



# GEILER & ASSOCIATES, LLC

*Consultants in Acoustics and Presentation Technologies*

## Introduction to Sound Transmission Class (STC)

The amount of sound isolation a wall assembly provides is typically measured as its Sound Transmission Class (STC) rating. The STC rating system looks at the amount of noise mitigation provided by the assembly over a broad range of frequencies and a single number is calculated as its rating. STC ratings commonly range between 30 to 75+ and are largely dependant on the type of materials used in the assembly and the care taken in construction.

In stud wall assemblies, STC is governed by the type of studs used (metal or wood), number of studs used (single, double, or triple stud walls), the number of layers of gypsum board in the wall assembly, the amount of insulation in the stud cavities, and the type of isolation elements used (resilient channels, neoprene isolators, etc.) if any. Similarly, in masonry assemblies, STC is governed by the thickness of block or concrete, mass of the material and its porosity.

Below is a list of STC ratings and common subjective results associated with them:

### Subjective Effectiveness of STC Ratings

STC	Sound Heard Through Wall or Floor
35 – 40	Most words and phrases clearly heard and understood
42 – 45	Medium loud speech audible, occasional words intelligible
47 – 50	Loud speech audible but not intelligible, music audible
52 – 55	Loud speech almost inaudible, loud music audible
57 – 60	Loud speech inaudible, loud music faint
62 – 65	Low frequencies heard faintly
70	Very loud music heard faintly
75+	Recording studio quality, all but loudest noises inaudible

Source: Based on State of the Art Acoustik. Inc., <http://www.sota.ca>

## STC Testing, Estimation and Modeling

STC ratings are determined by laboratory testing. Measurements and tests performed in constructed buildings, known as in the “field”, are labeled as Field STC (FSTC) or Apparent STC (ASTC) tests and are typically lower than the ratings found when the measurements are made in a laboratory setting. This is due to factors such as care in construction, the presence of flanking paths found in the field, room layout, furnishing and finishes, background noises in the field, and common test error. Field test ratings are typically up to 5 points lower than laboratory test ratings.

There are a few software programs available, such as Insul by Marshall Day Acoustics ([www.marshallday.com](http://www.marshallday.com)), which are based on STC test research that allow the user to predict the STC ratings of common materials and assemblies. Tools such as these can help a designer when trying to determine an STC rating but, whenever possible, actual STC data obtained from a laboratory test at a reputable laboratory should be used to confirm the STC predictions given by software programs.

A good source of STC rating information is the National Research Council Canada – Institute for Research in Construction. Lengthy research reports and test findings can be found on their website such as the “Gypsum Board Walls: Transmission Loss Data” report IRC-IR-761 ([http://irc.nrc-](http://irc.nrc.ca)

[cnrc.gc.ca/pubs/ir/ir761/](http://cnrc.gc.ca/pubs/ir/ir761/)) which contains many standard metal and wood stud wall constructions and their tested ratings. A similar report performed by the California Department of Health Services titled "Catalog of STC and IIC Ratings for Wall and Floor/Ceiling Assemblies" can be found from various sources on the internet but includes many dated tests which may have been conducted with older standards.

A word of caution: Manufacturers who are interested in selling products such as gypsum board, neoprene wall isolators, sound batt insulation and other materials will also typically provide STC ratings on tested assemblies. It is always a good idea to seek out copies of the certified test reports that these numbers are derived from by contacting the manufacturer instead of using the information found in marketing materials or catalogs. Instances of "estimated ratings" based on different assemblies are not uncommon. For example, the "Fire Resistance Design Manual" produced by the Gypsum Association contains many estimated ratings for assemblies that are not accurate when compared to actual field test data. When in doubt, contact the manufacturer directly or seek out a reputable acoustic consultant for advice.

### Common Wall Types and Associated STC Ratings

Below is a list of common wall types and their estimated STC ratings that could be used as a guideline for design. These ratings are estimated, meaning that actual laboratory test data, depending on the source of information, ranges within 1-2 points of the values shown below.

<u>Single Stud Gypsum Board Constructions , 4" steel studs with batt insulation</u>	<u>STC</u>
1-Layer 5/8" thick gypsum, both sides	47
2-Layers 5/8" thick gypsum one side, 1-Layer 5/8" thick gypsum other side	52
2-Layers 5/8" thick gypsum, both sides	56
1-Layer 5/8" gyp. attached w/ resilient channel*, 1-Layer 5/8" gyp. other side	50
1-Layer 5/8" gyp. attached w/ resilient channel*, 2-Layers 5/8" gyp. other side	55
2-Layers 5/8" gyp. attached w/ resilient channel*, 2-Layers 5/8" gyp. other side	59
 <u>Dual Stud Gypsum Board Constructions , 4" steel studs with batt insulation</u>	 <u>STC</u>
1-Layer 5/8" thick gypsum, both finish sides	55
2-Layers 5/8" thick gypsum one finish side, 1-Layer 5/8" thick gypsum other finish side	61
2-Layers 5/8" thick gypsum, both finish sides	65
 <u>Masonry Constructions, Block painted or sealed on both sides</u>	 <u>STC</u>
8" CMU (28 lbs/block)	45
8" CMU (34 lbs/block)	49
8" CMU (48 lbs/block)	52
8" CMU (34 lbs/block), cells filled with fiberglass insulation	51
8" CMU (34 lbs/block), cells filled with grout	55
8" CMU (34 lbs/block), resilient channel* and 5/8" gypsum one side	53
8" CMU (34 lbs/block), resilient channels* and 5/8" gypsum both sides	56

\* Estimated STC ratings only relevant for "RC Deluxe" resilient channel manufactured by Dietrich.

Source: Based on NRC-IRC "Gypsum Board Walls: Transmission Loss Data" report IRC-IR-761

To help insure that the walls will perform as intended, sound isolation partitions should be installed in accordance with include ASTM E 497, "Standard Practice for Installing Sound-Isolating Lightweight Partitions".

### Limitations of the STC Rating

Even though the STC rating is one of the better tools available for designing for sound isolation, there are a few shortfalls designers should be aware of. The underlying theory of the STC calculations takes into account that the human ear does not hear low frequencies as well as it does mid and high frequencies. This can become a problem if a wall type is selected specifically for low-frequency performance based entirely on its STC rating.

Low frequency sound is better isolated with walls that incorporate an airspace in the center of the assembly. Dual or Triple stud walls and CMU/Stud walls where the building elements are isolated from each other by a 1/2" or more are more effective at mitigating low-frequency sound than single stud walls or CMU only walls with the same STC rating. This is helpful to know when designing around mechanical rooms, band rooms and gymnasiums where low frequency sound may be a concern.

### STC Ratings of Common Glass Assemblies

Similar to wall assemblies, STC ratings for windows are determined in laboratory tests. Some companies specialize in manufacturing acoustic windows which make use of multiple lites, often laminated and separated by an airspace in window frames that are split between the lites to create isolation similar to that of an "airspace" in a wall construction.

Some STC ratings of common window assemblies are listed below.

<u>Glazing Type</u>	<u>Estimated STC</u>
1/4" Tempered Safety Glass	31
1/2" Tempered Safety Glass	36
1/4" Laminated Safety Glass	35
1/2" Laminated Safety Glass	38
1" Insulated (1/4" Lite, 1/2" air space, 1/4" lite)	35

Source: Monsanto Acoustical Glazing Design Guide, 3<sup>rd</sup> Edition

Consult an acoustic consultant or acoustic window manufacturer if ratings for different configurations or higher ratings are needed.

### STC Composite Ratings

Interior walls that are composite assemblies (walls with windows and doors in them) should be rated based on their composite ratings. To find the rating of a wall made of different assemblies (windows, doors, vents, etc.) STC ratings from each of the components should be taken into consideration as well as the percentage of total area of each component. Details on this procedure are beyond the scope of this STC introduction, but can be found in Appendix D of ANSI S12.60 standard "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools" which is used as a reference in LEED for Schools.