# STCratings.com

## RECOMMENDED RATINGS

In general, loud speech can be understood fairly well through an STC 30 wall but should not be audible through an STC 60 wall. An STC of 50 is a common building standard and blocks approximately 50 dB from transmitting through the partition. However, occupants could still be subject to awareness, if not understanding, of loud speech. Constructions with a higher STC (as much as 10dB better - STC 60) should be specified in sensitive areas where sound transmission is a concern.

The Uniform Building Code (UBC) contains requirements for sound isolation for dwelling units in Group-R occupancies (including hotels, motels, apartments, condominiums, monasteries and convents).

UBC requirements for walls: STC rating of 50 (if tested in a laboratory) or 45 (if tested in the field*).

UBC requirements for floor/ceiling assemblies: STC ratings of 50 (if tested in a laboratory) or 45 (if tested in the field*).
* The field test evaluates the dwelling's actual construction and includes all sound paths.

An assembly rated at STC 50 will satisfy the building code requirement. However, as mentioned above, occupants could still be subject to awareness, if not understanding, of loud speech. Therefore, it is typically argued that luxury accommodations require a more stringent design goal.

Rules of Thumb
Weaknesses - What You Should Know
The difference between STC and NRC
STC Ratings for Various Wall Assemblies
STC Ratings for Masonry Walls
Home

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Welcome to **STCratings.com**, a collaborative arm of Acoustics.com. This site aligns with our goals of promoting the importance of acoustics and acoustic-related issues across a variety of related industries.

A common acoustic issue in virtually any space is sound transmission. Sound transmission can be both airborne and/or structure borne vibration. (Structure borne vibration is assessed by a different standard, Impact Insulation Class - IIC, and is not addressed in this text). Airborne sound travels through the air and can transmit through a material, assembly or partition. Sound can also pass under doorways, through ventilation, over, under, around, and through obstructions. When sound reaches a room where it is unwanted, it becomes noise. Noise such as that from automobiles, trains and airplanes can transmit through the exterior structure of a building. In the same way, noise from mechanical equipment or speech can transmit from one room within a building to an adjacent space.

Sound transmission can cause noise control, confidentiality, and privacy issues. Sound from a noisy environment such as a mechanical equipment room or an area with loud activities or music can transmit through a partition into a quieter space. This will cause unwanted noise within the quieter space. This is not only an annoyance; in several cases it can cause the quieter space to become unusable for its intended purpose. Several spaces require confidentiality. Offices of counselors, lawyers, or human resource departments cannot function in a space where sound will transmit through the surrounding walls and into an adjacent space. In most other office situations if confidentiality is not an issue, privacy is. If sound transmission is not properly controlled, the space or environment will not provide privacy for its users.

Transmission Loss is a measurement of a partition's ability to block sound at a given frequency, or the number of decibels that sound of a given frequency is reduced in passing through a partition. Measuring Transmission Loss over a range of 16 different frequencies between 125-4000 Hz, is the basis for determining a partitions Sound Transmission Class.

The Sound Transmission Class (STC) is a single-number rating of a material's or an assembly's ability to resist airborne sound transfer at the frequencies 125-4000 Hz. In general, a higher STC rating blocks more noise from transmitting through a partition.

STC is highly dependant on the construction of the partition. A partition's STC can be increased by:

- Adding mass
- Increasing or adding air space
- Adding absorptive material within the partition

A partition is given an STC rating by measuring its Transmission Loss over a range of 16 different frequencies between 125-4000 Hz. 125-4000 Hz is consistent with the frequency range of speech. The STC rating does not assess the low frequency sound transfer. Special consideration must be given to spaces where the noise transfer concern is other than speech, such as mechanical equipment or music.

Even with a high STC rating, any penetration, air-gap, or "flanking" path can seriously degrade the isolation quality of a wall. Flanking paths are the means for sound to transfer from one space to another other than through the wall. Sound can flank over, under, or around a wall. Sound can also travel through common ductwork, plumbing or corridors. Noise will travel between spaces at the weakest points. There is no reason to spend money or effort to improve the walls until all the weak points are controlled.

**Adding Mass**
The weight or thickness of a partition is the major factor in its ability to block sound. For example, a thick concrete wall will block more sound than a thin gypsum/2x4 wall. Mass is commonly added to existing walls by adding additional layers of gypsum. When the mass of a barrier is doubled, the isolation quality (or STC rating) increases by approximately 5 dB, which is clearly noticeable.

back to top

**Increasing or Adding Air Space**
An air space within a partition can also help to increase sound isolation. This, in effect creates two independent walls. However, the STC will be much less than the sum of the STC for the individual walls. The airspace can be increased or added to an existing partition. A common way to add an airspace is with resilient channels and a layer of gypsum. An airspace of 1 ½" will improve the STC by approximately 3 dB. An air space of 3" will improve the STC by approximately 6 dB. An airspace of 6" will improve the STC by approximately 8 dB.

back to top

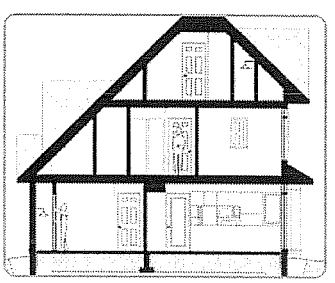
**Adding Absorptive Material in the Partition**
Sound absorptive material can be installed inside of a partition's air space to further increase its STC rating. Installing insulation within a wall or floor/ceiling cavity will improve the STC rating by about 4-6 dB, which is clearly noticeable. It is important to note that often times, specialty insulations do not perform any better than standard batt insulation.

back to top

# impact insulation class (iic)



## IIC – WHAT IS IT?



In a multi–level home or business, when a floor covering in one of the upper rooms is impacted, by dropping an object or moving furniture for example, the impact creates a vibration that travels through the floor, subfloor, and through the ceiling to the room below. These vibrations result in unwanted and annoying sounds in those rooms. This is called impact sound transmission. Floor coverings with a high IIC rating help to reduce impact sound transmissions to lower levels, thus reducing or eliminating those bothersome noises. The lowest IIC rated floors/ceiling assemblies come in at around 25 and the highest rated systems can come in at 85 and up.

**Common Guidelines to use when selecting the proper IIC rating for your space:**

**IIC 50** – The least amount of impact sound transmission reduction considered effective. Some occupants would be dissatisfied with this level of sound transmission.

**IIC 60** – Considered a medium level of impact sound transmission reduction.

**IIC 65** – Considered a high level of impact sound transmission reduction that would satisfy most occupants.

## HOW IIC IS DETERMINED



The IIC rating is the determined by using a standard tapping machine with five–steel faced hammers to strike a test floor material, generating sounds between 125 Hz – 4000 Hz. The impact creates vibrations that travel through the flooring and produce sounds on the other side. Depending on the amount of impact sound that is lost during the transmission, the results from each tap are plotted on a graph. Depending where those points fall on the graph, they are compared to a reference and the IIC rating is determined.

The IIC rating can be tested in one of two different environments. Each floor covering product can be tested individually and given an IIC product rating based on that test, or can be tested as part of an entire floor/ceiling assembly. The latter can include not only the floor covering (carpet, hardwood, tile, etc.), but also the subfloor, underlayment, flooring joists, ceiling below, as well as adhesives and sealants that may be needed for installation. In addition, there are plenty of other sound–deadening materials that are used in floor/ceiling assemblies. For example, fiberglass insulation and resilient channels can be used to increase an IIC rating. In these tests, the entire floor/ceiling assembly works together to result in the structure's overall IIC rating.

The most appropriate and accurate way to measure the IIC of a home or building is to do so after installation. This way, all materials are taken into account for and given a total IIC value. Also, any air vents or other obstacles that sound can travel through are also accounted for with this method. This method is also known as the Field Impact Insulation Class (FIIC).

## OTHER HELPFUL IIC INFO



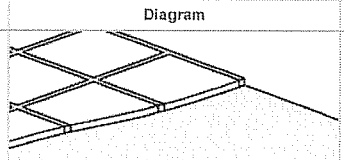
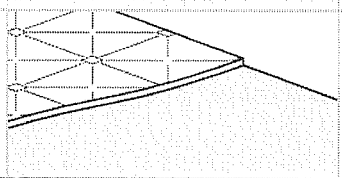
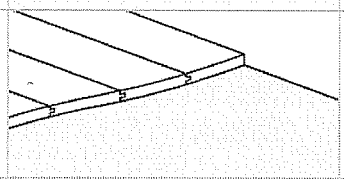
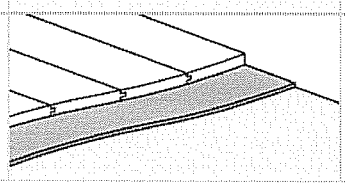
The easiest way to reduce impact sound transmissions is to cushion the blow. For example, carpet with a high quality pad is considered one of the most effective impact sound transmission reducers. Other resilient floors such as vinyl, cork, and rubber have slight give which cushions blows and also helps to increase the IIC rating. In addition, "floating floors" such as hardwood or bamboo installed over a resilient underlayment also helps to increase the IIC rating of the finished floor. Quite the opposite, concrete covered directly with hard, unforgiving surfaces such as ceramic tile, stone, hardwood, and bamboo can create quite a noisy surface to walk on. This is because there is no give in the floor system.

It is important to note that because the IIC scale measures sounds that are within the range of a human voice, the scale does not include noises that are below 100 Hz. This can include the light "thudding" often heard when someone walks across a floor with a lightweight joist system in the room above. Though these thuds are a very low range, they still can be bothersome to the person in the room below. The IIC also does not account for the squeaking, rattling, or crunching sounds that are the result of walking on a loose joist construction.

## FLOORING JOISTS AND CONCRETE SUBFLOORS

There is no easy way to accurately determine the projected IIC rating or a floor covering until it is installed and tested in the field. A large reason for this is the different types of subfloors -- concrete or wood joist, which can have a large effect on the IIC rating of the floor covering. In addition, other sound deadening materials (an underlayment for example) can add to the IIC rating. To give you a better idea of the difference these factors make, the tables below show estimates of the excepted IIC ratings that you may achieve with the type of floor system shown. The first table shows floor coverings tested over concrete subfloors and the second table shows floor coverings rated over a basic floor joist system.

*Table 1: Approximate IIC ratings for a 150-mm-thick concrete slab with various kinds of toppings. (Only part of the basic assembly is shown.)*

| Ref | Diagram | Topping | IIC Rating |
|---|---|---|---|
| 1-1 |  | None, or ceramic or marble tile | 28 |
| 1-2 |  | Vinyl flooring | 35-40 |
| 1-3 |  | Hardwood flooring | 30-35 |
| 1-4 |  | 9-mm-thick hardwood on 5-mm-thick resilient layer | 45-50 |

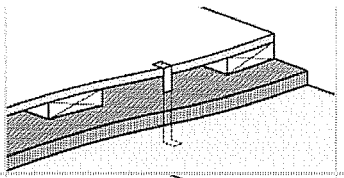
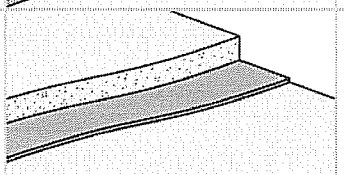
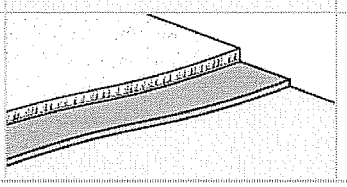
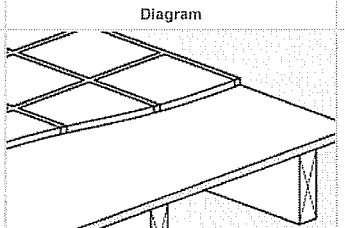
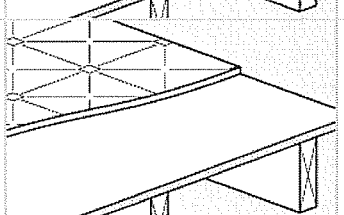
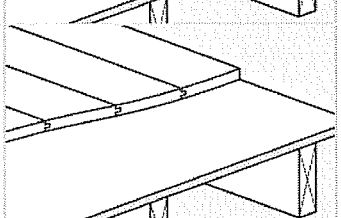
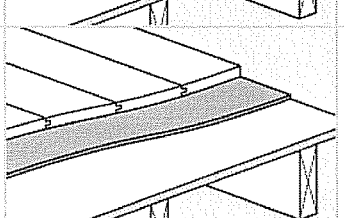
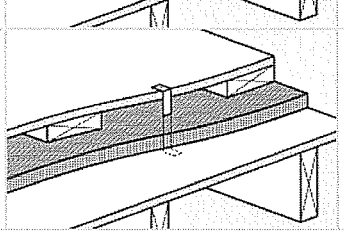
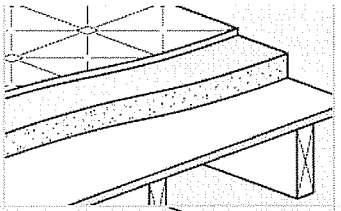
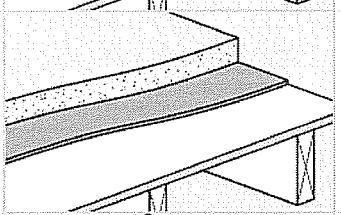
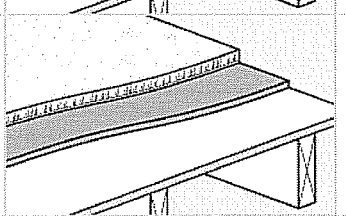
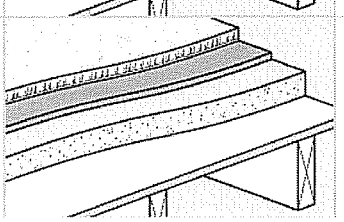
| | | | |
|---|---|---|---|
| 1–5 |  | 16–mm plywood or OSB on 40– x 90–mm wood strapping on 25–mm mineral fibra board | 50–55 |
| 1–6 |  | 35–mm concrete on 25–mm mineral fibra board | 60–85 |
| 1–7 |  | Carpet and underlay | 75–85 |

*Table 2: Approximate IIC ratings for a basic joist floor (ICC 45) with different floor toppings. (Only part of the basic assembly is shown.)*

| Ref | Diagram | Topping | IIC Rating |
|---|---|---|---|
| 2–1 |  | Ceramic or marble tile | 40 |
| 2–2 |  | Vinyl flooring | 47 |
| 2–3 |  | Hardwood flooring | 47 |
| 2–4 |  | 9–mm–thick hardwood on 5–mm–thick resilient layer | 47 |
| 2–5 |  | 16–mm plywood or OSB on 40– x 90–mm wood strapping on 25–mm mineral fibra board | 55–68 |

| | | | |
|---|---|---|---|
| 2–6 |  | Resilient flooring on 35–mm concrete | 52 |
| 2–7 |  | 35–mm concrete on resilient layer | 55–65 |
| 2–8 |  | Carpet and underlay | 75–85 |
| 2–9 |  | Carpet and underlay on 35 –mm concrete | >85 |

To learn more about increasing the IIC rating of a floor/ceiling system, visit FindAnyFloor's section on Sound Controlling Floor/Ceiling Materials.

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