ABOUT YOUR APARTMENT

REDUCING NOISE IN YOUR APARTMENT

AE 2

Introduction

Noise control in apartment buildings has a significant bearing on your privacy and well-being. Complaints about loud music and voices, telephone and television noise, doors slamming, garage openers clattering, water pipes banging and ventilation fans humming, are common in multi-unit residential buildings. The sound of aircraft, traffic, construction, tree pruning and lawn cutting can be an annoyance in almost any place we call home. Humans have learned to accept a certain amount of noise as an inevitable consequence of urban living. Yet, there are limits to the noise you should tolerate, and ways to improve the acoustic privacy in your apartment.

Acceptable levels of noise depend on several factors: how well the building was constructed, the loudness of the sound, your tolerance for noise and the time of day. For example, some noise from your neighbours may be tolerable while you are watching television, but would be objectionable at bedtime. Your perception is influenced by the sound frequency.

Figure 1 - One person's music . . . **Source—Photo by John Burrows**

A low-pitched sound is harder to control in a building than a high-pitched sound. This is why the thumping bass sound from a neighbour's stereo can be annoying. The impact noise of a dropped object, slammed door or footsteps on a stair can also be irritating, and is a common cause for complaint in multi-unit residential buildings.

This article provides basic information about the behaviour of sound and noise, and suggests ways to improve the peace and tranquility in your apartment or condominium. It includes a discussion of improvements you can make yourself and others that can be made with the help of your building management.

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About Sound

In order to appreciate how sound moves through a multi-unit residential building, it is useful to have a basic understanding of the mechanics of sound. Sound energy travels from a source through air, water or solid objects. As sound vibrations strike the eardrum and cause it to vibrate, the process we call *hearing* begins. *Noise* is simply objectionable sound. The *pressure* level that a sound wave exerts when it strikes a surface is measured in decibels (dB). The larger the vibration of the source and thus the disturbance of the air, the greater the sound pressure level and the louder the sound heard by the ear. The dBA unit corresponds to the human assessment of overall loudness and measures the energy associated with a sound wave. The ear cannot detect small changes in sound pressure but most people will notice a difference of three decibels or more. An increase of 10 decibels is perceived as a doubling of the pressure, or loudness, of the sound. Table 1 shows typical sound levels for some common sources.

Airborne Sound

Airborne sound reaches you through doors, cracks, windows, floors and walls from sources such as voices, audio equipment and traffic. The common types of floor and wall assemblies used to separate dwellings in multi-unit residential buildings have been tested in laboratories to determine their ability to absorb sound vibrations.

The National Building Code of Canada uses *Sound Transmission Clas*s (STC) to gauge the ability of floors and *interior* walls to absorb sound as it moves between living units. It measures the average *transmission loss* of sound at different frequencies after it has passed through a separation between apartments. A floor or wall assembly with a high STC rating has better sound reducing characteristics than an assembly with a lower STC rating. Table 2 shows how the STC ratings for walls relate to their ability to reduce certain types of sound.

Table 2 -- The audibility of speech and music through walls of various STC ratings

STC	Noise source
45	Loud or amplified speech audible Loud music audible, and bass notes particularly strong
50	Loud or amplified speech faintly audible Loud music barely audible, but bass notes quite noticeable
55	Loud music not generally audible, but bass notes still heard
60	Loud music inaudible except for very strong bass notes

Source—Warnock, A.C.C., J.D. Quirt and M. Lio. Fire and Sound Control in Wood-frame Multi-family Buildings, Canada Mortgage and Housing Corporation, 2002.

Table 1 -- Sound pressure levels for common sound

Noise source	*Decibels (dBA)
Jet takeoff, artillery fire	120 or more
Rock band or home theatre system	100-120
Un-muffled truck or motorcycle	80-100
Average radio or TV	70-90
Human voice at 1 m (3.2 ft.)	55-60
Background in private office	35-40
Quiet home	25-35
Buzzing insect at 1 m (3.2 ft.)	15-25
Threshold of hearing	0

Source—Warnock, A.C.C., J.D. Quirt and M. Lio. *Fire and Sound Control in Wood-frame Multi-family Buildings,* Canada Mortgage and Housing Corporation, 2002.

Building regulations are the responsibility of the provinces and territories, and some municipalities, which may adopt the *model* National Building Code of Canada (NBCC) or develop their own building codes. Therefore, the requirements for sound control in residential construction may differ between provinces and territories. The NBCC requires that walls and floors in newly constructed multi-family buildings have a minimum STC rating of 55 to separate residential suites from adjacent elevator shafts and refuse chutes, and 50 from every other space in a building. The NBCC does not address sound coming from outside a building, which may also be an annoyance to residents. Table 3 shows the NBCC required STC ratings and recommended ratings that provide a higher level of sound privacy.

Impact Sound

Impact noise results from foot traffic, dropped or sliding objects or banging, causing sound to migrate through construction materials. Although impact noise is transmitted primarily through floors in residential buildings, it also moves through the walls and structure. It is often perceived as a sharp tapping sound in buildings with concrete floors. In buildings with wood-frame floors, it is often heard as a dull thud. Padding or cushioning on top of the floor or between the floor layers will significantly reduce the movement of impact sound in both types of construction.

Airborne and impact sound have some things in common, but impact transmission is more difficult to measure and control. The character and loudness of impact noise transmitted through a wall or floor depend on many factors including the nature of the object striking the surface and the force of the blow, the rigidity of the assembly, and the resilience of the surface. Construction with a good STC rating for airborne sound will not necessarily provide acoustic privacy for impact sound. Different construction techniques are required to reduce impact noise. For example, a concrete floor topping on a wood subfloor reduces airborne sound transmission, but allows impact sound to move through the floor much more readily. A cushioning layer should be placed between the concrete and the wood subfloor to absorb impact noise vibrations.

Impact Insulation Class (IIC) is used to measure the ability of floors to reduce impact sound. The NBCC does not address impact sound. Table 3 shows ratings for impact sound that are *recommended* for floors, to obtain a reasonable level of acoustic privacy.

Outside Noise

Airborne sound can also come from outside in the form of traffic, sirens, construction activity and voices. The NBCC does not address sound control requirements for exterior walls. Heavy materials and insulation in exterior walls in combination with solid fencing and landscaped berms, can provide 50 dB or more relief from outside noise. Windows are less effective in controlling sound transmission with most providing noise reduction of 25 to 30 dB, or less if they are very leaky.

Solving Noise Problems in Apartments

This section contains general advice that may apply to your situation. It is intended to help you to improve your comfort and satisfaction. It provides you with information that will be useful when dealing with acoustical experts, building managers or neighbours. An acoustical consultant should be retained to study serious and persistent problems, and to recommend solutions.

Table 3 -- Minimum recommended STC and IIC ratings

Assemblies	NBCC Required STC	Best Practice Recommended STC	Recommended Impact Insulation Class
Party walls or corridor walls	50	55	-
Bare party floors	50	55	55
Carpeted party floors	50	55	65
Elevator shafts	55	65	-

Source—Warnock, A.C.C., J.D. Quirt and M. Lio. *Fire and Sound Control in Wood-frame Multi-family Buildings*, Canada Mortgage and Housing Corporation, 2002.

There are two ways to reduce the amount of noise entering your apartment:

- Reduce the noise at its source
- Improve the ability of the building to reduce the noise before it reaches you

Reducing Noise at its Source

Apartment noise results from three sources:

- Neighbours: telephones, music, voices, activities and appliance
- Building services: refuse chutes, elevators, plumbing, mechanical and electrical
- Exterior noises: traffic and construction activity

a. Reducing Noise from Neighbours

The first step in reducing sound from human activity is to make residents aware how their activities affect others. An agreement between neighbours is likely to be the most amicable and cost-effective solution to occupant-caused noise problems. If discussions with your neighbours fail to correct the noise problem, consider consulting the building management. Many lease and condominium agreements restrict noisy activities or limit them to certain time periods during the day, or on weekends.

Make Neighbours Aware of the Noise They Make

Managing sound involves cooperation. If neighbours' activities are noisy, consider these steps:

- Get to know your neighbours. Contact may lead to cooperation on noise issues
- Speak reasonably and calmly with neighbours about noise. There is a good chance that reason will lead to a workable solution.
- Speak with other neighbours and consider a joint strategy. Ask others who are also bothered to discuss noise with the offending neighbour.

Discuss with your neighbours ways to reduce objectionable noise:

- Stereo and other audio equipment should be situated away from walls shared with other units.
- Footfall sound can be a problem in apartments, especially those with hard floor surfaces. Avoid walking in high heel and other hard-soled shoes.
- Dropped objects or scraping chairs in areas with hard floor surfaces will cause impact sound in adjoining units. Use carpets or mats in areas where objects are more likely to be dropped, and felt cushions under chair and table legs.
- Place objects, such as shoes, on a floor rather than dropping them.
- Keep music and T.V. volumes at a reasonable level and be receptive to comments from other neighbours, especially those with special needs.
- Although they may be accustomed to the noise their children make, neighbours should be aware that some occupants don't have children and may be irritated by the noise. However, all neighbours must understand that children have a right to live there and to behave like children.
- If hosting a party, neighbours should advise other occupants about when the party will take place, and consider inviting them if it will be an open party.
- Observe reasonable hours for noisy activities. Vacuuming, moving heavy furniture, repairs and alterations generate noise that can travel to other apartments. Restrict these activities to daylight hours or in accordance with the lease or condominium agreement.
- Further action such as complaints to law authorities are beyond the scope of this bulletin, but should be considered as a last resort after good-neighbour options have been exhausted.

b. Reducing Noise from Building Services and Equipment

Mechanical devices, such as elevators, refuse chutes, garage door openers and air conditioning units are sources of noise and vibrations, and should be maintained and operated in a proper manner. Your building management may consider the following strategies to reduce noise from the high-frequency whine of motors and fans, the low-frequency hum of transformers, the rumble of moving equipment and the banging of objects dropping down chutes:

- Improve the methods used to isolate mechanical devices from the building structure. Ensure that motors, such as garage door systems, compressors and fans are mounted on springs or resilient pads to reduce the transfer of vibrations through the building.
- Locate annoying noise sources away from building occupants. Air conditioning compressors may be placed on flat roofs or on the ground, away from operable windows.
- If it is impractical to eliminate an annoying source of noise, it may be possible to install a timer that shuts off the machine during sensitive periods of the day.
- Restrict the hours during the day or week that garbage chutes, compactors, freight elevators and generators may be used.
- Upgrade bathroom and kitchen fans to quieter models.
- Consult an acoustic expert to prepare a comprehensive plan for noise management.

A common way for airborne sound to come into your living area is through openings and gaps, such as the holes around electrical outlets and pipes. Consider the following actions to reduce sound entry:

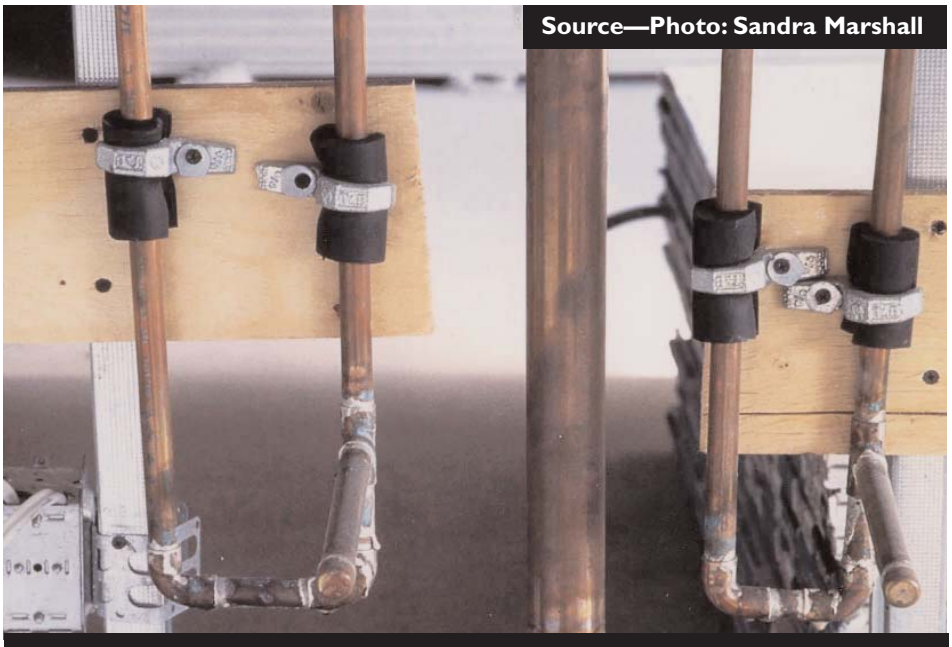
- Place gaskets behind electrical outlet cover plates. These are sold in hardware stores to protect against drafts on exterior walls.
- Electrical switches and outlets in common walls should be installed offset from those on the other side of the partition to reduce sound transmission. If this isn't the case, your building management may agree to have some outlets and switches moved, or installed in sealed electrical boxes. Electrical work should be performed by a licensed electrician.

Noise may also move freely through rigid materials, such as plumbing, as well as wall and floor framing that extend between apartments. Your building management may undertake the following repairs:

- Install toilets on resilient gaskets to reduce the transmission of structure-borne noise.
- Ensure that piping is isolated from solid framing with flexible sleeves and cushions.
- Install pressure-relief piping to eliminate water hammer.
- Install garage door openers and tracks on rubber bushings to absorb vibrations.

c. Exterior Noise

If noise from outside the building happens on a regular basis, consider the following:



Source—Photo: Sandra Marshall

Figure 2 - Water pipes isolated with resilient sleeves

- Municipal bylaws limit the type of noise and restrict the times of day when certain activities can take place. Avoid confrontation and, if necessary, contact bylaw officers who can advise you on noise regulations.
- Traffic noise can be reduced if the municipality agrees to create a reduced speed zone or to install speed bumps on offending roads.
- Physical changes to the site can discourage loitering. For example, lighting and security patrolling can discourage after-hours activities that generate noise.

Reducing Noise with Building Assemblies

Apartment walls and floors are designed to provide a certain degree of sound resistance. If there are indications that too much sound is being transmitted through walls and floors, a qualified acoustical consultant can test the construction to measure performance, and repairs can be made.

Minor changes may improve sound performance:

- Furnishings and upholstery: Heavy upholstery and draperies absorb sound, which explains why furnished rooms are quieter and less likely to echo than empty rooms. Adding more and heavier fabrics and upholstery may lead to some noise reduction.
- Wall-floor junctions may have gaps that allow sound to move through the floor and wall. Careful caulking of the joint under the baseboard may reduce airborne sound transmission.

Major retrofits offer an opportunity to improve sound performance in the following ways:

- Insulation: Glass fibre, mineral wool and cellulose insulation are often used in floors and walls between apartments to dampen noise. Sound travels more easily through empty spaces than through insulation, which absorbs part of the sound energy as it passes through. The STC rating can be substantially improved by adding insulation if there is none.
- Mass: Heavier assemblies generally reduce airborne sound better than light assemblies. The STC rating of walls and floors can be improved by adding more weight, such as additional layers of drywall and denser flooring materials.
- Decoupling: *Decoupling* separates parts of the wall and floor structure so they do not touch, thus eliminating a direct path for sound to follow. Resilient channels are flexible metal strips commonly used to decouple drywall from the wall or floor structure. Resilient channels and drywall should *not* be installed directly over existing drywall or plaster, because this may create a sealed chamber that amplifies the sound and makes the noise problem worse. If plaster or drywall is attached directly to the wall or ceiling structure, consider removing it and installing one or two layers of new drywall on resilient channels attached to the framing.

Improvements to the building envelope, including walls, windows and roof can reduce the amount of noise that reaches your apartment. Consider the following when replacing windows:

- Opened windows can provide a direct path for airborne noise. Pay attention to the window operation direction. A window should open away from noise sources so that the window deflects, rather than captures the noise.
- Installing high STC performance windows will help when the windows are closed. Typical STC ratings for windows vary from 25 to 40 depending on type, glazing, frame, size of air space and how they open. Ratings of STC 35 to 40 are recommended for high-noise locations, such as near arterial roads, factories and airports. Specialty acoustic windows can produce higher transmission loss ratings ranging from STC 45 to STC 55.
- Install air conditioning if operable windows admit too much noise.

Doors may allow noise to pass between corridors and living spaces. The ventilation of many apartment buildings relies on air moving from the public corridor into the living units, through a gap around the

door. This air movement is intended to contain smoke and cooking odours within the apartment and, unfortunately, also provides a ready path for noise. Restricting this air flow could affect air quality in living units, especially those that receive very little fresh air. Changes to the doors and seals should be done in consultation with building management to ensure that fire performance and ventilation are not compromised. Consider the following:

- In buildings where ventilation systems are designed to pressurize the hallway so that air moves under suite doors into living areas, it may *not* be advisable to reduce the size of the gap under the door and improve the seals on the door. If you install weatherstripping on your door or frame, you should monitor the air quality in your apartment for a few weeks. If the air has become staler or more humid, you may have to remove the weatherstripping.
- Where air flow around the door is not required, doors, frames and seals can be upgraded. STC ratings for standard doors range from 27 to 32. With improvements to seals around the doors, the ratings may be increased by up to 5 dB.
- Specialty acoustical doors can be obtained for locations requiring greater sound isolation. Sound control doors are much heavier than conventional doors and can attain STC levels in excess of 50 dB. The associated frames and hinges are built to support the additional weight, and particular attention is paid to the design of the perimeter seals.
- Where space permits it, a second suite door enclosing a vestibule may significantly reduce the noise between the corridor and the apartment suite.

Use good quality materials when undertaking a flooring replacement. The impact noise reduction capability of tightly woven carpet and a dense underpad is substantial. This is why condominium regulations may prohibit the removal of carpets.

Where impact noise is a common problem and carpets are not desirable, building management should consider installing f*loating floors* instead of direct-applied hard flooring. A floating floor incorporates resilient padding between the finish flooring and the subfloor. The resilient material impedes the transfer of impact noise vibrations to the subfloor. A hardwood floor can provide good impact noise reduction when it includes a resilient layer below the hard surface as well as around the perimeter.

Installation details are important. The added thickness of a floating floor may lead to modifications to the suite door threshold, the raising of baseboards and the undercutting of doors. Keep the flooring from touching the walls, and leave a small gap under baseboards to ensure good separation of the hard finish from the subfloor and walls.

Summary

Noise control can be simple when occupants are willing to work together to implement a solution. When good-will is lacking, regulations may be needed to ensure that neighbours make less noise. You may reduce the noise in your apartment by implementing some of the measures in this article. Common sense, concern and co-operation can go a long way towards improving acoustic privacy in multi-family dwellings.

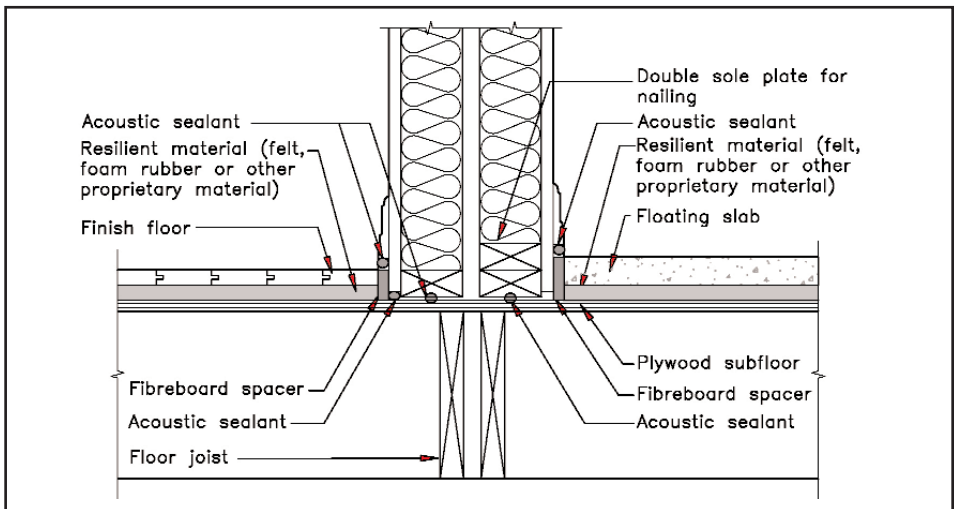


Figure 3 - Installation and edge details for floating floors and slabs

References

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