


**Demystify the acoustics
of your building**



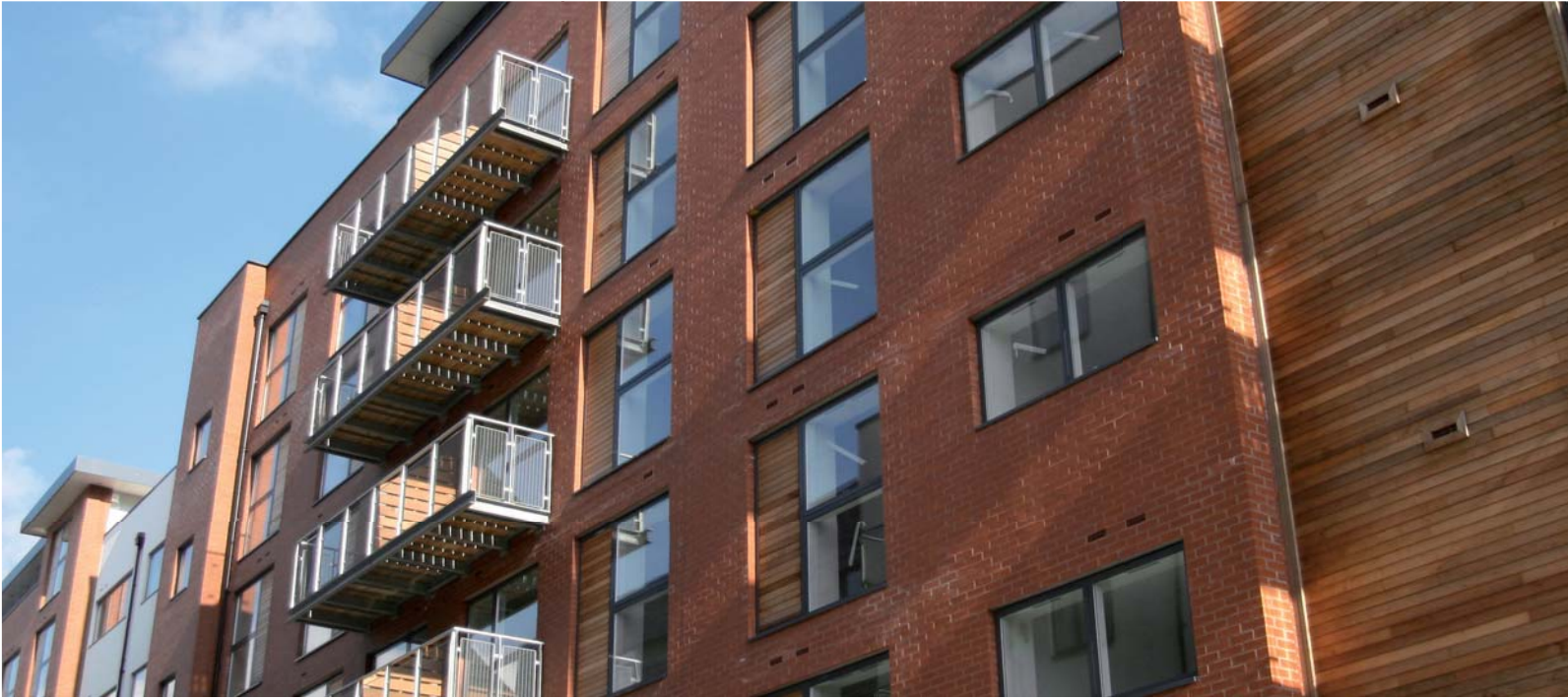
“Soundproofing is becoming a major concern. Before buying a housing unit, consumers are more than ever asking about the acoustical performance.”

Yves Joli-Coeur,

Distinguished lawyer and general secretar
of the Quebec condo-boards association.

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Demystify the acoustics of your building

The aim of this paper is to improve your understanding with respect to the acoustics of buildings and help you, if necessary, to choose materials that can provide all the occupants of your building with peace of mind and increased acoustic comfort.

1. Difference between sound and noise

Noise : Noise is a complex sound produced by various vibrations, often diffused and not harmonic. Noise is usually disturbing and unpleasant, whether high or low amplitude. (i.e.: mechanical sound , impact noise and loud music)

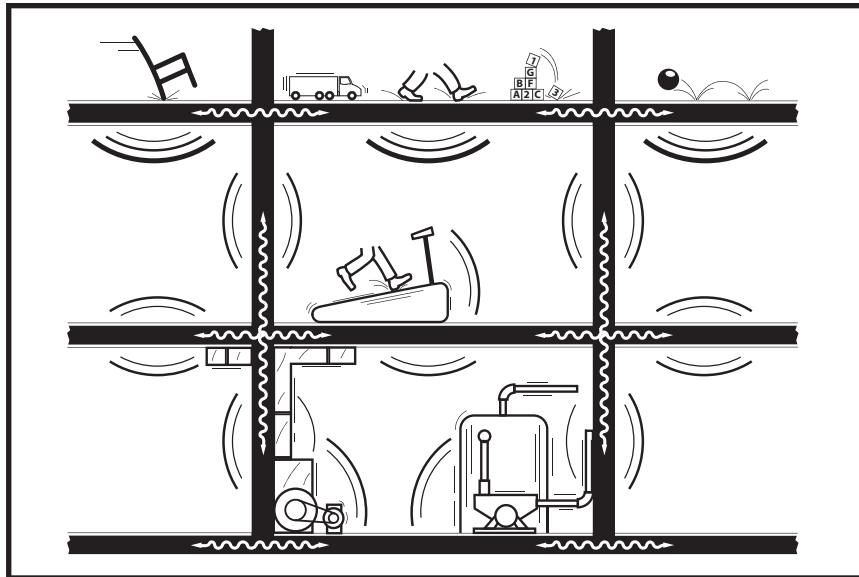
Sound : sound is a physical manifestation of vibration in a space perceived by the entire body and especially by the sense of hearing. A sound, depending on the strength and frequency, is usually described as harmonious, soft and pleasant. (i.e.: soft music)

2. Types of noise

A. Impact noise

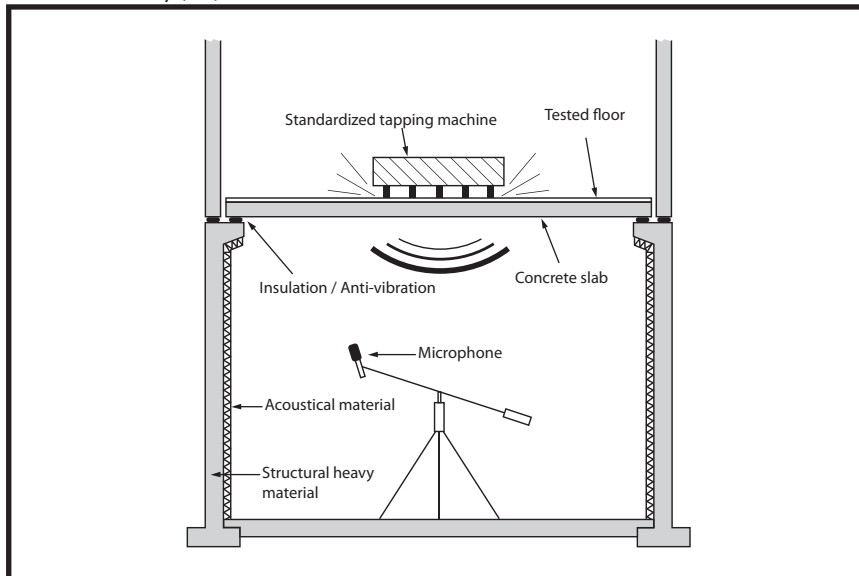
Is caused by shock or vibration : foot steps and furniture, falling objects, etc. Impact noise, also known as the structure-borne noise or impact noise is transmitted by the vibration of the structure, walls and floors of the building.

1- In your building (FIIC)



FIIC factor depends largely on the materials used during the building construction.

2- In a laboratory (IIC)



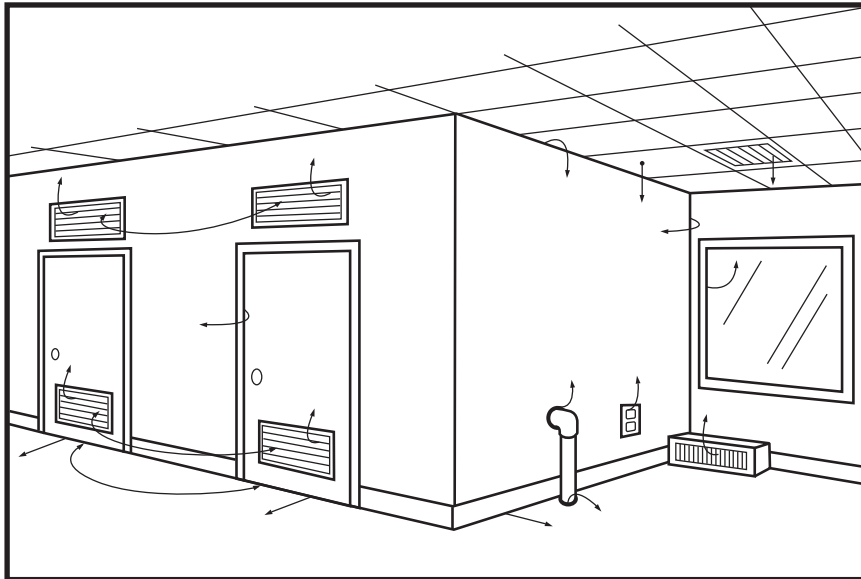
Tests made in laboratory gives more accurate values due to the quality of the assembly and overall environmental conditions.

B. Airborne sound

The sounds come from voices on the radio, television, sound system, etc.. These sounds are transmitted by vibrating in the structures (floors or walls) or through openings in the walls and the outside shell of the building.

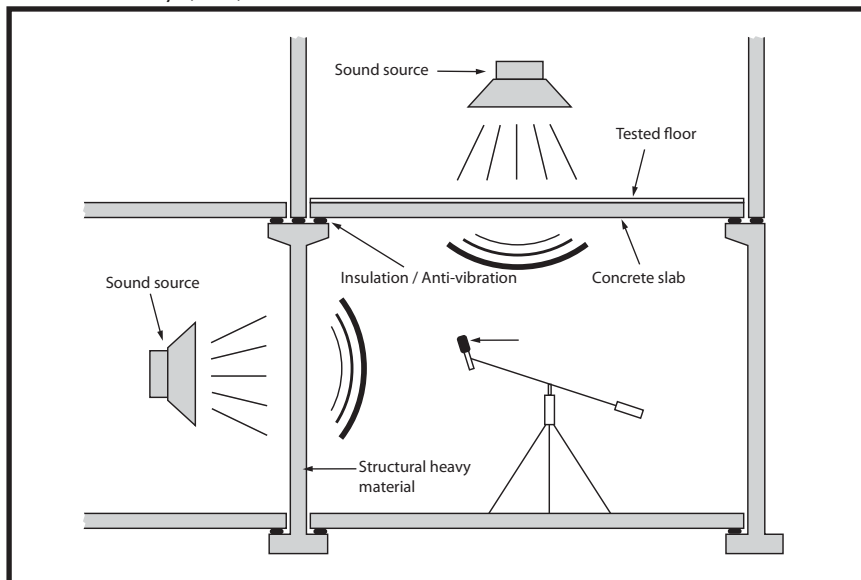
Airborne noise movement (STC - Sound Transmission Class)

1- In your building (FSTC)



FSTC factor depends largely on the materials used during the building construction.

2- In a laboratory (STC)



Tests made in laboratory gives more accurate values due to the quality of assembly and environmental conditions.

3. What is Architectural acoustics?

A. Definition of Architectural acoustics

Architectural acoustics is the science of noise control within buildings. This applies more and more to multi-unit dwellings where sound quality may have important implications for health and well-being.

B. Acoustical measurements

I. The IIC and the FIIC

1. The IIC is the measurement index used to compare the values of an acoustic assembly in a building (floors or walls). The IIC Impact Insulation Class is the coefficient of transmission of impact sound. The IIC is an absolute value obtained by acoustic standardized tests.
2. In industry, these values will be presented in two forms: either IIC or by FIIC. They refer to the same value, except that the IIC indicates that the tests were conducted in the laboratory and in the case of the FIIC, the addition of the letter "F" means the tests were conducted in a the building.

Important : It is interesting to note, the laboratory values are generally higher than those obtained in a building. Although the laboratory values are more accurate than those obtained in a building are more representative of the actual sound quality of the environment where you live.

II. The STC and FSTC

1. The STC is the index of measurement used to compare the values of an acoustic assembly in a building (floors or walls). STC Sound Transmission Class is the index of sound transmission. The STC is an absolute value obtained by acoustic standardized tests.
2. In industry, these values will be acoustic data in two forms: either STC or by FSTC. They refer to the same extent, except that the STC indicates that the tests were conducted in the laboratory and for the FSTC, the addition of the letter "F" means the tests were conducted in a building.

Important : It is interesting to note, the laboratory values are generally higher than those made in the field. Although the laboratory values are more accurate than those obtained in a building are more representative of the actual sound quality of the environment where you live.

Note : Most people in the industry will give a greater importance to the IIC values than those published for STC. It seems that the impact sound (IIC) are often the source of conflict in multi-family buildings or condominiums. A better knowledge of acoustics or the assistance of an acoustician can help you better understand the importance of these acoustic phenomena and to guide you in choosing an acoustic membrane.

4. The building structure and its role in the transmission of impact noise and airborne sound

A. The movement of sound

As previously mentioned sound is vibration that can move through material or is transported in the air. The speed and ease of spread of sound will vary with the type of structural assembly of the building and the density of the materials that compose it.

The sound moves easily in the air through all openings, ducts, spacing between the structure itself and non-sealed mechanical parts of the building.

B. Four phenomena that influence in their own way the acoustics of your building

I. Density

The density of the materials influence the speed of sound transmission. The harder and more compact the materials are, the higher the frequency of vibration of these materials will be and will more easily transport the sound. It then will travel further and faster. (Ex: steel) In return, the softer and less compact materials (more porous, with multiple cavities or cells (air bubbles or flexible), they vibrate less and they will reduce sound transmission. (i.e.: wood) These materials have, to some degree, the ability to absorb vibrations and sound.

II. Mass

The mass, represented by the structure of the building, influences the absorption of sound. The heavier the materials, thicker, bigger the less they will vibrate and the more they block the sound and provide the inertia to the building. (Example: concrete) Mass plays an important role in one of the great acoustic principles, that of the of " spring-mass." The spring-mass system ensures top performance in the sound insulation of adjacent rooms by combining optimum acoustic protection. The acoustic membrane acts as a spring between two masses.

III. Cavities

Empty cavities, and smooth hard surfaces, of a building act as a sound board. They act like a musical instrument which amplifies the sound that surrounds it.

IV. The separation

Direct contact between rigid materials of the structure or floor transfers, transmits and amplifies the sound, mechanical vibration and noise. Making sure that high-density materials, which make up the building, will be separated from each other by resilient materials drastically reduces the movement of vibration.

5. Acoustic standards

A. What are the standards of the National Building Code (NBC)?

The **NBC** (National Building Code) sets out technical provisions prepared by the **NRC** (National Research Council Canadian) to describe the minimum standards of construction in Quebec. NBC describes the types of materials, their characteristics and the minimum performance they must reach when used in construction.

In the case of acoustics, the NBC recommends, for a floor / ceiling assembly in multi-family buildings of more than one floor or condominium, a minimum of acoustic performance of **55 FIIC and 50 for the FSTC**.

B. What are your sound requirements?

Although the NBC requires the floor / ceiling assembly to achieve a minimum noise value of **FIIC 55**, it is not uncommon for management committees or boards of elected directors of condominium corporations to require a higher acoustic performance. Some associations require a minimum of **60 FIIC**.

C. What type of building do you live in and what can be considered as a reasonable expectations?

There are two main types of construction: wood frame and those made of concrete. It is unrealistic to think that these two types of construction will provide the same acoustic values.

Despite the addition of a significant amount of acoustic materials, wood frame buildings can rarely compete with the IIC and STC of a concrete building. The concrete walls embedded in structural assemblies offer a superior performance against the transmission of airborne sound (STC).

The type of acoustic material and the construction method chosen will influence the results. The quality of the construction itself, in every detail, plays a major role in achieving superior results.

In an average quality construction, an 8" concrete slab may, on its own, provide a FIIC of 32 to IIC of 34. It is therefore reasonable to assume that with an 8" concrete slab, a quality acoustic membrane and hard flooring (like wood), you can reach a FIIC of 58 to 60.

In terms of building a wood frame, a very good fit can help you achieve a FIIC of 55 to 58.

6. Published acoustic values

A. What they do not tell you!

Unfortunately, some less than well intentioned companies take advantage of the fact that sound is a very complex science in order to manipulate consumers. They try to take advantage of the situation by not presenting their product in a simple, comprehensive and honest manner.

In most cases, manufacturers will try to give you particularly high values, while voluntarily failing to mention under what conditions the tests were performed.

- For example :
- The type of floor / ceiling assembly tested
 - The presence of a suspended ceiling in the assembly tested.
(A suspended ceiling can add 10-14 points to the published result.)
 - Other acoustic materials involved in the assembly tested.

B. How to read and compare the results?

Besides the fact that the tests can be performed in the laboratory (IIC) or field (FIIC), there are two major trends in the market in the way of hiding the actual acoustic values of a products.

The first is to publish "marketing" documents with very high values without specifying the assembly measured. Most people will be impressed and even fooled by these numbers. Manufacturers of acoustic products often lead people to believe that the acoustic performance comes from their product, while the assembly itself contributes to, in some cases, up to 90% of the published value.

The second is to fail to mention that the acoustic results were achieved by tests done in the laboratory (IIC), and under perfect conditions. The laboratory results (IIC) are always higher than those obtained in the field (FIIC) for the simple reason that the laboratory construction is superior and will prevent sound transmission better than a conventional building.

It is important to ALWAYS compare the values published for similar assemblies, tests performed and conditions (laboratory or building + similar assemblies).

7. The selection of your acoustic membrane

A. Immediate performance of the membrane

- Select a membrane that meets the recommended minimum acoustic performance stated by the NBC (55 FIIC) and your condominium, taking into account the type of construction (wood frame or concrete) in which you will live
- Insist on knowing the exact type of assembly used and the conditions under which the tests were selected for the membrane. Often, the manufacturer can provide a copy of the test performed on a structure similar to yours.
- Select a product that is unlikely to be damaged during transport, handling or installation, or react with products, such as adhesives or solvents used in your assembly.

B. Long term performance of the selected membrane

- Some products have a very limited shelf life, so you must choose an acoustic membrane that will last. No one wants to have to remove flooring after a few years to replace a defective acoustic membrane.
- The deterioration of the membrane undoubtedly affect the acoustic performance of your floor assembly. Choose a material which does not deteriorate and that does not react with its environment.
- The compressive strength and the capacity of your membrane to regain its shape after the application of a heavy load is critical. The membrane must not be deformed at any time to the point of not being able to recover its original shape and characteristics.

8. Compatibility of the membrane

A. The membrane must be compatible with the flooring material and the other products used for the assembly

- Ensure the compatibility of your membrane with the flooring material;
- Ensure the compatibility of your membrane and the methods of installation recommended by the flooring manufacturer (double glue, floating wood, ceramic and mortar, etc.).
- When you need to use adhesives, they must be chemically, mechanically, and physically compatible with the membrane in order to maintain the acoustic properties in the short and long term.

9. What your membrane should provide

A. Acoustic

- I. Does the IIC capacity of the acoustic membrane meet your minimum requirements and those of the NBC?

B. Health

- I. Is it healthy for you and your environment?
- II. Does it contain VOCs or cancer-causing chemicals?

C. Resistance

- I. Can it be easily damaged before, during and after the final installation?
- II. Is this membrane considered to be resistant and virtually indestructible?

D. Properties

- I. Will it retain its acoustic properties over time?
- III. Will it retain its acoustic properties under pressure?
- III. Will it retain its physical properties over time? (Thickness, structural stability, etc.).

E. More added value

- I. Does it provide thermal value? (Warmer for the feet)
- II. Is it more comfortable? (Less tired and sore legs, is softer when you walk on the floor?)
- III. Is it compatible with most flooring products? (Will it simplify the flooring choice?)
- IV. Will it enable you to install your flooring so it will be at the same height as the other flooring material in your building? (Does not require transition moldings, minimum thickness). Will the total thickness of the assembly require you want to modify the existing doors and the stairs?
- V. Is it compatible with radiant heat systems?
- VI. Is the warranty equivalent in length to that offered by the flooring material?

F. LEED

- I. As part of building a LEED structure, does your acoustic membrane contribute to obtaining LEED credits?
- II. Is the selected acoustic membrane really green? Is the manufacturer eco-friendly?

10. The winning recipe for acoustic success

A. Before and during construction

1. Make sure that your building design meets the recognized principles of acoustic design. Hire a competent acoustician that will guide you throughout the project.
2. Make certain that all the details of construction will be carefully monitored to maximize the quality of the building.
 - a. Separate, wherever possible, the dense elements of the building.
 - b. Seal any openings where the sound could escape, especially in and around the plumbing and ventilation.
 - c. Seal all cracks and openings in the building's envelope. If air can pass, the sound can too.
3. Choose recognized and proven acoustic materials. Pay special attention to their installation. Follow manufacturers' recommendations.
4. Hire an acoustician to validate the acoustic quality of the building throughout the construction. The acoustician may take the necessary corrective action in the field to avoid the high costs of demolition and reconstruction.

B. After construction or during a renovation

1. Hire an acoustical consultant that will validate the sound quality of your building and advise you on how to maximize it.
2. Determine, with the help of the acoustician, realistic and achievable acoustic values that you plan on obtaining for your building.
3. List the actions to be taken to maximize the quality of the existing building. Often these actions are only minor, but they bring impressive results.
4. Make a list of materials and assemblies that are accepted by the management committee of the building for the final choice of surface finishes (floors and walls) or significant changes to the building. Choose recognized and local products.
5. Create some lifestyle guidelines for the occupants, to ensure peace of mind for all (shoes with cushioned soles, sound systems and home theater, noisy events, "parties", felt under furniture, pets, etc.). In short, better safe than sorry.
6. Ensure that the building's occupants know, understand and comply with recommendations made by the management committee of the building.

11. Action plan to create an acoustic environment

Even if the building meets the desired sound level, here are some suggestions to help you manage the noise level in the building.

1. Planning rules (suggestions)

- a. Limit ceramics for use in the kitchens and bathrooms only.
- b. Use acoustic membranes under ceramic floors.
- c. Use acoustic membranes under the hardwood floors or laminate.
- d. Use soft flooring material (flexible).
- e. Promote the use of carpet in common areas such as hallways.
- f. Insist that the occupants provide a plan for their work to ensure compliance with building standards. When in doubt, ask the occupant to provide you with the results of professionally performed acoustic tests.
- g. Require the use of a door sweep seal at the bottom of the corridor doors to cut the sound transmission.

2. Lifestyle recommendations (suggestions)

- a. Restrict the use of hard soled shoes.
- b. Use protective felts under all furniture.
- c. Make people aware that their home theater system can be a source of conflict. (Put felt insulation under the body of sound and control the level of sound.)
- d. Prohibiting or restricting the procession of animals that can be noisy.
- e. Suggest the use of rugs in high traffic areas.

Important note :

Write clear and complete documentation for all standards, requirements and recommendations for your building. Give the occupants a complete copy that they should sign. By signing, they promise the management committee that they have read and understood the entire document and agree to comply.

Considering no material or assembly is perfect, each positive action you will take to improve the level of acoustic comfort of your building will benefit you and all the people who will have daily contact within the environment.



**For more information, please contact Finitec Canada
at 1-888-838-4449 or visit www.finitec-inc.com.**

