Technical Q & A

Controlling Sound

by WTCA Staff

Find out how sound ratings are determined and how sound is transmitted.

All editions of *The Metal Plate Connected Wood Truss Handbook* contain some general information about sound transmission class (STC) ratings and impact insulation class (IIC) ratings. It includes a CAM (Component Additive Methodology) process to determine both ratings. The third edition of the Handbook has additional information about transmission. Underwriters Laboratories Inc. (UL), an independent, not-for-profit product-safety testing and certification organization, does not include STC or IIC ratings in their fire assembly testing but does include sound transmission reducing products that have been tested or qualified for use in specific fire rated assemblies. This generally means one has to go to the product manufacturer for specific information regarding sound ratings. What is good for fire performance may not be good for sound performance or the reverse. Requirements for firestopping and continuous fire barriers may serve to transmit sound between structure areas. Where no alternative is available, the requirements for fire generally take precedence over those for sound.

The intensity of sound is measured in decibels (dB). The greater the intensity of sound, the higher the dB. Sound striking a wall or ceiling surface is transmitted through the air in the wall or ceiling cavity. It then strikes the opposite wall surface, causing it to vibrate and transmit the sound into the adjoining room. Sound also is transmitted through any openings into the room (e.g., air ducts, electrical outlets, window openings and doors). This is called airborne sound transmission. Owens Corning developed the *Noise Control Guide,* which discusses design techniques to reduce noise levels. The following excerpts are from this document.

There are three methods of controlling airborne sound transmission: mass, breaking vibration path, or cavity absorption.

1. **Mass:** Heavy walls of cement block or other masonry can reduce sound transmission. If surfaces are sealed and joints are tight, each doubling of weight can increase transmission loss by 3-6 dB. Weight is not always the cheapest or aesthetically pleasing answer to good acoustical design, however.

2. **Breaking vibration path:** Discontinuous construction with a minimum of direct mechanical connection between the surfaces reduces transmission by breaking the sound path (e.g., double stud or staggered stud walls, resiliently-mounted wall and ceiling surfaces). Discontinuous construction will improve sound transmission performance by 6-10 dB.

3. **Cavity absorption:** With discontinuous constructions, blanket-type insulation materials further improve performance by absorbing sound energy in the cavity before the sound can set the opposite wall surface in motion. Fiberglass insulation can improve performance in discontinuous construction 5-15 dB at minimum cost.

The STC method of rating airborne sounds evaluates the comfortability of a particular living space. The higher the STC, less sound will travel through. You generally see STC ratings specified for floor/ceiling and wall assemblies in apartment buildings. Some building codes require minimum sound ratings. For example, some

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at a glance

- ❑ The requirements for fire generally take precedence over those for sound.
- ❑ What is good for fire performance may not be good for sound performance. The reverse is also true.
- ❑ Determining sound ratings is a building designer or specialty engineering responsibility, so be sure not to take on any design work responsibility that falls beyond your scope of work.

STC Rating	Privacy Afforded
25	Normal speech easily understood
30	Normal speech audible, but not intelligible
35	Loud speech audible and fairly understandable
40	Loud speech barely audible, but not intelligible
45	Loud speech barely audible
50	Shouting barely audible
55	Shouting inaudible

Table 1.

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jurisdictions in California require multi-family buildings to have STC ratings of 54 or higher. The International Residential Code (IRC) includes sound requirements in Appendix K and requires a minimum STC rating of 45. The International Building Code (IBC) includes sound requirements in section 1207 and requires a minimum laboratory STC rating of 50 while allowing a field test rating of 45. An STC of 50 or above is generally considered a good airborne noise control rating. Table 1 describes the privacy afforded according to the STC rating.

Impact Sound Transmission is produced when a structural element is set into vibration by direct impact. Someone walking across a floor is one example. The vibrating surface generates sound waves on both sides of the element. The IIC is a method of rating the impact sound transmission performance of an assembly. The higher the IIC, the better the impact noise control of the element. An IIC of 55 is generally considered a good impact noise control rating. For a wood floor assembly, the single most important variable affecting the IIC rating is typically the floor finish. These ratings are found in the same IRB and IBC sections noted with identical minimum rating requirements.

How do you estimate wood floor sound performance? Sound transmission and impact insulation characteristics of a floor assembly can be estimated by adding up the values of the individual components. Typical contributions of various products to an STC and IIC rating are shown in Table 2. An example calculation is shown in Table 3. You'll notice that wood structural members (trusses, I-joists and solid sawn lumber) all have the same base rating. Specific combinations and arrangement of materials can impact the ratings, so it is recommended that assemblies based upon estimated values be compared to similar tested assemblies. Determining sound ratings is definitely a Building Designer or specialty engineering responsibility, so make sure you don't take on any design work responsibility that is beyond your scope of work. SBC

To pose a question for this column, call the WTCA technical department at 608/274-4849 or email technicalqa@sbcmag.info.

Description	STC High Frequency	IIC Low Frequency
Basic wood floor - consisting of wood joist (I-joist, solid-sawn or Truss) 3/4" decking and 5/8" gypsum wallboard directly attached to ceiling	36	33
Cushioned vinyl or linoleum	0	2
Non-cushioned vinyl or linoleum	0	0
1/2" parquet flooring	0	1
3/4" Gypcrete® or Elastizel®	7-8	1
1 1/2" lightweight concrete	7-8	1
1/2" Sound Deadening Board (USG)	1	5
Quiet-Cor® underlayment by Tarkett, Inc.	1	8
Enkasonic® by American Enka Compant	4	13
Sempafloor® by Laminating Services, Inc.	1	11
R-19 batt insulation	2	0
R-11 batt insulation	1	0
3" mineral wool insulation	1	0
Resilient channel	10	8
Resilient with insulation	13	15
Extra layer of 5/8" gypsum wallboard	0-2	2-4
Carpet & padding	0	20-25

Table 2.

Description	STC	IIC
Carpet & Pad	0	20
3/4" Gypcrete®	7	1
Wood Truss Floor	36	33
Resilient Channel	10	8
Total	53	62

Table 3.

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