition junctions with floors, ceilings, columns and window mullions, supply and return air openings, convector cabinets, radiant ceiling panels, and other penetrations for building services.

Demising partitions must be well-sealed acoustically, specifically at junctions with base-building components (at the floor, underside of ceiling, columns, window mullions, window sills, at the perimeter baseboard radiation cabinets, etc.). Obvious leaks, such



as gaps where light can be seen shining through, must be sealed with neoprene foam tape and/or non-hardening caulk.

4.2.8.4 Ceilings

It is difficult to provide a good acoustical seal with ceiling tiles that straddle partitions. Ideally, ceiling tiles should be cut and cross T's installed at the top of partitions. Installing foam tape between the track and the T-bar grid and/or generous application of non-hardening acoustical caulk between the track and the T-bar grid and the gypsum board/ ceiling tile junctions on both sides of the partition would reduce noise leaks. These cross T's can be fastened to the track with screws to compress the foam tape.

4.2.8.5 Plenum Barriers

Where there are no solid plenum barriers above the ceiling and the partitions extend only to the underside of the T-bar ceiling the partition noise isolation is limited by noise flanking through the ceiling tile and over the partition so that the effective STC of the partition will be limited. In order to mitigate sound transmission consider the following:

- Return Air Grilles: locate as far from adjacent rooms as possible
- Acoustical Tile: existing ceiling tiles can be sprayed with an acoustical coating on the back of the tile panels to increase the STC by approximately .5. Use tiles with an NRC of at least .65-.75. Applying the coating should raise the ceiling STC to approximately 35-39.
- Ceiling Insulation: install a layer of fiberglass batt insulation on top of ceiling tiles. Batts should be placed only within 4' of partitions.

4.2.8.6 Doors and Windows

Doors typically limit the STC rating of the partitions that they are located in. A minimum level for doors of meeting/ conference rooms or offices requiring confidentiality between rooms. Where acoustical privacy or noise are a concern, install automatic door bottoms to seal the gap at the bottom of the door. Ensure that the joint between the wall and the door frame is sealed air-tight with a continuous caulk sealant around both sides of the frame. Continuous caulk sealant at the stop/jamb and stop/head junctions will prevent sound leaking between the stop or stop seal and the jamb/head.

Sliding doors, pivot doors, or frameless glass doors should not be used for rooms where confidentiality is a priority as there is no practical way to adequately acoustically seal them when they are closed.

Wherever possible, stagger doors/ windows across corridors and maintain maximum separation between doors/ windows to make sound travel farther between spaces.

Where acoustical privacy or noise are a particular problem and windows are needed, double glazing should be used and operable windows gasketed.

Where a partition butts up to a window, the installation of a gypsum board and sheet metal brake shape on each side of the partition that covers and seals the junction as well as building up its mass and providing a pocket that is sealed to the face of the mullion should be installed. This type of seal allows the exterior wall and partition to move



independently of each other through external temperature fluctuations while maintaining an acoustic seal.

4.2.8.7 Perimeter Radiation Cabinets

To improve noise isolation, a double leafed gypsum board baffle should be installed inside the cabinet at each demising partition location. Gypsum board should be cut to fit around any pipes and sealed with mineral fibre batt insulation and a non-hardening acoustical caulking. The gypsum board should not rigidly contact pipes. All joints/interfaces with the exterior wall gypsum board should be caulked and sealed air-tight. Baffles should extend down to and be sealed at the floor. The interface of any demountable demising partitions with the perimeter radiation cabinet must also be sealed air tight with neoprene tape or caulk on both sides of the partition.

4.2.8.8 Acoustic Panels

For larger spaces such as theatres, auditoriums, and classrooms, acoustic wall panels treat the acoustical problem of echoes by absorbing the sound waves rather than allowing them to reflect off hard surfaces. These spaces should be reviewed with Campus Architecture prior to installation.

Revision History

Revision Date	Version	Description
Feb 2014	1.0	Baseline version
July 6, 2023	1.0	Added Revision History table to end of document and reset to Version 1.0.