STC: Room Acoustics: more than just a number

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United Plastics Corporation
511 Hay Street, P.O. Box 807
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Tel: (336)786-2127
Email: infoaia@unitedplasticscorp.com
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STC: Room Acoustics: more than just a number

Presented By: United Plastics Corporation
511 Hay Street, P.O. Box 807
Mount Airy, NC 27030
Email: infoaia@unitedplasticscorp.com

Description: Provides an overview of basic acoustic definitions focusing on sound control techniques and products to reduce noise through wall systems.

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Learning Objectives

At the end of this program, participants will be able to:

- define noise, decibel, frequency, and transmission loss and outline the difference between structure borne and airborne noise
- identify the correct wall assembly techniques used to treat low-, mid- and high-frequency environments
- define STC (Sound Transmission Class) and compare the STC levels achieved by different wall assemblies, and
- translate guidelines in relation to isolation, mass, radiation efficiency, and absorption to achieve proper design and acoustic performance.

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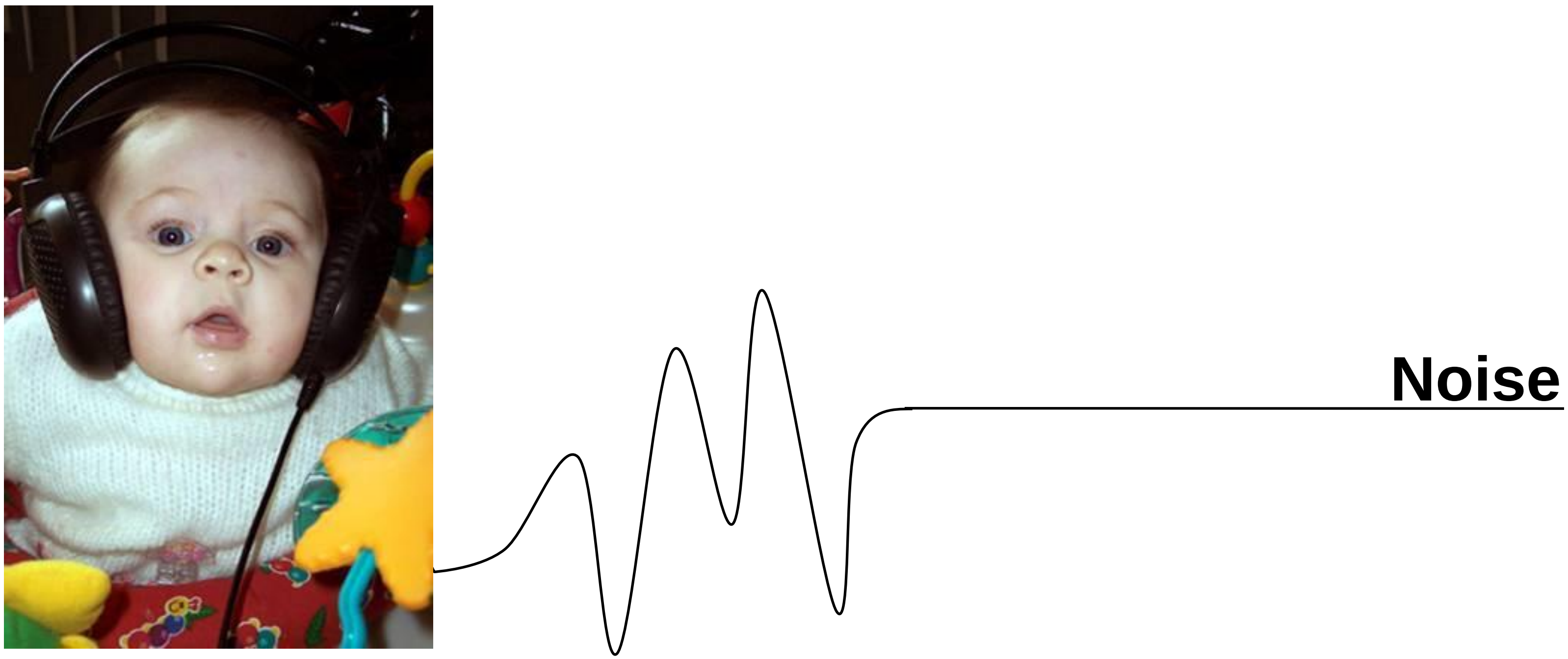
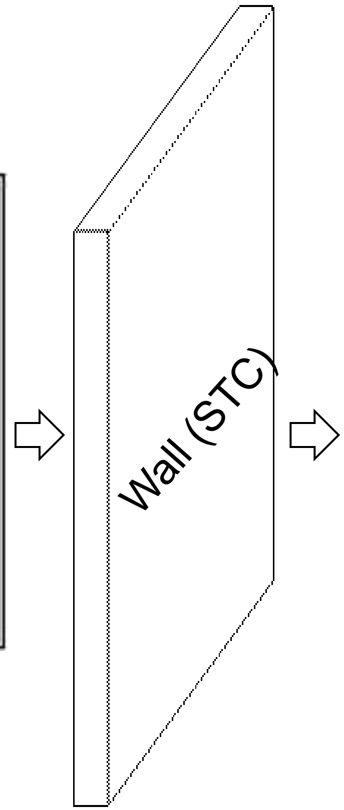

Noise

Noise

Great **sound** to one person…

Can be **noise** to someone else…



The goal is to understand the basics of Sound Control Solutions and offer a 'best practices' approach to improve the quality of the environment.

Definition of Noise

Noise is simply 'unwanted sound'.

noise (noiz) n. 1. a. Sound or a sound that is loud, unpleasant, unexpected, or undesired.[1]

Noise is:

- televisions on while you are trying to sleep
- neighbors talking in the adjacent apartment
- washers/dryers running while watching TV
- distractions in a loud workplace
- teenagers practicing their musical talents in their rooms
- people walking on the floor above your apartment

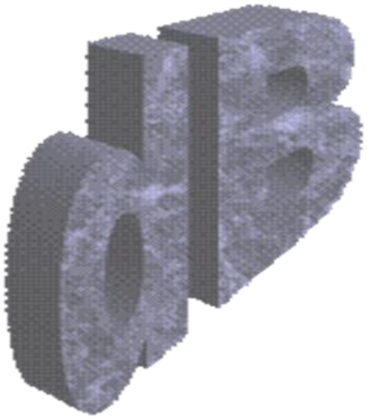
All of these are examples of **noise**. They do not have to be **loud** to be an annoyance – they just have to be louder than any other noise in the surroundings.

[1]Source: http://www.thefreedictionary.com/noise

What is a Decibel (dB)?

- The decibel (dB) is commonly used in acoustics to quantify sound pressure levels relative to some 0 dB reference.

- 0 dB is the reference point where the eardrum no longer vibrates and sound is not heard.

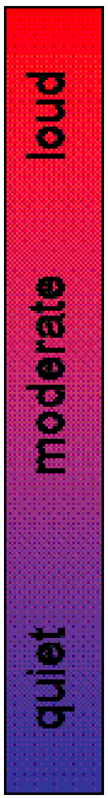


- The dB scale allows one to use a logarithmic rather than a linear scale. It has the distinct advantage of allowing one to do calculations within a scale of small numbers rather than over an extremely large scale of numbers.

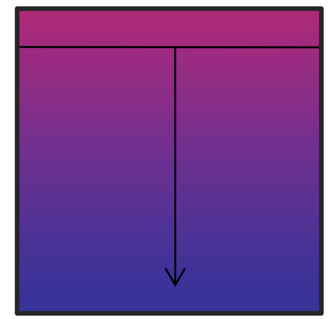
- dB = 10*log [(Pressure measured in Pascal)/(*Pressure at threshold of hearing)]

The dB Scale

It is important to understand what the dB scale is and what the levels mean. One does not need to achieve 0 dB in a room to eliminate noise.



- 140 dB – Apollo rocket
- 90 dB – loud manufacturing environment (ear protection is required – limited exposure OSHA)
- 60 dB – car interior while driving
- 50 dB – people talking
- 40 dB – ambient noise (outside during the night with limited background noise)
- 0 dB – threshold of hearing (eardrum begins to detect vibrations)



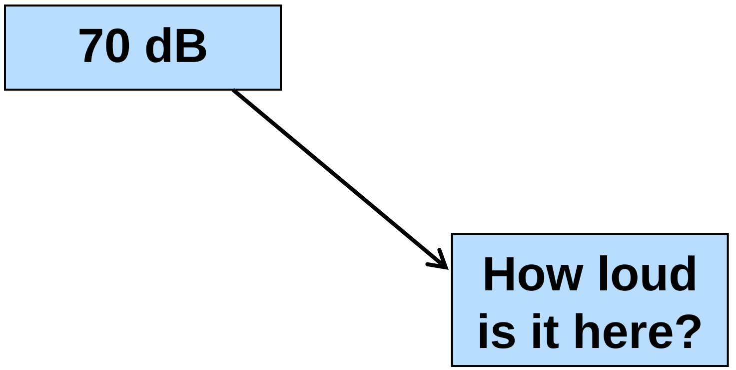
Goal: To achieve **sound pressure levels** (dB) <u>below 40 dB</u> (which for many environments will be void of any ‘noise’ issues).

Adding and Subtracting dB’s

If one was to DOUBLE the sound pressure levels, how many dB increase is this?

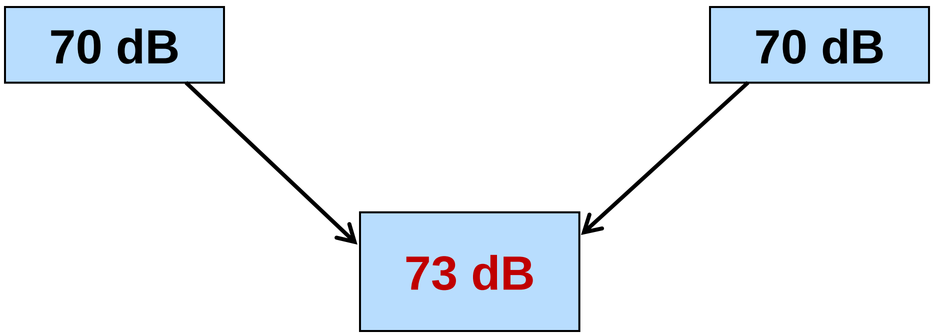
If one wanted to reduce the noise levels by 50%, how many dB decrease is this?

Assume you are sitting in your home theatre room; the left speaker is at 70 dB and the right speaker is at 70 dB.



The 3 dB Rule

When you DOUBLE the noise levels (two speakers in this instance), the sound pressure levels increase by 3 dB.



70 dB + 70 dB = 73 dB

The logarithmic sum of doubling a noise source is:

dB=10*log(2) = 3 dB

↑ Double the volume

Therefore, when designing a wall system – or trying to reduce noise levels - a 3 dB reduction is the same as turning down the volume knob 50%.

- 3 dB decrease (or increase) = 50% reduction in sound pressure levels
- 6 dB decrease (or increase) = 75% reduction in sound pressure levels
- 9 dB decrease (or increase) = 87.5% reduction in sound pressure levels

And so on…

Frequency (Hz)

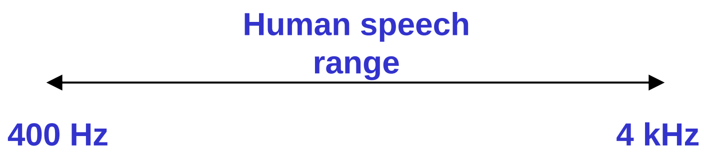
Frequency is simply 'number of cycles per time interval', or to better visualize, how many times your eardrum moves back and forth per second (cycles/second).

Thus:

- at 100 Hz, the eardrum moves back and forth 100 times/second
- at 1000 Hz, the eardrum moves back and forth 1000 times/second, and
- at 5000 Hz, the eardrum moves back and forth 5000 times/second.

The human ear responds to a range of frequencies from approximately 20 to 16,000 Hz, with a maximum sensitivity ~ 3 kHz.

The human speech range is approximately between 400 Hz and 4 kHz.



Note: The term Hertz is named after German physicist Heinrich Hertz. Thus, when writing out the abbreviation, use a capital 'H' and a lower case 'z'. (Hz)

The Frequency Scale (Hz)

The frequency scale is broken into three distinct regions (low, mid and high). This is important because each frequency region has different acoustic treatments associated with reducing its sound pressure levels.

Low-Frequency	Mid-Frequency	High-Frequency
Boom Noise	Speech Noise	Siren Noise
Bass	Television / Radio	Birds Chirping
63 Hz – 315 Hz	400 Hz – 4 kHz	4 kHz – 10 kHz

Frequency (Hz) and Wavelengths

Wavelengths - lengths

100 Hz

11.1 ft long

Low frequencies have large wavelengths more than 10 ft long and carry a lot of energy with them. (structure borne)

1000 Hz

13.2 inches long

10,000 Hz

1.32 inches long

Conversely, high frequencies are only an inch long, and can travel through small cracks (much like water) and leak out through wall systems. (airborne)

The Frequency Scale (Hz)

Frequency range and corresponding acoustic treatments:

- low frequencies are reduced via isolation techniques, and
- high frequencies are reduced via mass and absorption techniques.

Low-Frequency	Mid-Frequency	High-Frequency
Treat with isolation techniques (like a spring or an ‘isolator’)	Treat with mass layers to block and reflect the noise	Treat with absorption
63 Hz – 250 Hz	400 Hz – 4 kHz	4 kHz – 10 kHz

The Frequency Scale (Hz) cont'd…

Structure Borne Noise and Airborne Noise

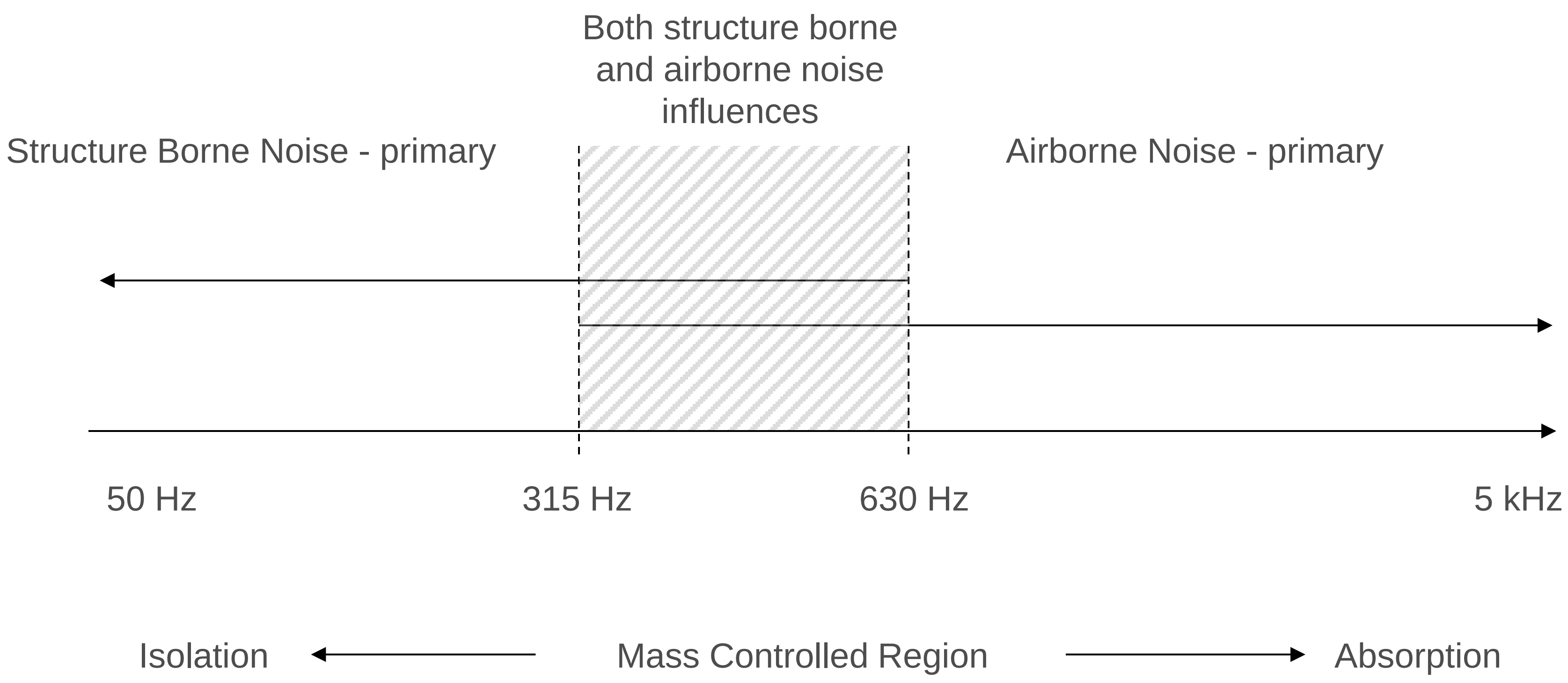
Additionally, another aspect of noise has to be addressed as it relates to frequency: the difference between structure borne noise and airborne noise.

Low frequencies are usually dominated by structure borne noise more than airborne noise. For instance, you can 'feel' the power of a subwoofer as it drives the 'structure' of the floor and walls. Conversely, high frequencies are dominated by airborne noise, much like the tweeter emitting sound from the speaker. You do not 'feel' high frequencies.

This difference between structure borne noise and airborne noise is important as the approaches to treat them are radically different.

Structure Borne Noise Versus Airborne Noise

The diagram depicts the frequency ranges that are primarily influenced by either structure borne noise or airborne noise. This is important because there are different acoustic treatments associated with each frequency range.

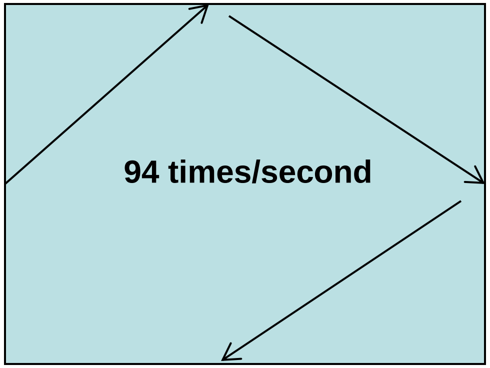


Speed of Sound

The speed of sound is approximately 1128 ft/s (344 m/s).

Think about that. In a typical office room (12’ X 12’ in dimension), the noise travels back and forth nearly 94 times in one second!

This reveals the value of absorption on the walls (curtains, carpeting, et al) as these absorptive items in a room have 94 chances to absorb and reduce noise levels every second.



Acoustic Treatments
Per Frequency Range
Isolation, Mass, Absorption

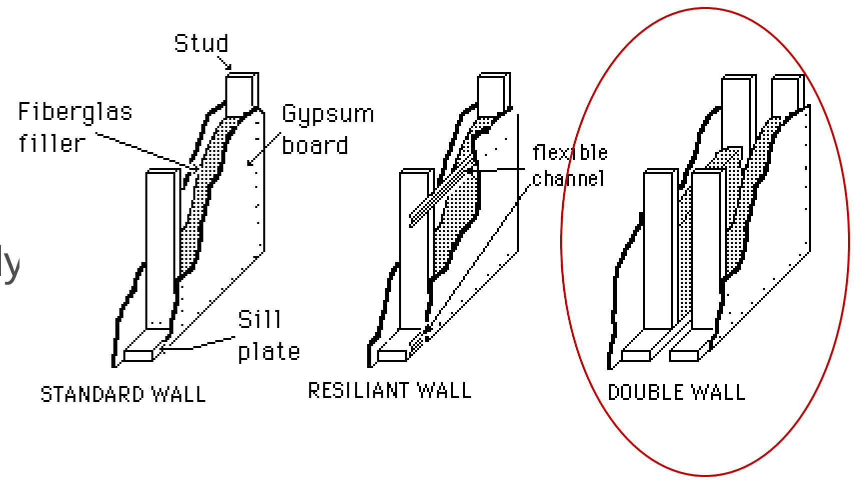
Low-Frequency: Isolation (< 250 Hz)

Low frequencies are the most difficult to treat (< 250 Hz). Wavelengths are very large, and these frequencies carry a lot of energy and drive entire wall systems.

The best way to treat (reduce) low frequencies is to make two separate wall assemblies and 'isolate' the transfer of energy from one wall to another.

Goal: To eliminate the transfer of vibration from one side of the wall to the other. For very loud source rooms (home theatres, for instance), a second wall assembly NOT mechanically attached in any way to the adjacent wall assembly is a preferred method.

Other methods: Reduce the number of studs (24" on-center spacing instead of 16") or significantly increase the mass of the entire wall assembly.



Best practices to reduce low-frequency noise:

1. **Add another wall assembly**
2. **Use fewer studs**
3. **Add mass**

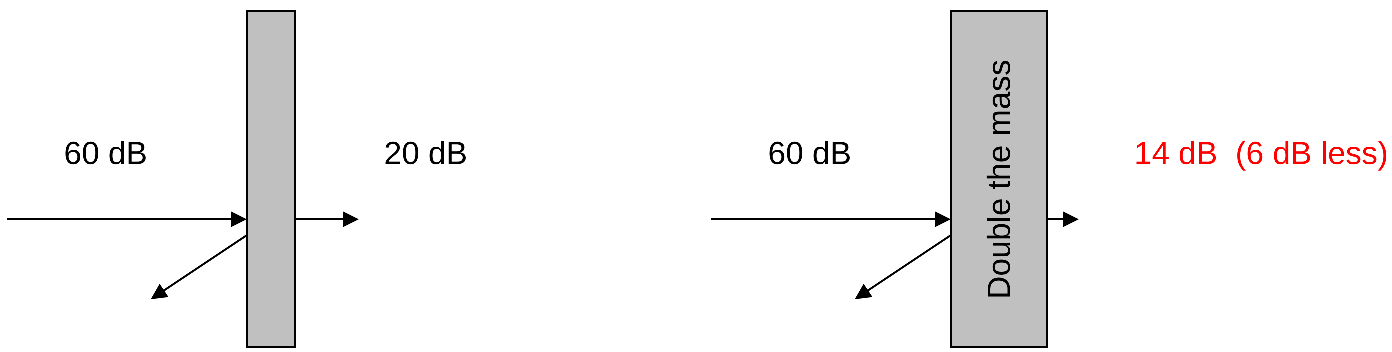
Mid-Frequency: Mass Controlled Region (250 Hz – 2 kHz)

This frequency range where most speech occurs is from approximately 400 Hz to 4 kHz. This mid-frequency range is best treated with MASS of the wall system.

The more mass that is added, the less noise is transmitted out the other side.

Rule of thumb: For every doubling of mass, the sound pressure levels are reduced by 6 dB throughout the spectrum.

For example:



Best practices to reduce mid-frequency noise:

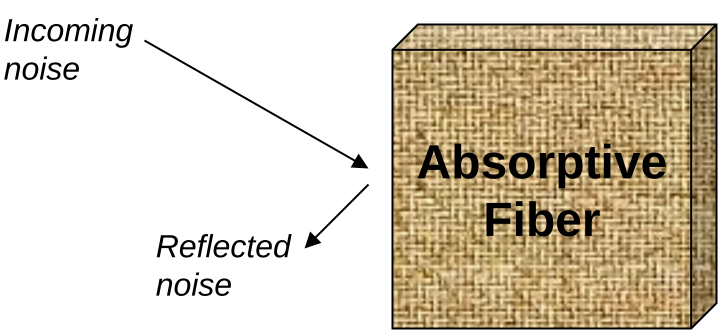
1. **Double the mass: reduce levels by 6 dB**
2. **Add absorption**
3. **Use isolation**

High-Frequency: Absorption Controlled Region (> 2 kHz)

In the higher frequency range, wavelengths are short and are more easily reflected off rigid wall systems. Recall that noise travels back and forth approximately 94 times a second in a 12' X 12' room environment. Thus, absorption would have 94 chances to absorb the echo within the room every second.

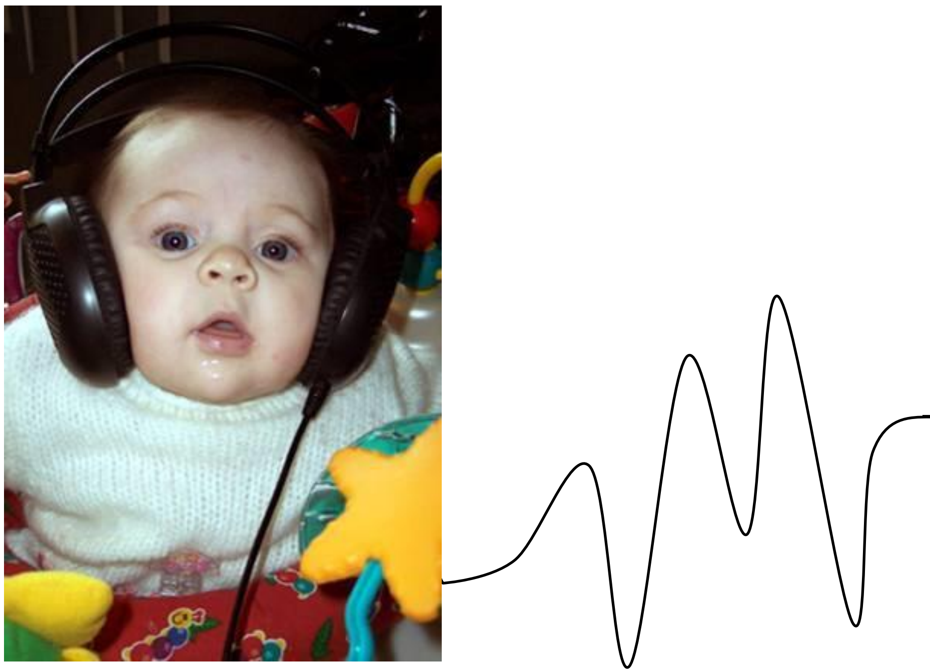
If the noise is not going through the wall, then it is being reflected back (echo). Add absorptive layers throughout the environment to absorb these reflections and minimize the echo in the room.

Difference between incoming noise and reflected noise = absorption of the product.



Best practices to reduce high-frequency noise:

1. **Add absorption (treat the room where the noise resides and not necessarily the wall between rooms)**



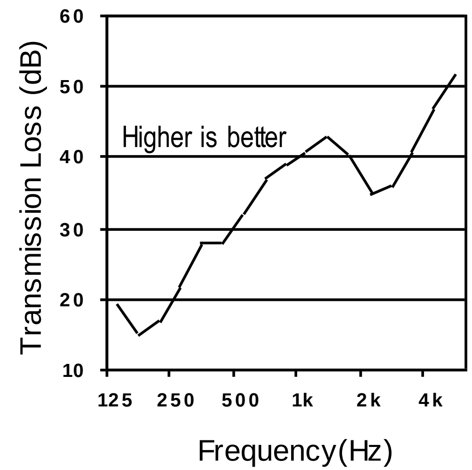
Transmission Loss

Definition

Simply defined, the Transmission Loss (TL) of a wall system is defined as how much noise is reduced from one room to the adjacent room. Levels are measured in dB and are plotted throughout the frequency range.

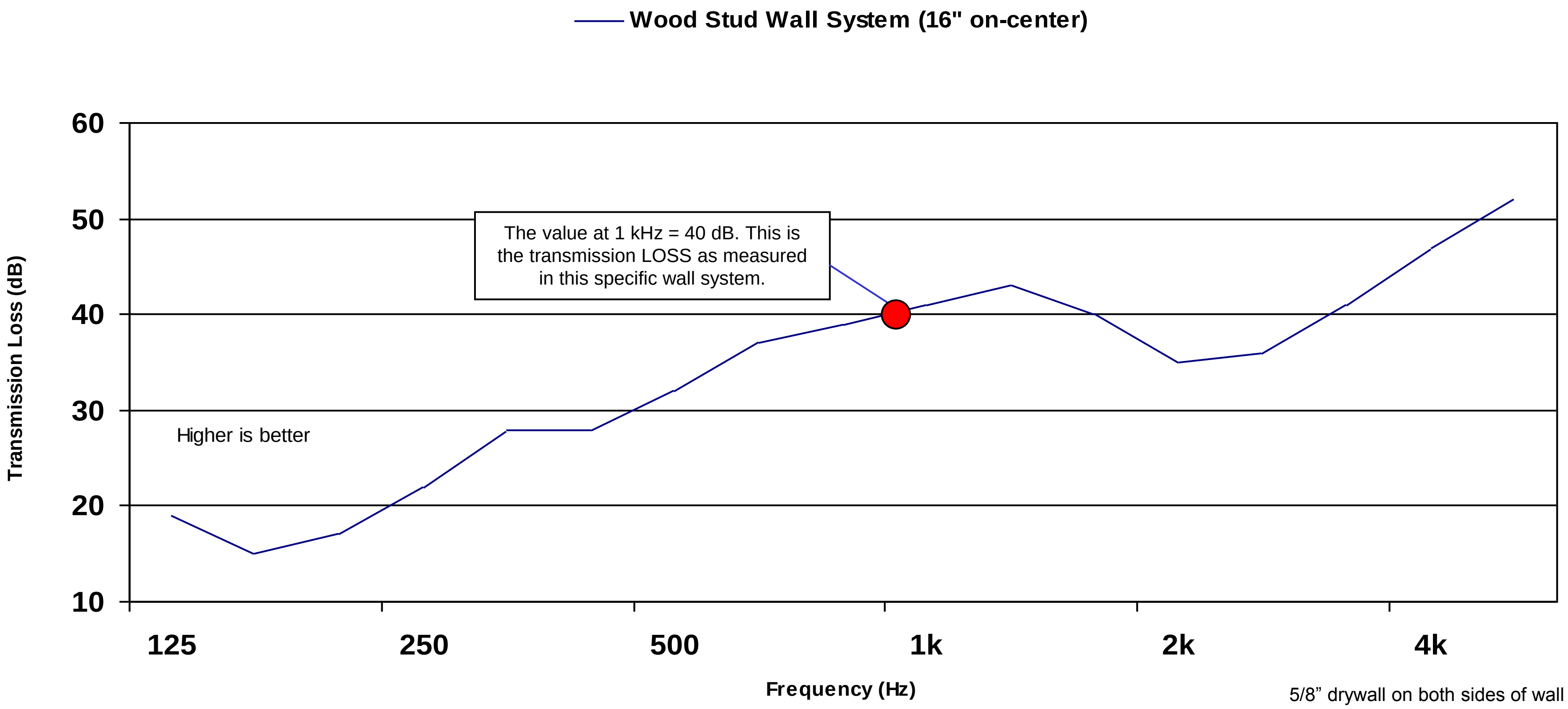
TL = Source Room – Receiving Room

TL = Source Room noise levels - Receiving Room noise levels =



Note: Higher is better. This means that the wall system REDUCES more noise between rooms.

Transmission Loss Graph: What it means



Here is the transmission loss of a wall system with wood studs (source room noise levels minus measured levels in an adjacent room).

What do the numbers mean?

Assume somebody is talking in a room next door. The Sound Pressure Levels at 1 kHz in this room are = 60 dB

A wall system, with 2" X 4" wood studs and 5/8" drywall is measured to have a Transmission Loss of 40 dB at 1 kHz

How loud is it in the adjacent room?

Source 60 ⟶ TL = 40 ⟶ ?

(from the chart on the previous page)

What do the numbers mean? cont'd…

Assume somebody is talking in a room next door. The Sound Pressure Levels at 1 kHz in this room are = 60 dB

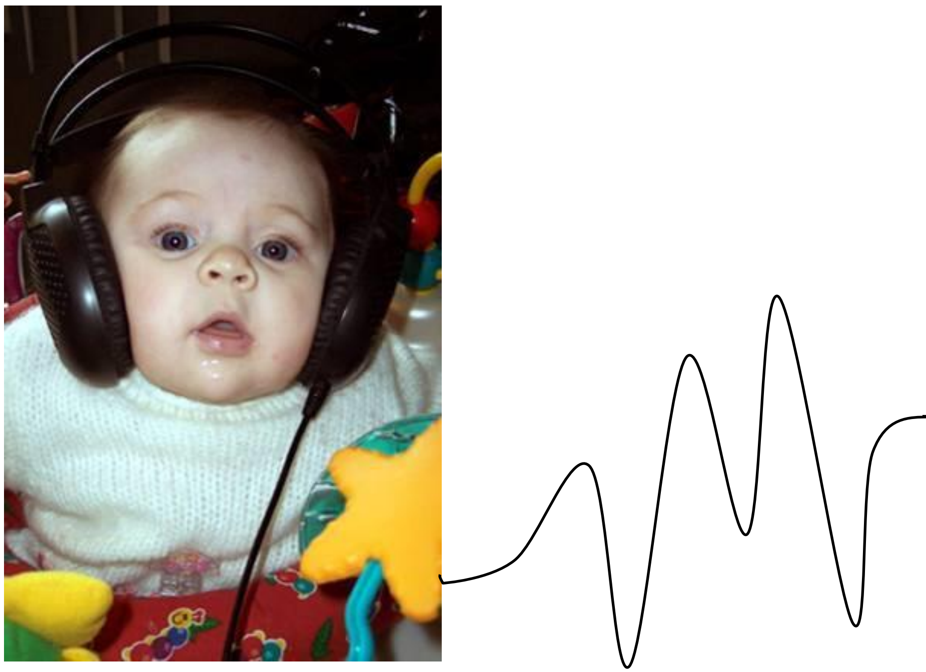
A wall system, with 2" X 4" wood studs and 5/8" drywall is measured to have a Transmission Loss of 40 dB at 1 kHz

The receiving room (adjacent room) 'hears' only 20 dB

Source 60 → TL = 40 → TL = source - receiving

[40 dB = 60 dB - 20 dB]

This is very quiet! And barely discernable.

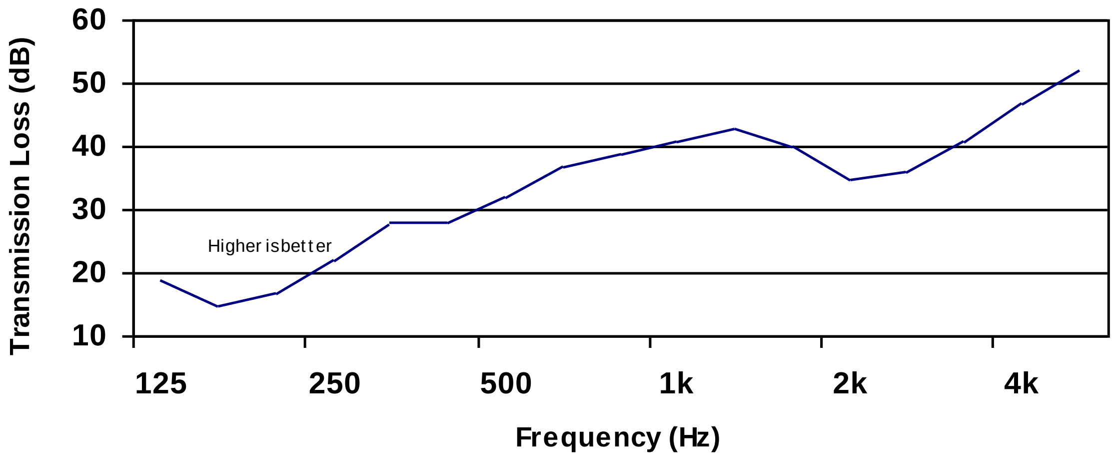


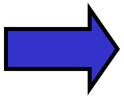
Sound Transmission Class (STC)

Definition

Sound Transmission Class (STC) is a SINGLE NUMBER CLASSIFICATION used to rate the transmission loss of a wall.

The higher the STC value, the more efficient the wall is in reducing sound transmission.





STC = 34

Transmission Loss

Very simply, the transmission loss of a wall system is measured and a single number is assigned to that entire chart. HOWEVER, this can sometimes be misleading (as will be discussed later in the course) as it all depends on which frequencies are the most important to treat, and what the best wall system is for your application.

Assigning a single number to a wide spectrum of frequencies often times does not tell the entire story – it is best to look at the entire frequency range and determine the best practices to reduce noise with the appropriate wall system.

How to calculate STC:

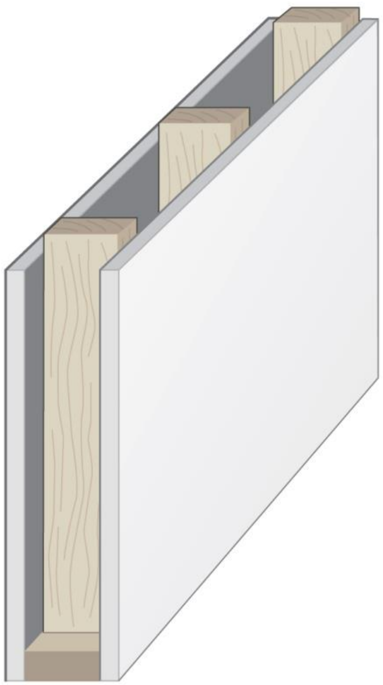
Measure the transmission loss (TL) for the wall system from 125 Hz to 4 kHz and plot on a chart. The STC for the wall is determined by superimposing a contour chart (not shown here) upon the TL curve such that (1) there is no more than an 8 dB deficiency between the TL and the STC contour at any 1/3-octave frequency (i.e., no test point may be more than 8 dB below the STC contour), and (2) the total deficiency between the STC contour and the TL curve (i.e., the value of the STC contour minus the value of the TL curve summed at all 1/3-octave frequencies from 125 Hz to 4 kHz) must be less than or equal to 32 dB. Once the curve has been adjusted to meet these two criteria, then the STC value of the wall is equal to the TL value of the contour at 500 Hz.

The more noise the wall system reduces – the higher the STC number.

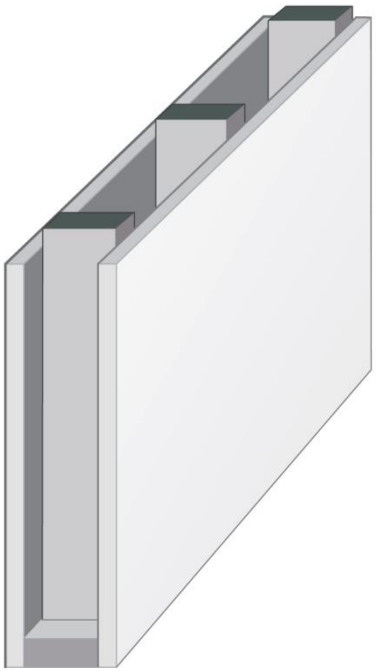
STC of Various Wall Assemblies

Influences of Stud Type: Wood Versus Metal

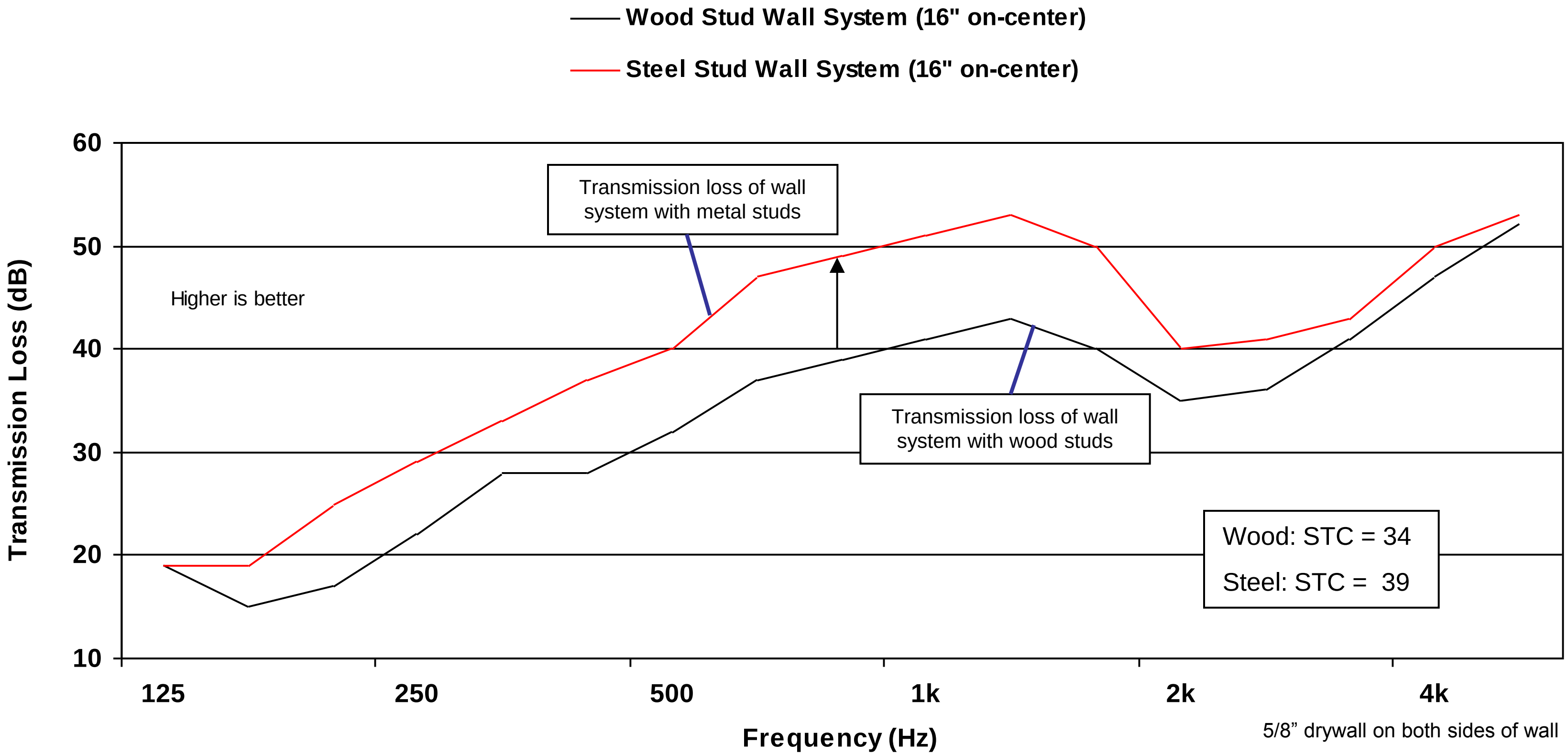
wood stud wall assembly



steel stud wall assembly



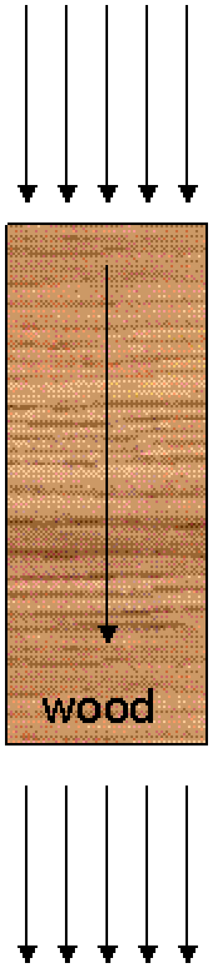
Influences of Stud Type: Wood Versus Metal cont'd…



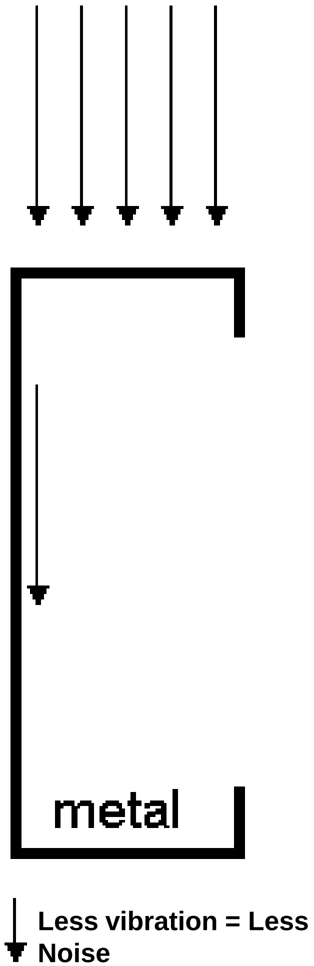
Metal studs perform approximately 6 dB to 10 dB better than wood studs throughout the spectrum. This is significant!

Wood Versus Metal Studs

1. vibration (noise) going into the wood studs
2. does not get 'absorbed' in the wood stud…
   too rigid and stiff
3. and transfers much of the original vibration out the other side



1. vibration (noise) going into the metal studs
2. however, the thickness of the metal stud is only ~ 1mm thick and 'absorbs' like a spring
3. only a small percentage of vibration is transmitted out the other side



Wood Versus Metal Studs

The type of studs used (metal or wood) is one of the most significant choices one can make to reduce noise in a wall system.

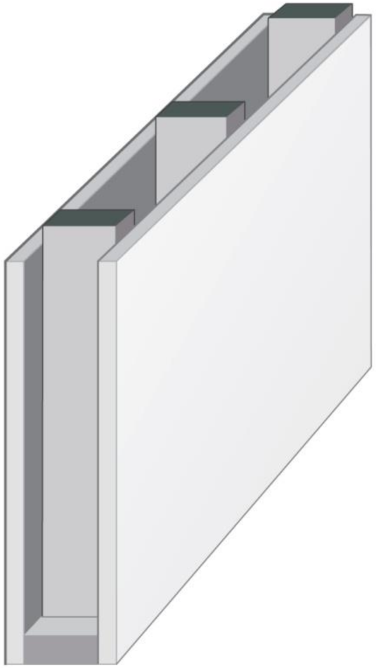
Metal studs act as more of a ‘spring’ and absorb much of the energy before the vibration exits out the opposite side. Conversely, wood studs are nearly incompressible, and transfer a higher percentage of vibration (noise) through the wall system.

Metal studs increase STC units by approximately 5 (from 34 to 39 for the assembly in the previous graph).

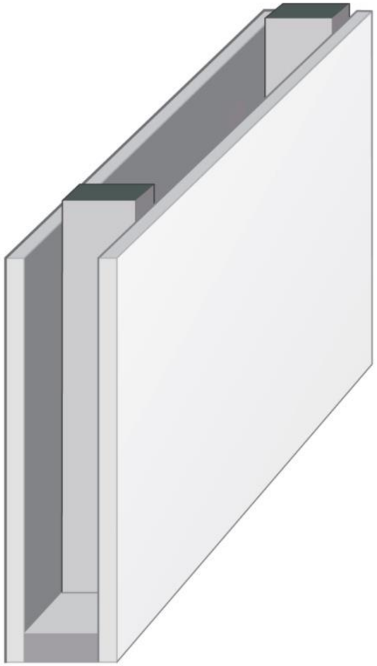
Whenever possible, metal studs should be the product of choice when building a wall assembly.

Influences of Stud Spacing: 16” Versus 24”

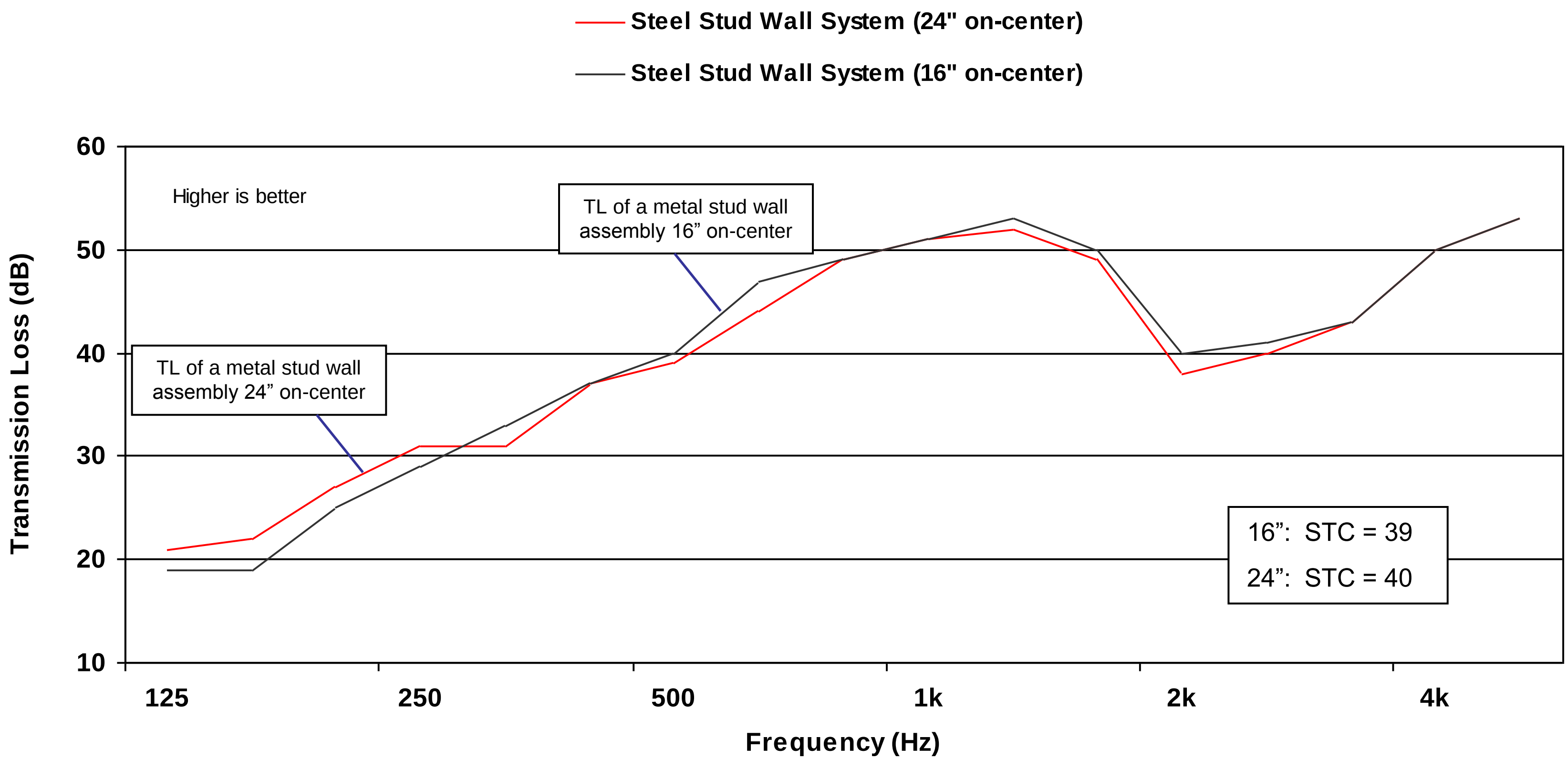
16” stud spacing



24” stud spacing



Influences of Stud Spacing: 16” Versus 24” cont’d…



- There are no consistent trends in performance between 16” or 24” spacing.
- 24” spacing offers improved low-frequency performance while 16” on-center improves mid- to high-frequency performance slightly. Since lower frequencies are most difficult to treat, the 24” on-center spacing is recommended as the best design for reducing noise.

Influences of Stud Spacing: 16” Versus 24” cont’d…

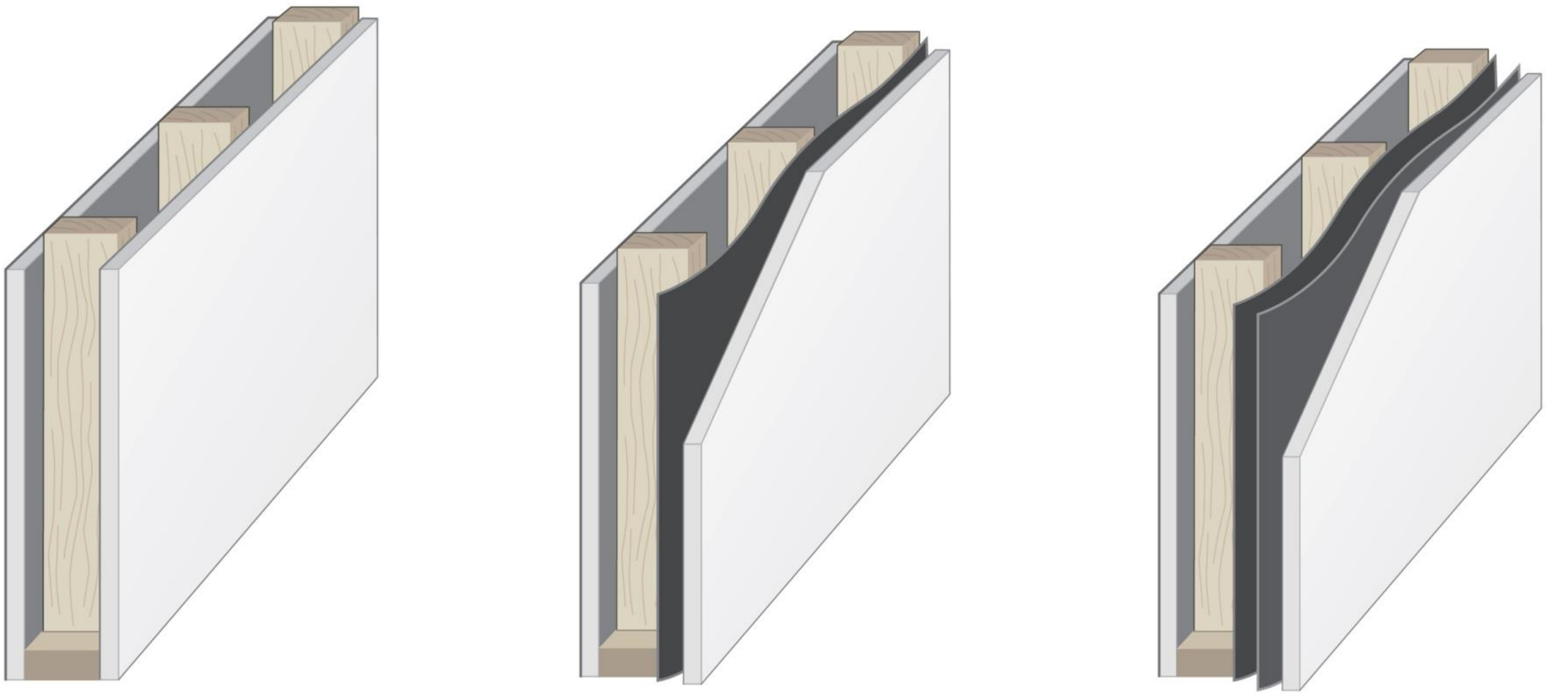
The spacing of studs from 16” to 24” has mixed results in terms of performance:

- The 24” on-center spacing reduces lower frequencies better than the 16” on-center spacing. This is due to fewer contact points in connection with the drywall to drive the structure borne vibration from one side of the wall to the other (more isolation).
- Recommendation: Whenever possible, wall designs should implement 24” on-center spacing of studs. This will reduce low frequencies from being transmitted from one side of the wall to the other – and generate cost savings by using less raw materials.

Note that there are three studs in a 48” section using 24” on-center stud spacing, whereas there are four studs while using 16” on-center spacing. Thus, there is 25% less surface area in the 24” spacing to transfer vibration through the wall system.

Influences of Adding Acoustic Barrier Layers: One Layer Versus Two Layers

wall system without barrier	wall system with an acoustic barrier	wall system with an acoustic barrier: 2-layer

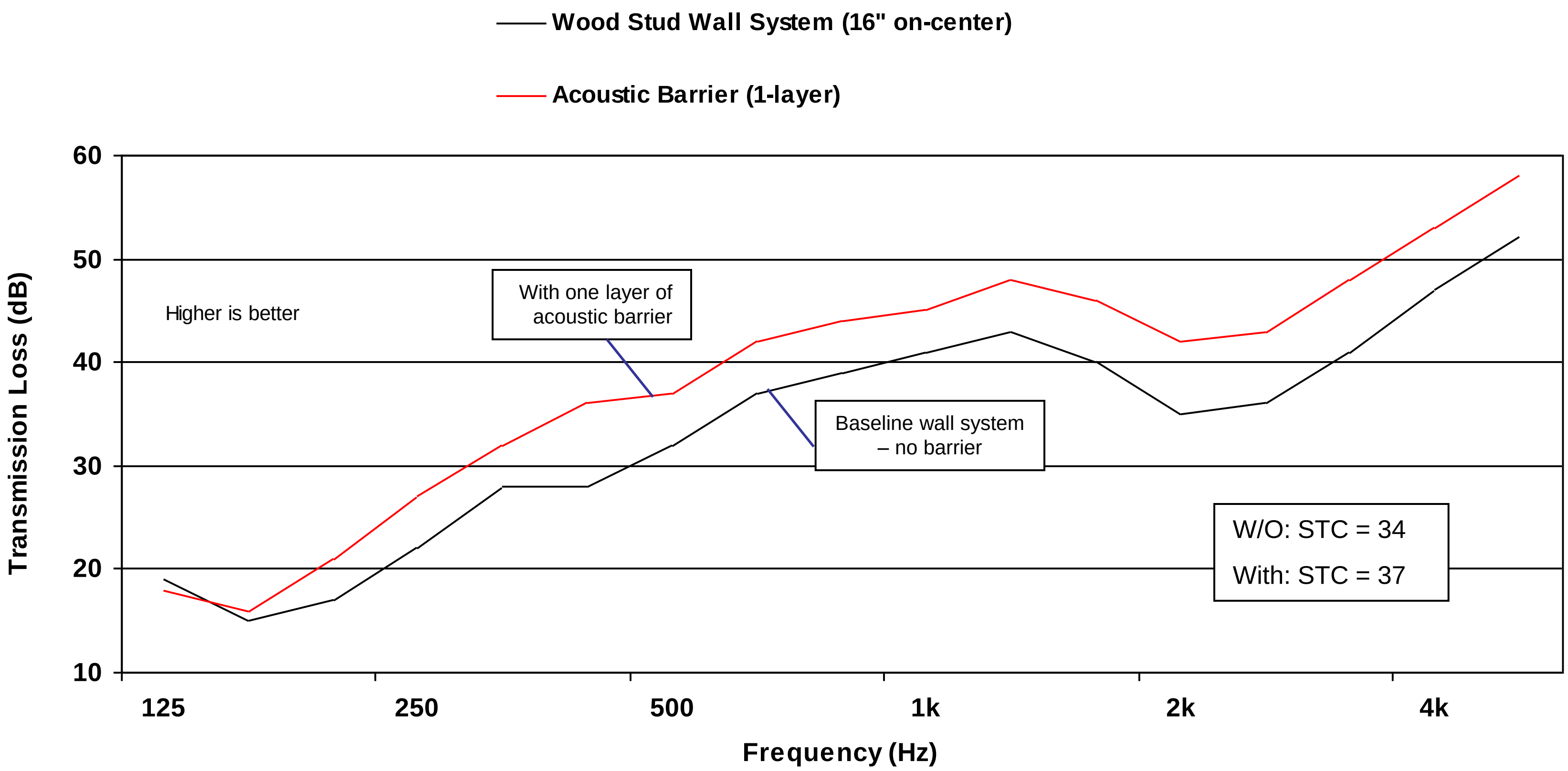


Acoustic Barriers

An acoustic barrier has the following traits:

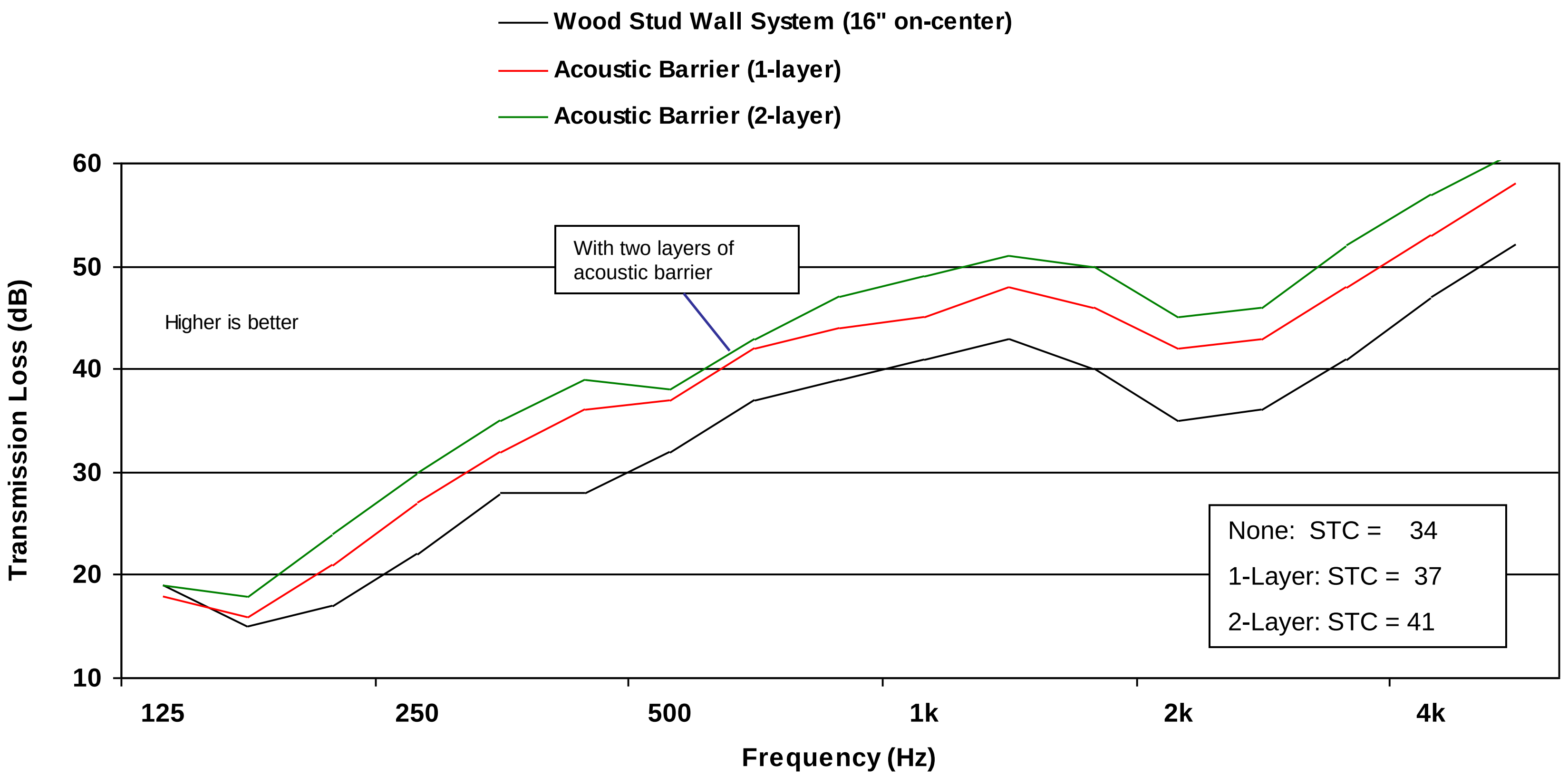
- heavy and dense, yet limp so it does not radiate vibration easily
- thin profile (~ 2mm thick)
- flexible to wrap around corners
- impermeable to moisture

Influences of Adding ONE Acoustic Barrier Layer



The addition of a 1 lb/ft^2 acoustic barrier placed behind the drywall offers ~ 5 dB improvement (reduction) in performance throughout the spectrum. This is significant!

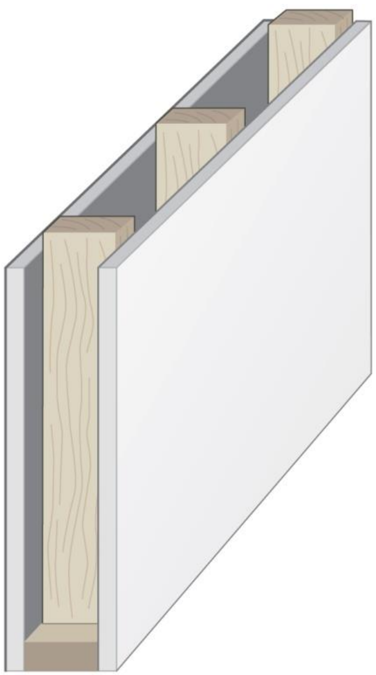
Influences of Adding ONE or TWO Acoustic Barrier Layers



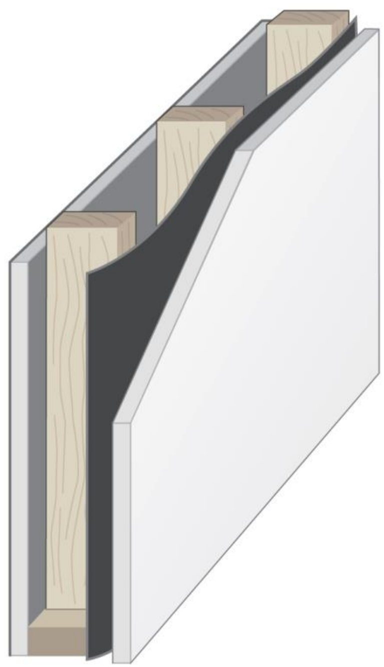
One layer reduces sound pressure levels ~ 5 dB throughout the frequency spectrum. Two layers reduce sound pressure levels ~ 10 dB throughout the frequency spectrum. Thus, each additional layer of acoustic barrier reduces noise ~ 5 dB throughout the spectrum.

Influences of Adding an Acoustic Barrier (one or two layers) With and Without Batt Insulation

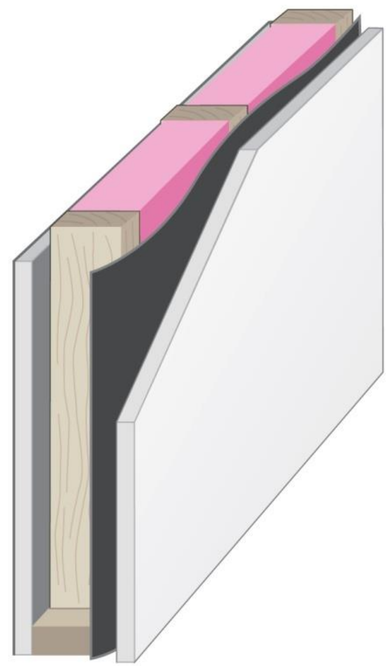
baseline wall system



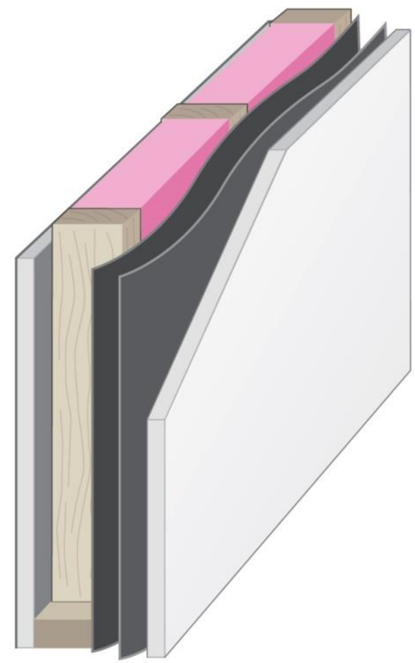
wall system with an acoustic barrier



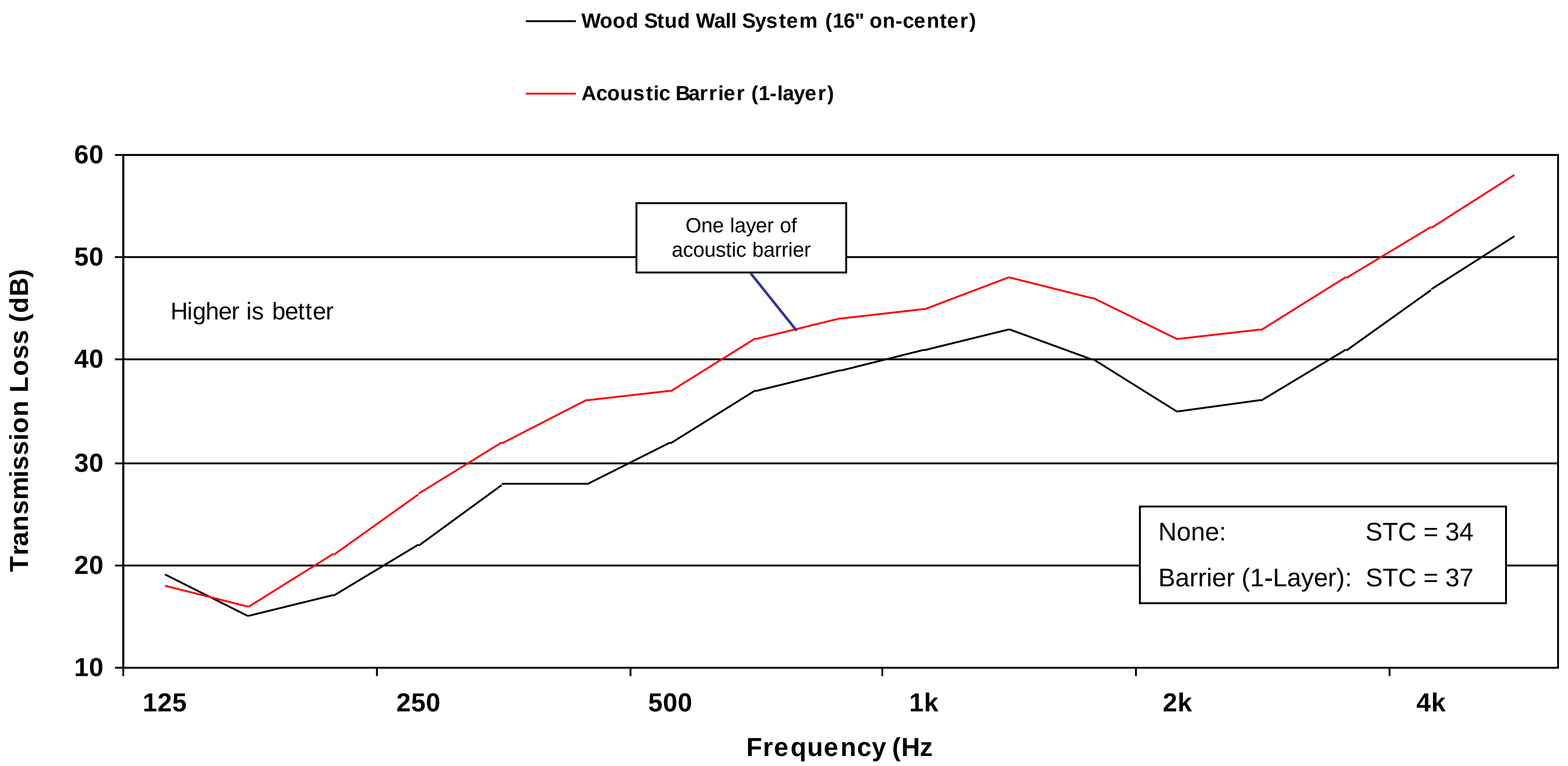
wall system with an acoustic barrier and batt insulation



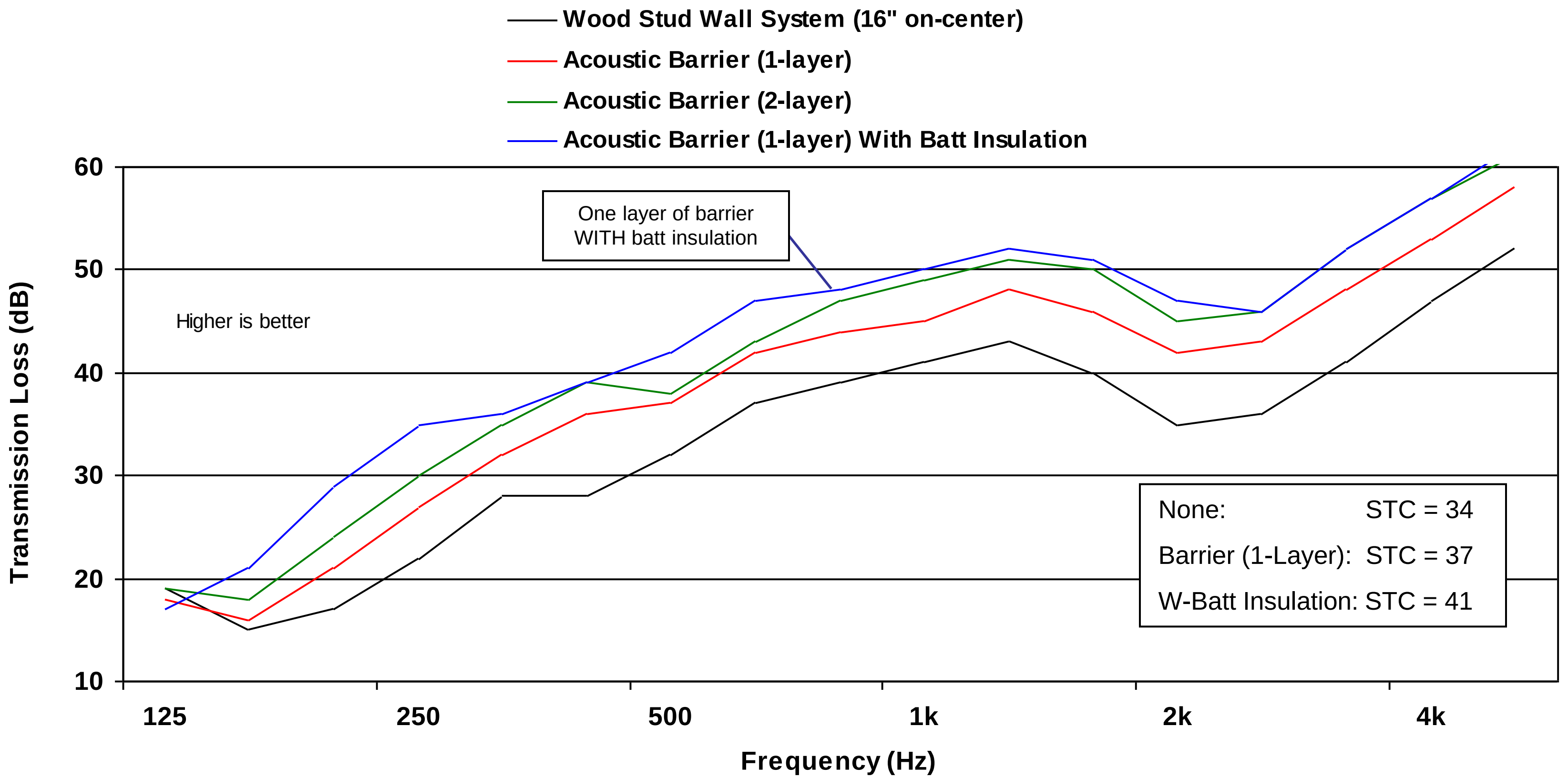
wall system with a 2-layer acoustic barrier and batt insulation



Influences of an Acoustic Barrier Layer With and Without Batt Insulation

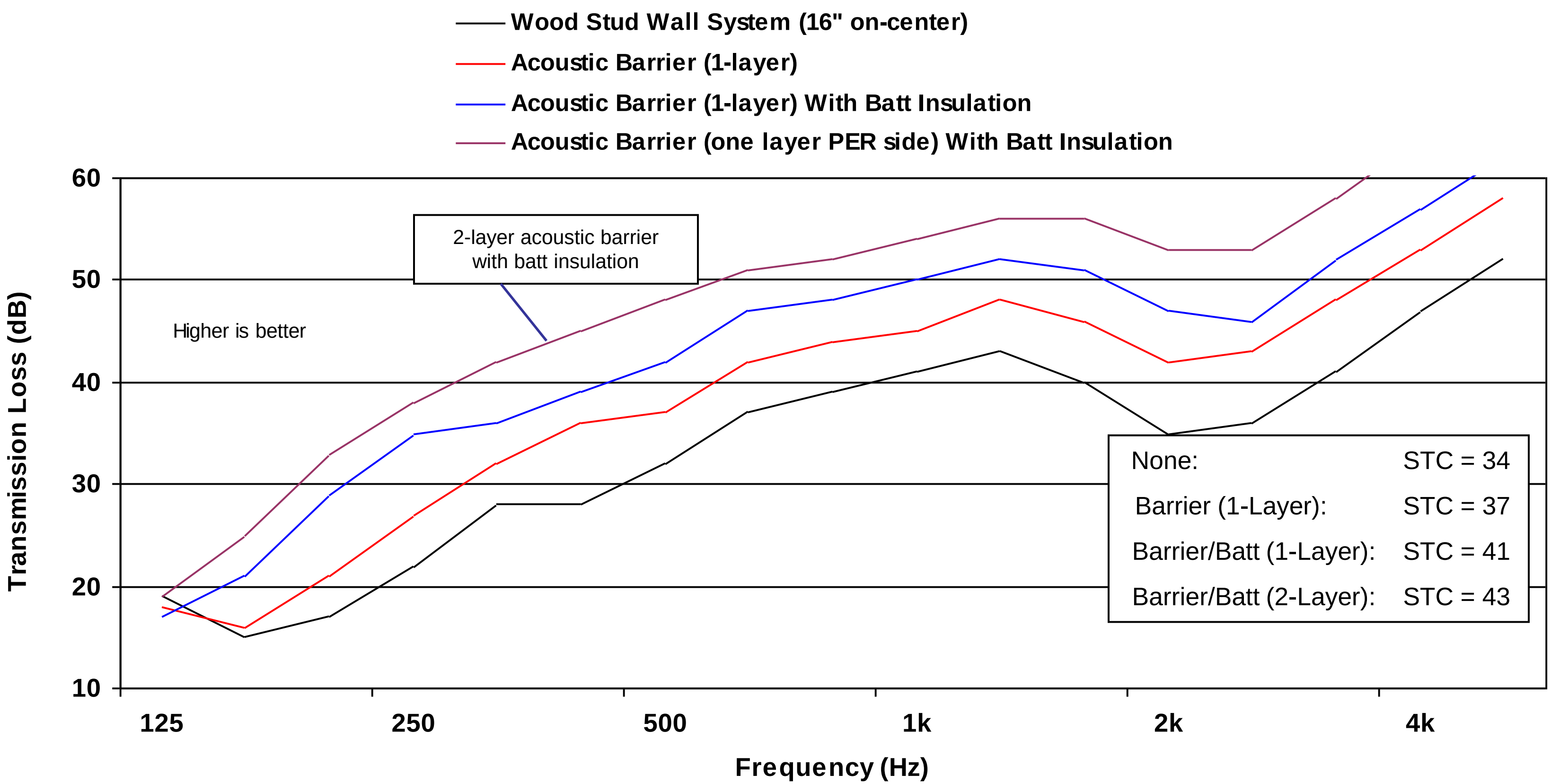


Influences of an Acoustic Barrier Layer With and Without Batt Insulation cont'd…



The combination of a batt insulation AND an acoustic barrier layer reduces sound pressure levels ~ 10 dB throughout most of the frequency spectrum.

Influences of One Versus Two Layers of Acoustic Barrier With Batt Insulation



Approximately 10 dB reduction in sound pressure levels occurs with a single layer of acoustic barrier plus batt insulation.
Approximately 16 dB reduction in sound pressure levels occurs with a layer of acoustic barrier on EACH side of the wall plus batt insulation.

Influences of One Versus Two Layers of Acoustic Barrier With Batt Insulation cont'd…

Acoustic barrier plus batt insulation:

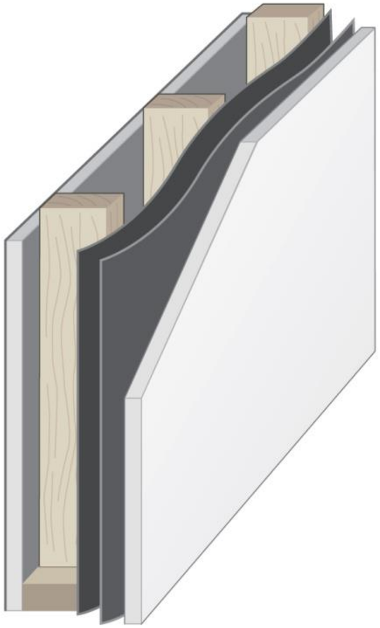
1. A single layer of acoustic barrier plus batt insulation reduces sound pressure levels ~ 10dB throughout most of the frequency spectrum.

2. A layer of acoustic barrier ON EACH SIDE plus batt insulation reduces sound pressure levels ~ 16dB throughout most of the frequency spectrum.

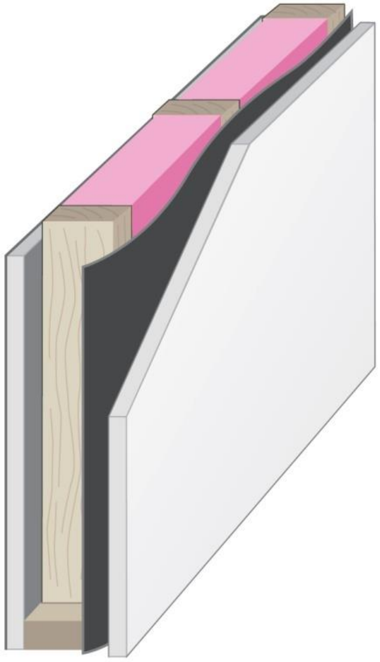
3. This wall assembly increases STC ratings ~ 7 to 9 points, depending upon single or dual layers of acoustic barrier, respectively.

Two Layers of Acoustic Barrier (no insulation) Versus One Layer With Batt Insulation

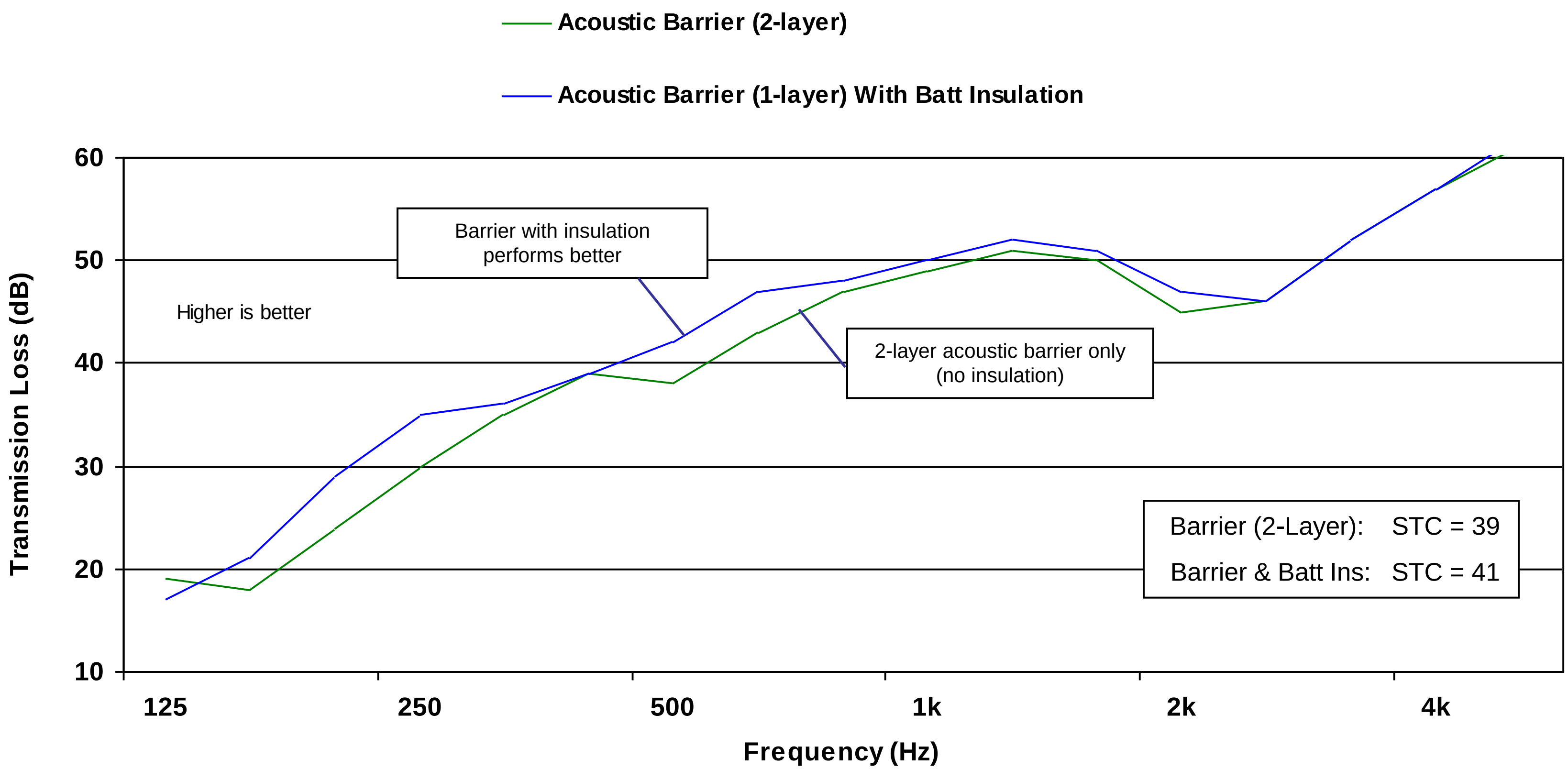
wall system with two layers of acoustic barrier – no insulation



wall system with an acoustic barrier on one side of the wall assembly – with batt insulation



Two Layers of Acoustic Barrier (no insulation) Versus One Layer With Batt Insulation cont'd…



A wall system that utilizes a single layer of acoustic barrier PLUS batt insulation performs better than two layers of barrier without insulation.

Two Layers of Acoustic Barrier (no insulation) Versus One Layer With Batt Insulation cont'd…

Conclusion

Which is better acoustically: two layers of acoustic barrier or a single layer of acoustic barrier with batt insulation?

A single layer of acoustic barrier plus batt insulation reduces sound pressure levels ~ 3 to 5 dB throughout most of the frequency spectrum as compared to a wall system with just two layers of acoustic barrier.

STC points are increased approximately 2 points with the batt insulation.

Points to Review

- Metal studs perform significantly better than wood studs.
- Spacing of studs is important. 24" on-center spacing is recommended due to the improved low-frequency performance.
- Acoustic barriers reduce sound pressure levels ~ 5 dB throughout the frequency range – PER layer.
- Acoustic barriers PLUS batt insulation significantly reduce sound pressure levels between rooms up to ~ 16 dB throughout the frequency range.
- Acoustic barriers PLUS batt insulation perform better acousticly than just two layers of acoustic barrier without insulation.

Learning Exercise

Lets take what we have learned thus far and create a STC wall system that achieves levels greater than 50….and greater than 60.

1. Start with a wood stud wall system (worst case) with no treatments

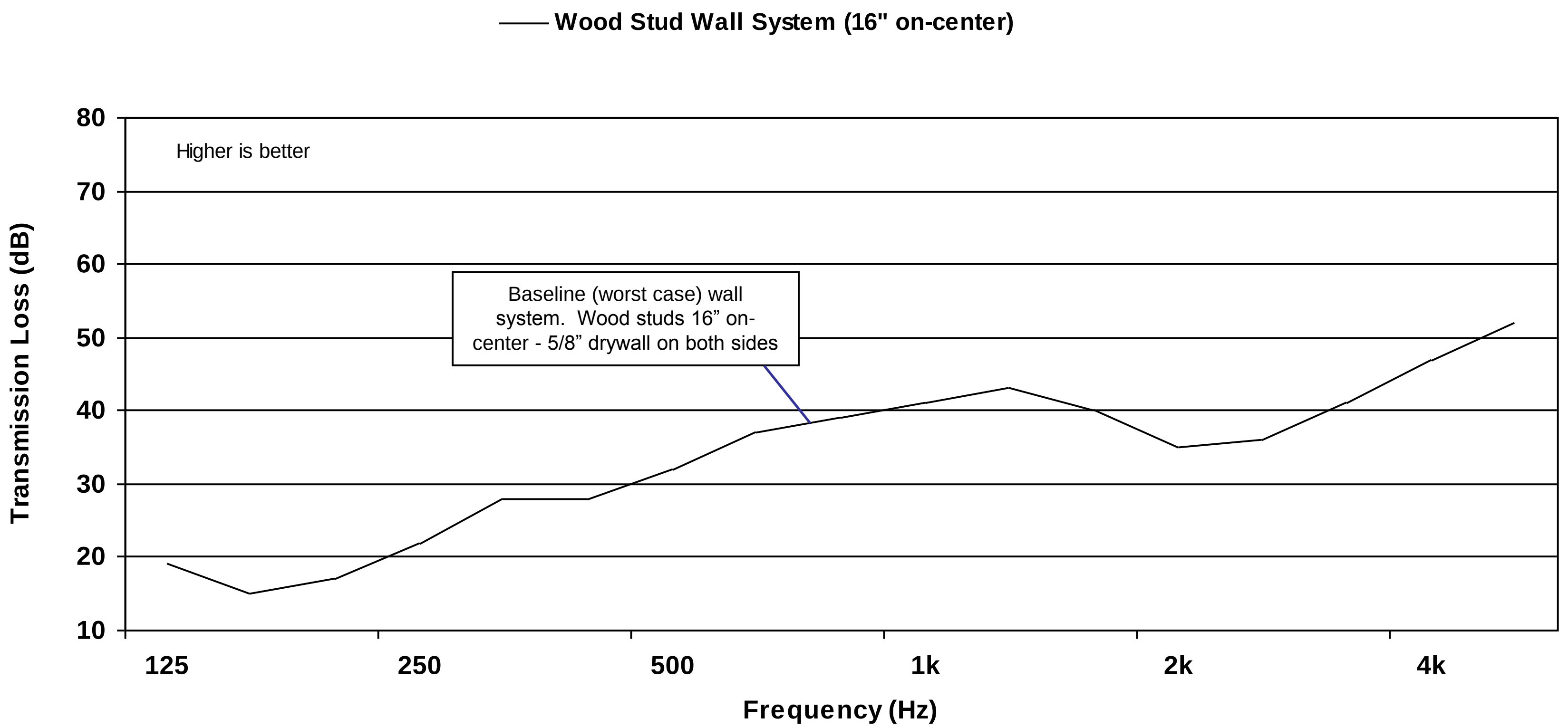
2. Change to metal studs

3. Add acoustic barrier plus batt insulation

4. Increase stud spacing to 24” on-center

5. And finally, add another barrier layer for a total of two barrier layers in the system

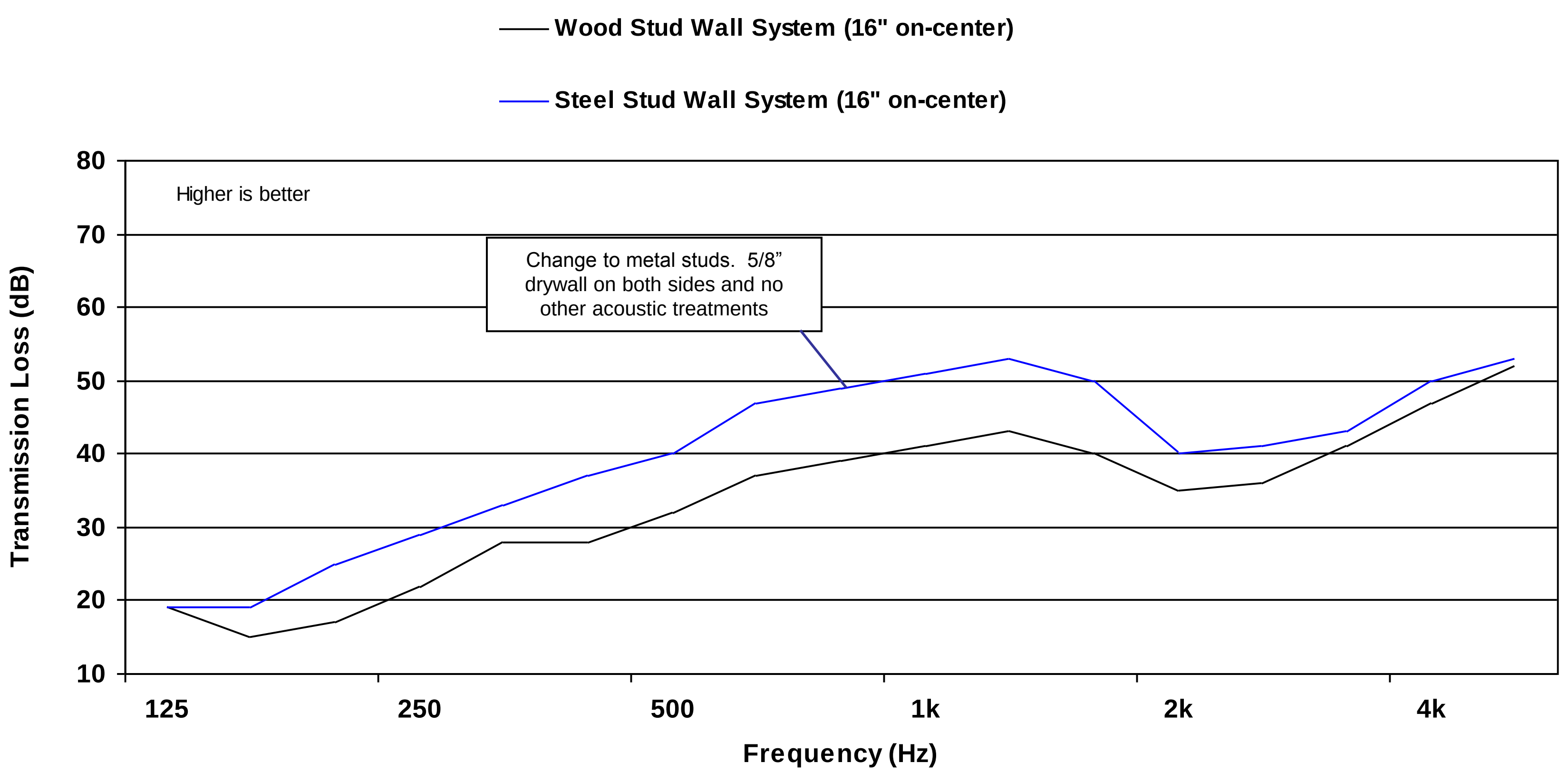
Wood Stud Wall System



Baseline

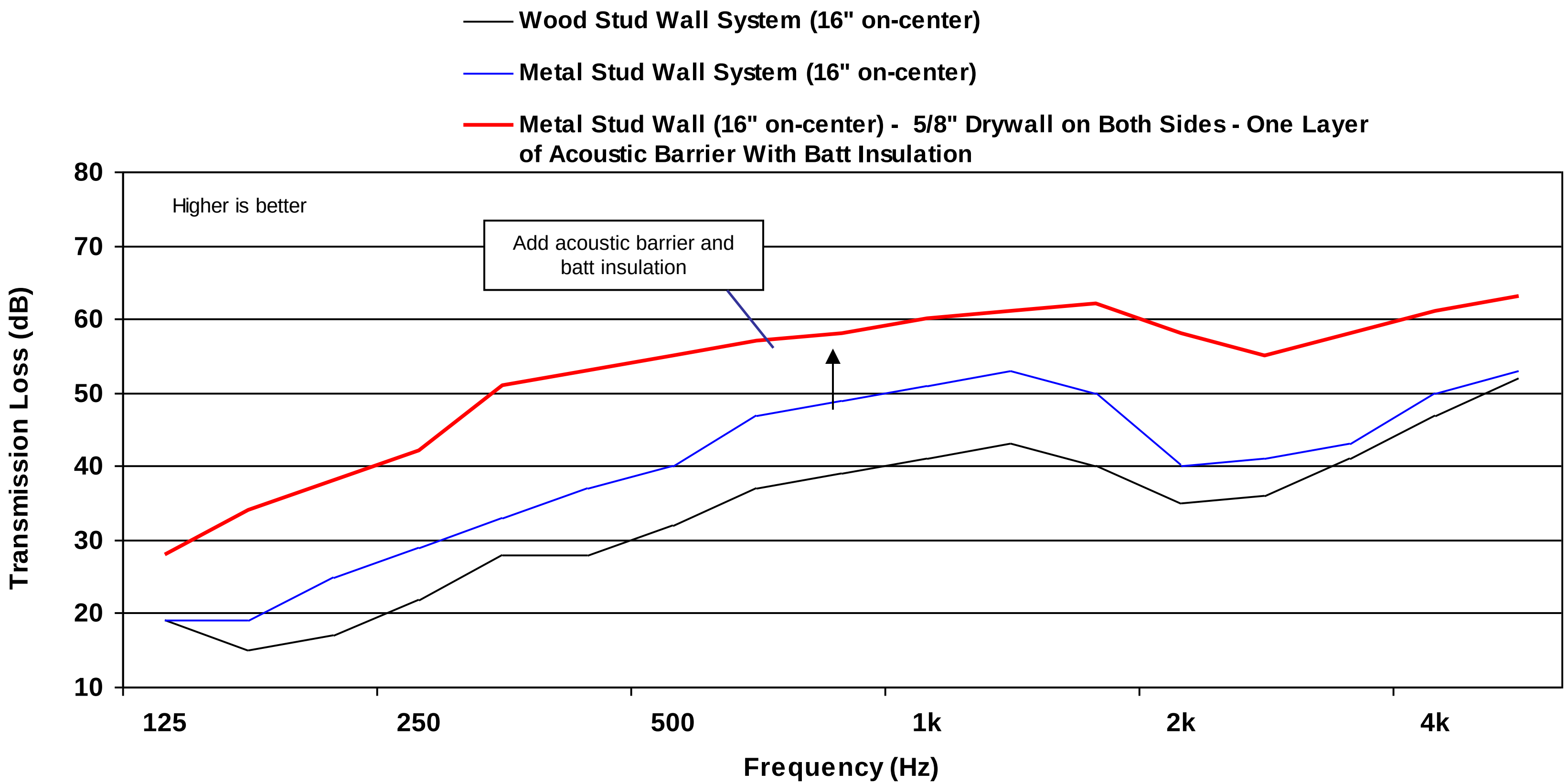
STC = 34

Change to Metal Studs



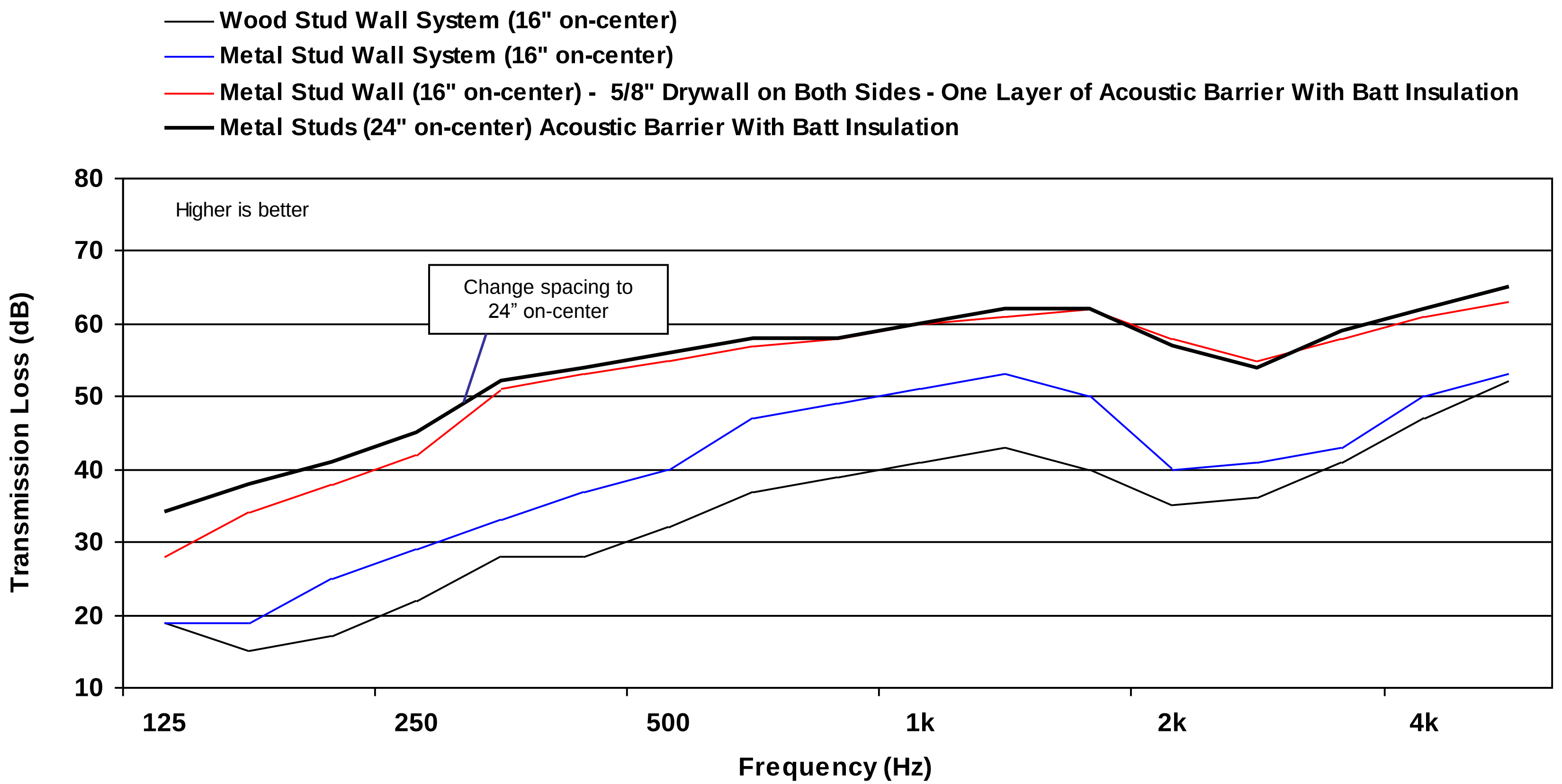
Baseline	STC = 34
Metal Studs	STC = 39

Add Acoustic Barrier and Batt Insulation



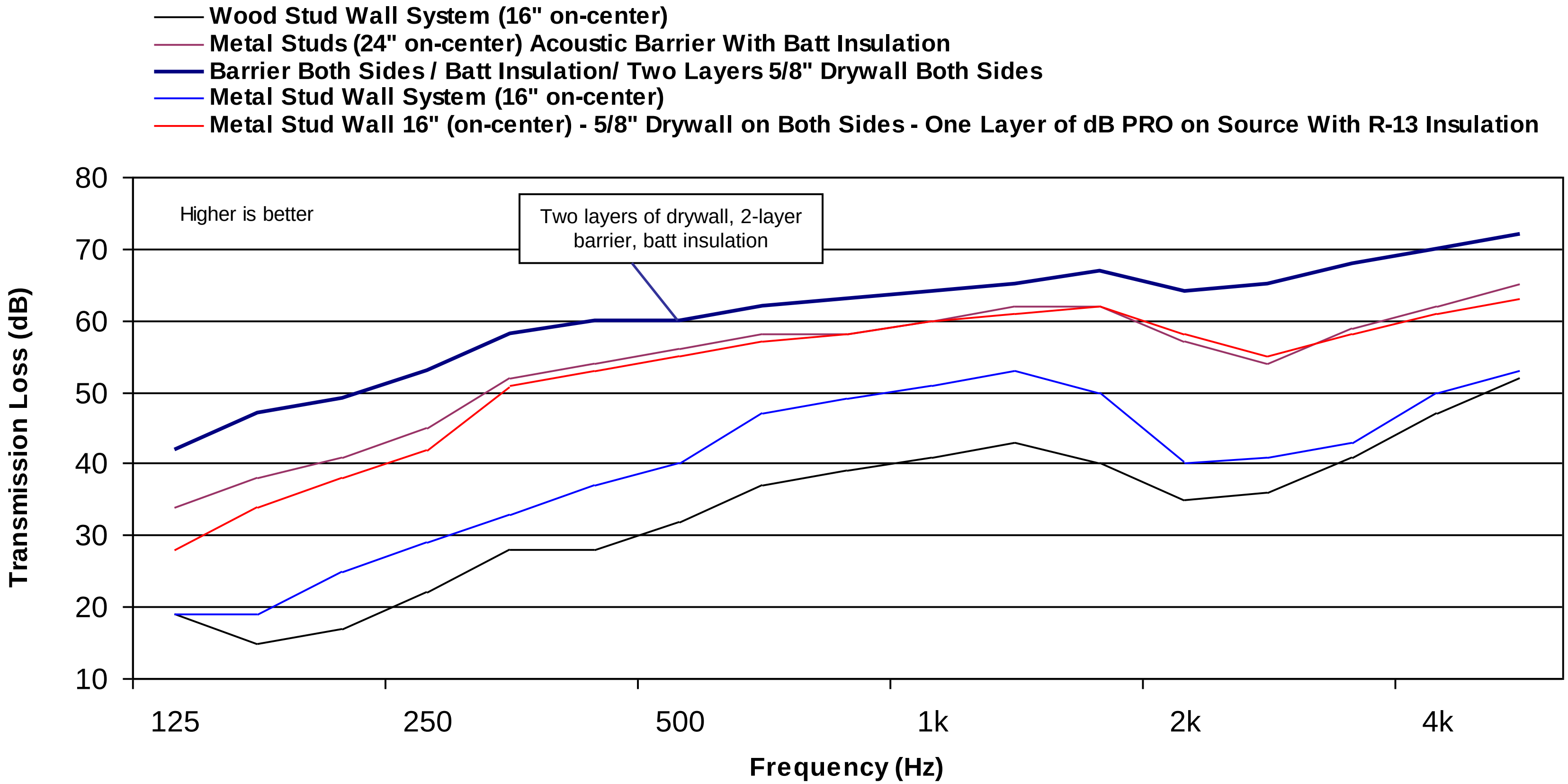
Baseline	STC = 34
Metal Studs	STC = 39
Metal Studs with acoustic Barrier & Batt Insulation	STC = 52

Change Spacing to 24" On-center



Baseline	STC = 34
Metal Studs	STC = 39
Metal Studs with acoustic Barrier & Batt Insulation	STC = 52
Metal Studs (24" on-center)/Barrier/Batt Insulation	STC = 56

Add Another Layer of Acoustic Barrier

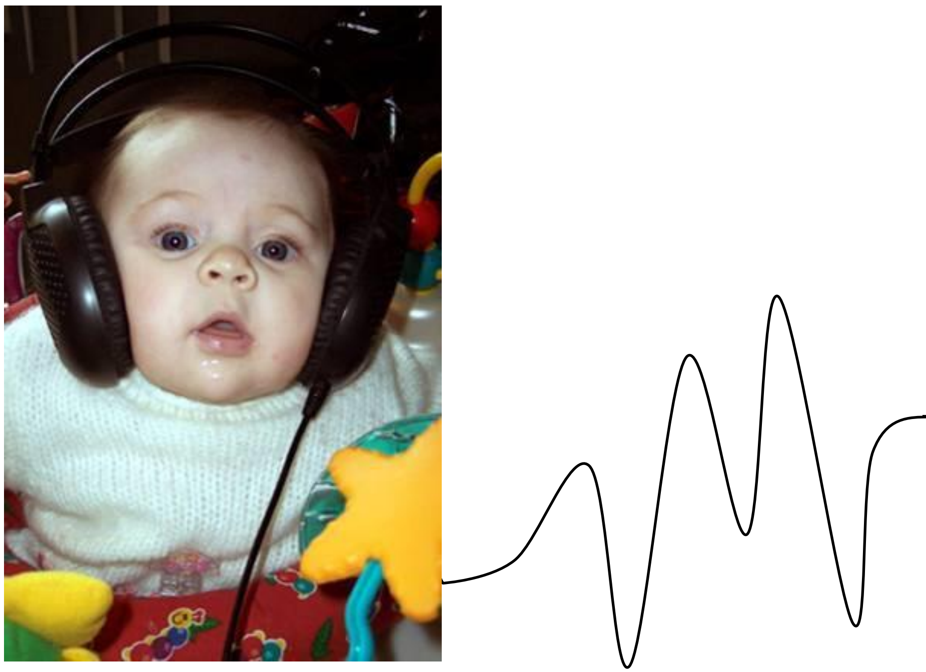


Baseline	STC = 34
Metal Studs	STC = 39
Metal Studs with acoustic Barrier & Batt Insulation	STC = 52
Metal Studs (24” on-center)/Barrier/Batt Insulation	STC = 56
Metal Studs (24” on-center)/2 Layers Drywall/2 Layers Barrier/Batt Insulation	STC = 62

To Summarize…

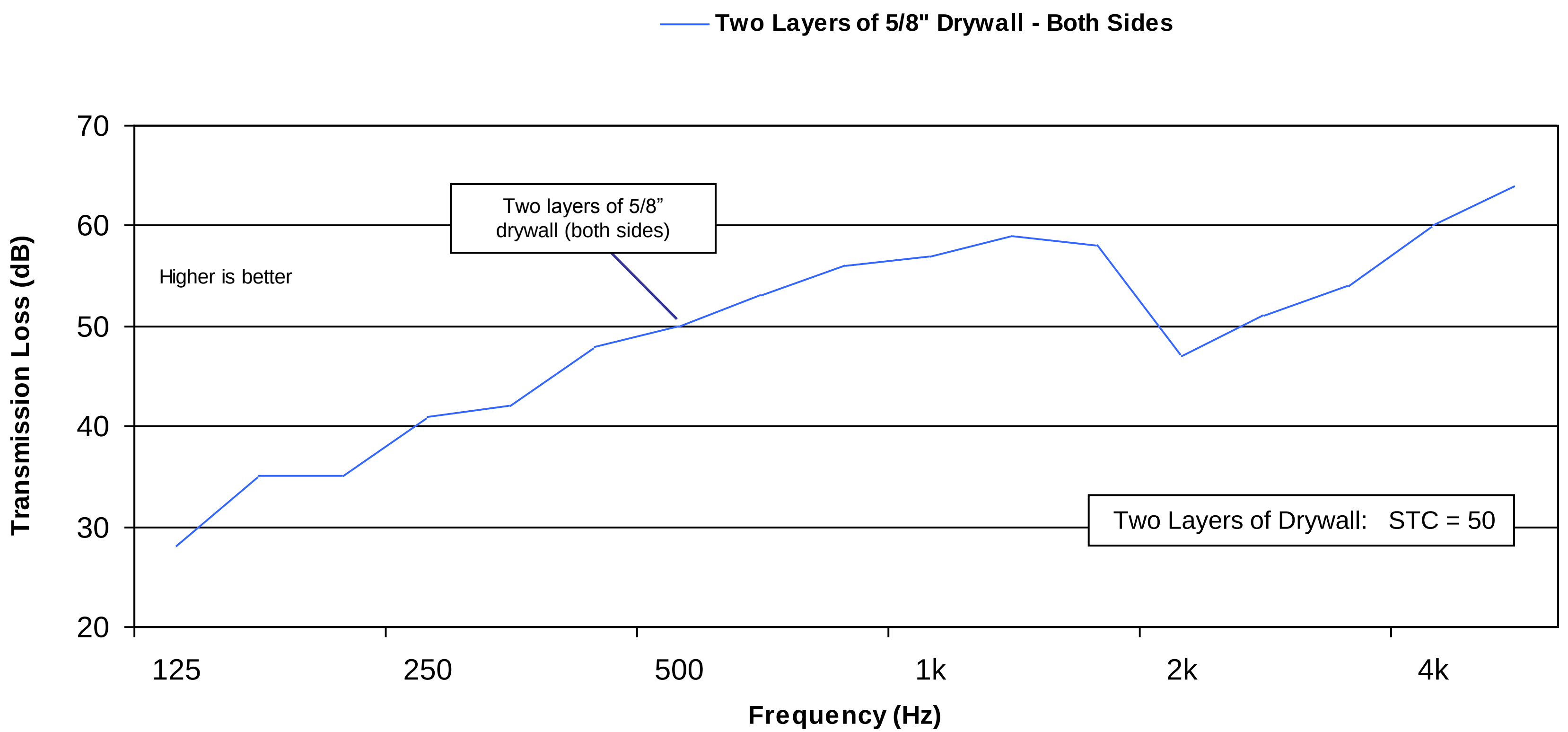
To achieve desired STC values in your wall system, there are multiple products/ designs that can be used:

- metal studs are invaluable - highly recommended to achieve desired STC levels
- batt insulation and acoustic barrier brings STC values up to 52
- increasing stud spacing to 24” on-center further increases STC up to 56
- STC values > 60 can be achieved by adding more layers (drywall and acoustic barrier)

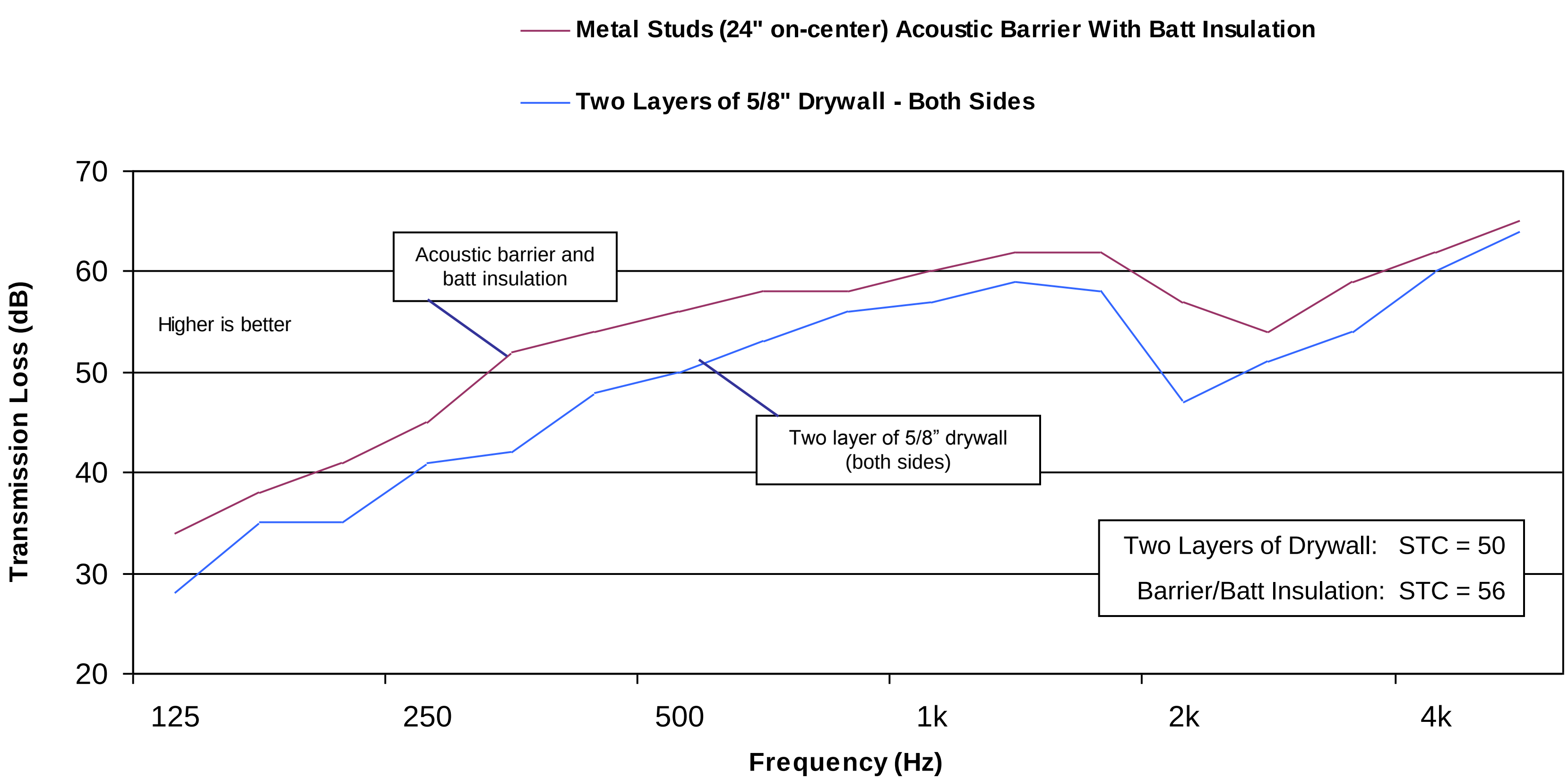


Alternative Wall Designs

Two Layers of 5/8” Drywall (both sides) Versus Single Layer 5/8” Drywall, Acoustic Barrier With Batt Insulation

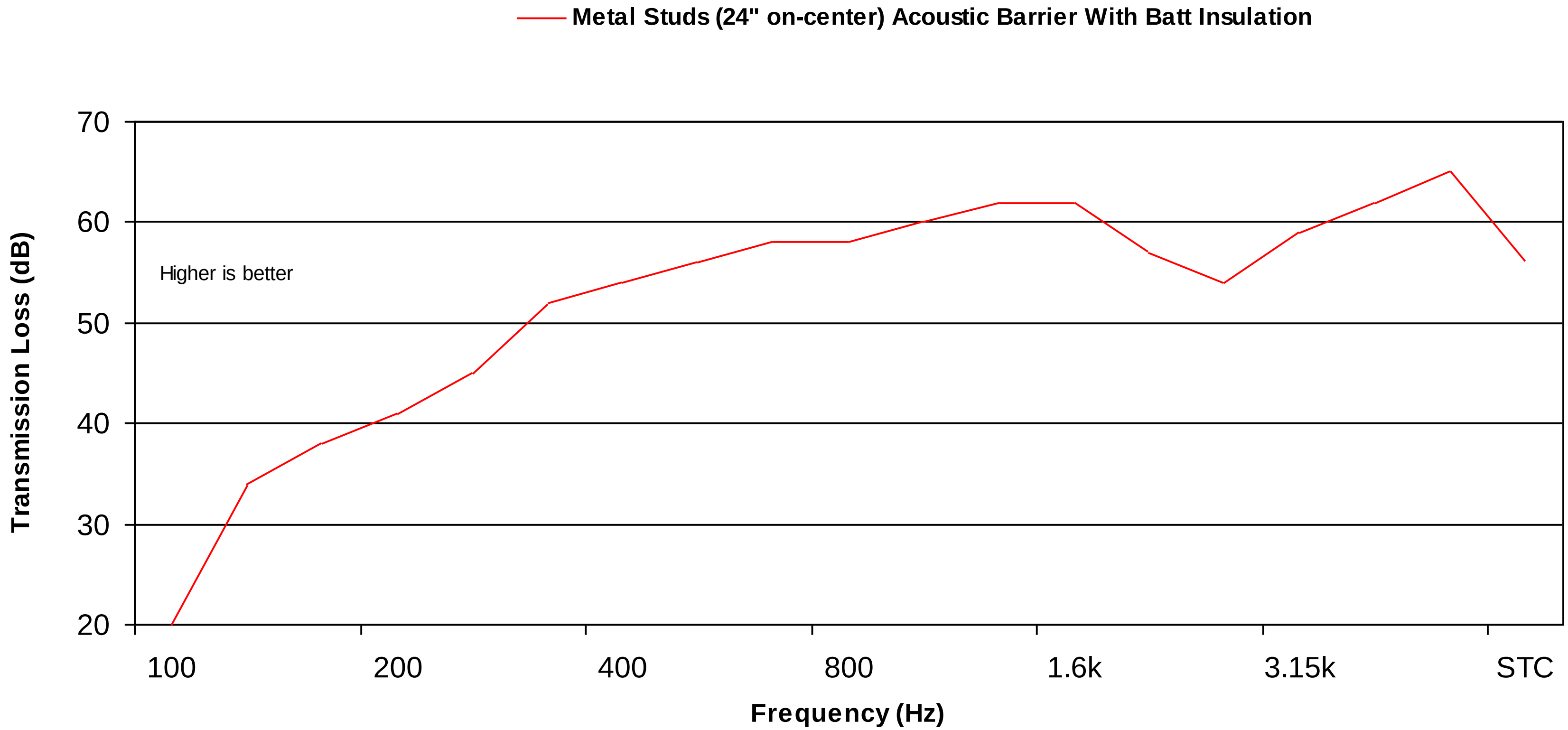


Two Layers of 5/8” Drywall (both sides) Versus Single Layer 5/8” Drywall, Acoustic Barrier With Batt Insulation cont’d…



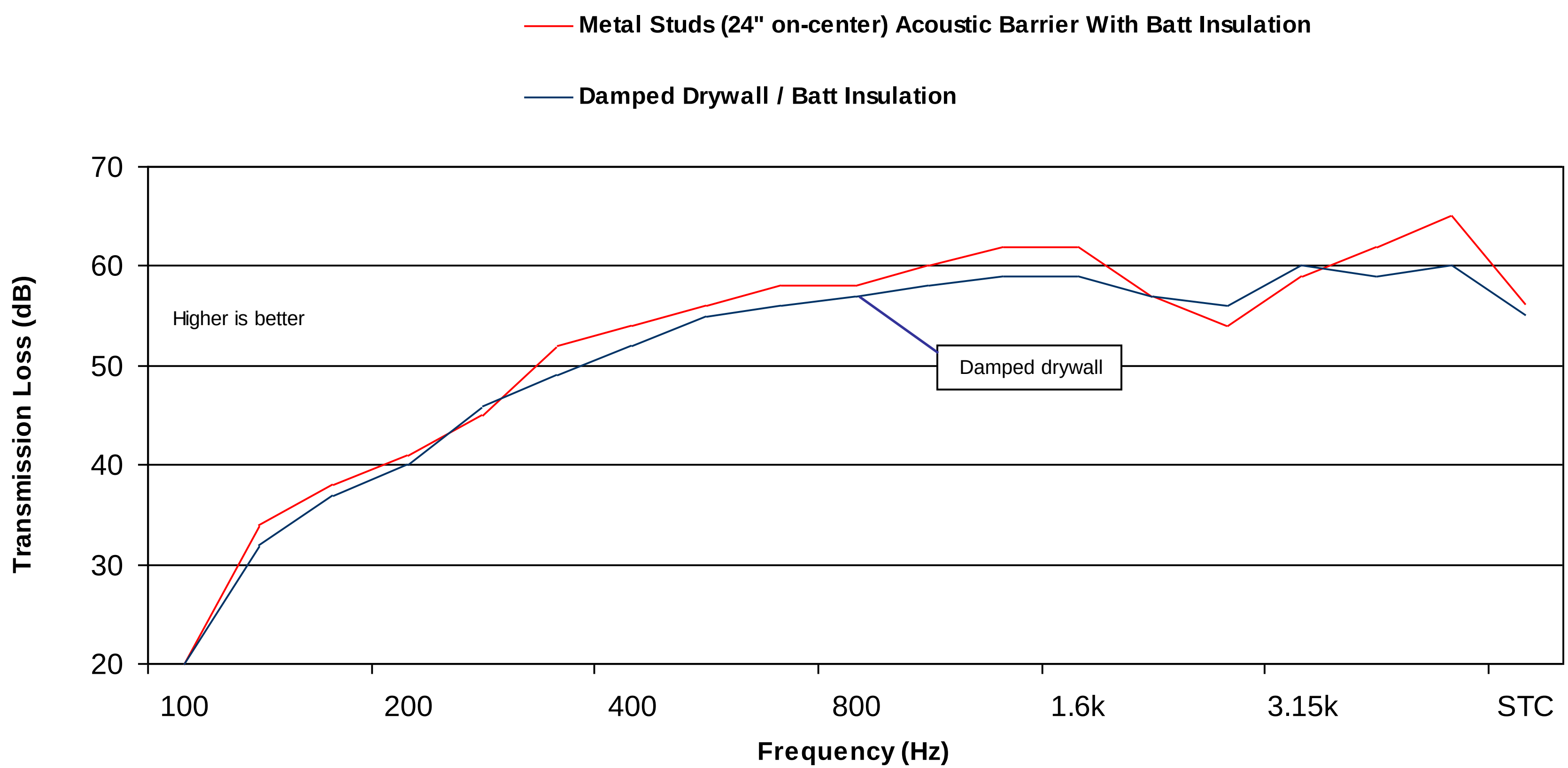
The wall system utilizing acoustic barrier performs significantly better than four total layers of 5/8” drywall.

Acoustic Barrier With Batt Insulation Versus 'Damped' Drywall With Insulation



- 5/8" drywall on both sides of wall

Acoustic Barrier With Batt insulation Versus 'Damped' Drywall With Insulation cont'd…



- 5/8" drywall on both sides of wall

To Summarize…

The acoustic barrier wall assembly has higher (better) measured transmission loss performance as compared to:

- multiple layers of drywall (two layers per side), and
- damped drywall (with batt insulation).

Why?

Previously it was mentioned that the transmission loss in the mid-frequency range was best treated with ‘mass’. However, that is only half of the story.

The remaining variable is STIFFNESS of the wall assembly – or more importantly, the ability of a wall to radiate noise efficiently (radiation efficiency).

Radiation Efficiency

Drywall is inherently stiff. Recall as a child taking a glass jar to the drywall to hear the noise on the other side of the wall. You hear the noise on the other side of the wall so well because drywall is stiff and radiates noise very efficiently.

A similar principal is at work with metal versus wood studs (wood being stiffer). Wood studs are very stiff, therefore vibration is more easily transmitted out the other side.

However, acoustic barrier is NOT. It is a limp barrier layer that has very LOW radiation efficiency. This means that when noise impinges upon the barrier layer, it does not put the barrier into motion and the vibration does not travel out the other side.

To reduce noise through a wall system, mass is very important, but one also wants to have very low radiation efficiency of the wall system so the vibration is minimal coming out the other side.

For example: On one hand, a drum cymbal is very efficient when struck – it will radiate noise for a very long time. **This is synonymous with drywall**.

Conversely, a laundry bag full of clothes will make a minimal thud when struck – but will NOT radiate any noise. **This is synonymous with acoustic barrier**.

Cost Analysis of Various Wall Assemblies

Cost Analysis of Wall Assemblies

This section examines the cost structure of the three most common types of wall assemblies:

1. Acoustic barrier with batt insulation

2. Damped drywall with batt insulation

3. Two layers of drywall (both sides)

Cost Analysis of Each System

Full Wall Systems Construction Costs Comparisons / ft2	Acoustical Barrier	Damped Drywall	2-layers drywall (both sides)
STC	**56**	**55**	**50**
Cost / ft2 (Estimated)	***$6.84***	***$7.84***	***$6.81***
Cost increase (compared to one layer of acoustical barrier)	***0%***	***13%***	***0%***

Drywall materials (side 1: 5/8" Type X)	**$0.30**	$0.30	$0.60
Drywall materials (side 2) (Damped Drywall costs here)	**$0.30**	**$2.50**	**$0.60**
Drywall, labor - side 1	**$0.85**	$1.25	$1.70
Drywall labor - side 2	**$0.85**	$0.85	$1.70
Acoustical Barrier materials	**$1.40**		
Acoustical Barrier , labor	**$0.20**		
Framework, materials	**$0.40**	$0.40	$0.40
Framework, labor	**$0.60**	$0.60	$0.60
Insulation, materials (3.5" batt insulation)	**$0.33**	$0.33	$0.00
Insulation, labor	**$0.40**	$0.40	$0.00
Sealant, materials and labor	**$0.65**	$0.65	$0.65
Mudding / taping, materials and labor	**$0.56**	$0.56	$0.56

Total cost materials + labor	**$6.84**	**$7.84**	**$6.81**

STC values based on published reports. Metal stud wall system – 24” on-center.

Cost Analysis of Each System cont'd…

Full Wall Systems Construction Costs Comparisons / ft2	Acoustical Barrier	Damped Drywall	2-layers drywall (both sides)
STC	56	55	50
Cost / ft2 (Estimated)	*$6.84*	*$7.84*	*$6.81*
Cost increase (compared to one layer of acoustical barrier)	*0%*	*13%*	*0%*

A wall assembly that achieves significantly higher STC values (acoustic barrier with batt insulation) actually costs the SAME as a wall system with two layers of drywall on both sides!

With costs being equal, it makes sense to offer a higher performing wall system.

Damped drywall costs nearly 13% more per square foot than an acoustic barrier wall assembly.

Designing Rooms With Correct Acoustic Treatments

The first thing to do is to take care of the rooms themselves with absorption.

- add draperies
- add plants
- add acoustic panels
- add carpeting

Noise WILL get into the rooms – either through adjacent walls, windows, doors, ceilings…from anywhere and everywhere.

Absorptive treatments are an easy way to combat these noise levels and capture (reduce) the reverberation as it is bouncing back and forth ~ 94 times per second.

ABSORPTION is key.

Designing Rooms With Correct Acoustic Treatments cont'd…

The second thing to do is to determine if isolation techniques are needed to combat low-frequency noise. If these rooms are near HVAC units, manufacturing plants, roads or highways, more extreme measures may be needed to reduce this low frequency.

- isolate the walls (two separate walls not connected in any way)
- extreme mass (concrete walls, for instance)
- use few studs (24" spacing versus 16" spacing)

ISOLATION is key for low-frequencies.

★ Please remember the **exam password NOISE.** You will be required to enter it in order to proceed with the online examination.

Designing Rooms With Correct Acoustic Treatments cont'd…

The third thing to do is to design an efficient wall system with an acoustic barrier.

- use 5/8" drywall to achieve the 1-hour fire rating to meet building codes
- with metal studs
- placed 24" on-center if possible
- with batt insulation to absorb inner cavity noise
- with an acoustic barrier to both ADD mass and reduce radiation efficiency

Reduce vibration transfer with an acoustic BARRIER.

Designing Rooms With Correct Acoustic Treatments cont'd…

Proper design and acoustic performance can be achieved if these simple guidelines are followed:

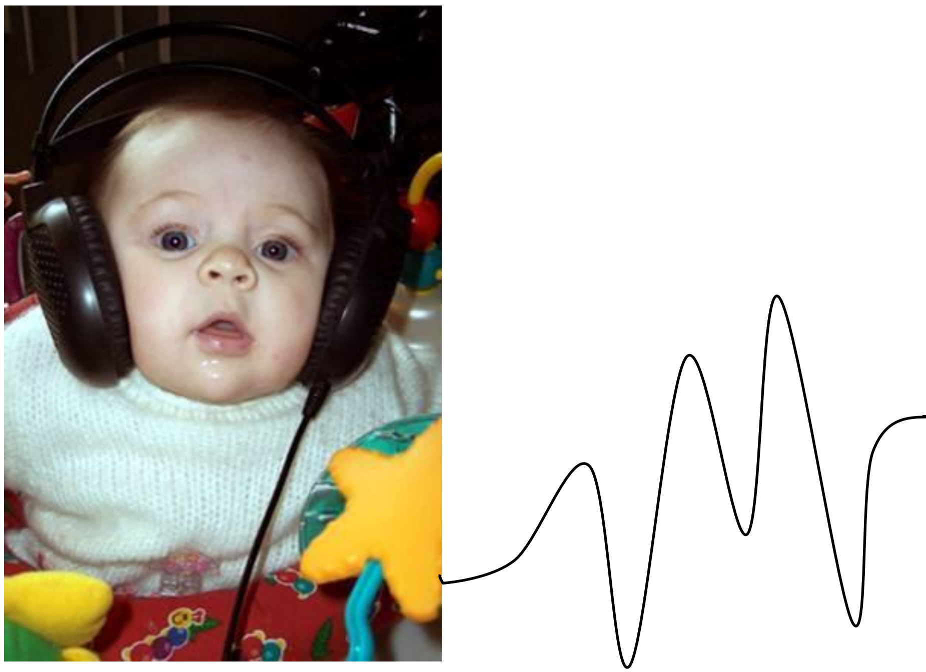
- Isolation
- Mass
- Radiation Efficiency
- Absorption

Low-Frequency

Mid-Frequency

High-Frequency

Failure to implement any ONE of these variables into your design will significantly degrade the overall performance of the system – and sound quality will be compromised.



Course Summary

Summary

- noise is simply ‘unwanted sound’
- low frequencies are treated via isolation techniques
- mid frequencies are treated via mass loading techniques
- high frequencies are treated via absorption techniques
- STC is a single digit rating number derived from the transmission loss test data
  - higher STC values indicate better performance

A wall assembly utilizing an acoustic barrier:

1. achieves higher STC values as compared to other popular wall assemblies
   - due to the heavy mass of the acoustic barrier
   - due to the low radiation efficiency of the acoustic barrier, and
2. is nearly 13% lower in overall cost when compared to damped drywall assemblies of similar STC values.

Conclusion of This Program

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