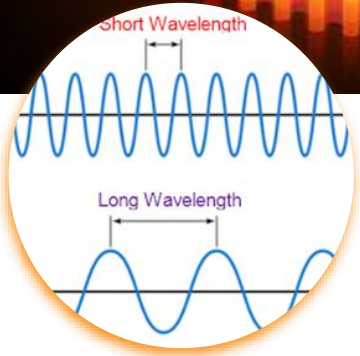
PRODUCT KNOWLEDGE

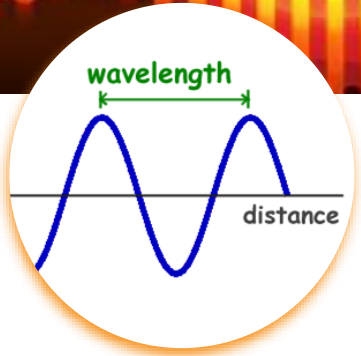
First…

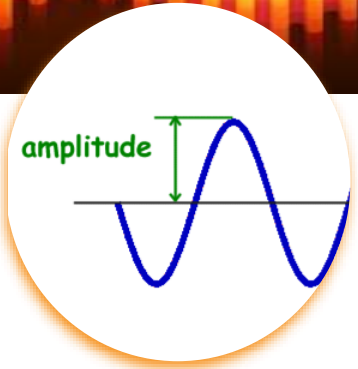
A little about SOUND

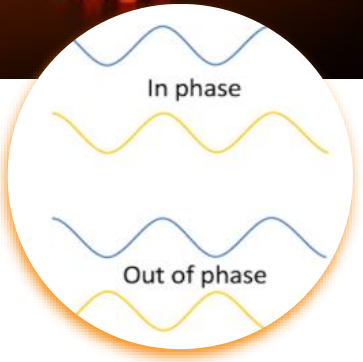
Part 1

BASIC CHARACTERISTICS OF SOUND









FREQUENCY

It is the measurement of waves or vibration (in Hz). It is how high or how low the sound is. A Bass drum, Thunder, Heavy traffic noise, Truck passing by are examples of LOW frequency. A bird chirping, a whistle, a child's voice are examples of HIGH frequency.

High Frequency - Short Wavelength
Low Frequency - Long Wavelength

WAVE LENGTH

It is related to the frequency of the sound waves. The higher the frequency, the shorter the waves. The lower the frequency, the longer the waves.

Low frequency is much more powerful and requires much more effort so it's best to recommend double thick layered blankets. While High frequency will be absorbed easily. Diffusion breaks those waves. It absorbs them and breaks them apart.

AMPLITUDE

The volume of sound in decibels. *Humans and animals sense a wide range of sound amplitude, volume or loudness -- from the very quiet to extremely loud.*

Loudness is measured in decibels, which really measures the energy of the sound.

The loudness of sound depends on the amplitude of the wave.

The bigger the amplitude, the louder the sound.

PHASE

Describes the relationship between 2 waves.Waves that are out of phase can cancel each other

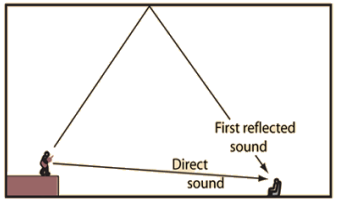
Imagine Hill (Peak) of waves and Valley of waves. When both Hill coincide with each other, waves becomes Higher. When both Valley coincide each other the wave becomes lower. When Hill and Valley coincide, it cancel each other.

"How to control sound reflection in a Voice Over Recording Studio?"

Every flat hard surface reflects the sound, like the bouncing ball from the wall. When you speak, the sound hits the wall and bounces back and gets back to the microphone. It is important to treat the first reflection so that if you speak, the sound is gonna be clearer. If the first reflection goes to the microphone, the recording can be muddy and not recognizable.

Porous materials are sound absorbers. they do not reflect sound. Foam or Fibers (blankets have fibers), Rockwool, Glasswool, those are example of porouse sound absrobers.

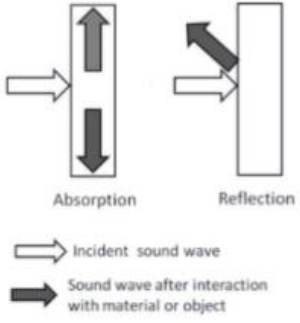
Imagine blowing an air into a bunch of strings, those strings are going to start moving and it will absorb the energy.. So the air motion stops. Because It spends its energy on vibrating all those strings. Same happens to the sound it loses its energy (it transforms to heat energy).



Acoustic foam have "open channels" . When the sound gets into the foam it bounces from one wall to another as it goes through the channels, loosing its energy..

The advantage of the Sound Blankets, it is easy to fix and adjust in the room. If the room is too dead for the artist, you can easily remove the blankets. While the Acoustic foam is glued to the wall.
Blankets are also more durable. Washable.

Reflection



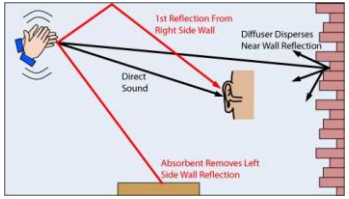
Diffusion

Imagine when you throw a ball in a bookshelf on a wall, or uneven surfaces, you won't know where it would go.

Diffuser is some kind of odd shape hard object. Some is made of wood material, sticking out at different length. Some is made in a special shape or angle.

The idea is that if the reflective surface is not flat, then the sound is going to be reflected in different angles. The Energy of the sound remains the same but it becomes scattered.

Absorption



Direct Sound

It is the sound that goes directly from a sound source (voice actor's mouth) to a microphone.

What is DEAD Room and LIVE Room?

"Dead Room" is where there is no echo at all.

"Live room" is a room with reflective surfaces.

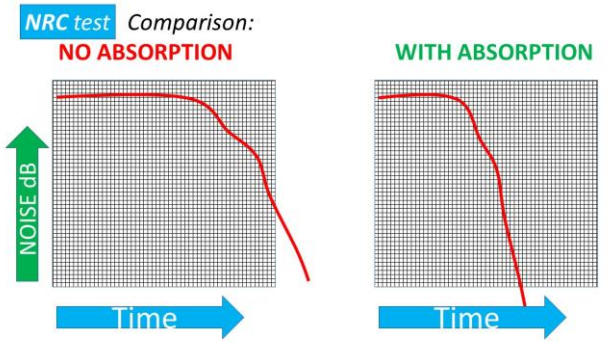
In DEAD room all the walls should be covered with sound absorption material so nothing is reflected back. VOICE Actor wants the room to be as dead as possible. But this is not ideal for Singers/Musicians. SINGERS wants a little bit of a Live Room so it won't sound dull and artificial.

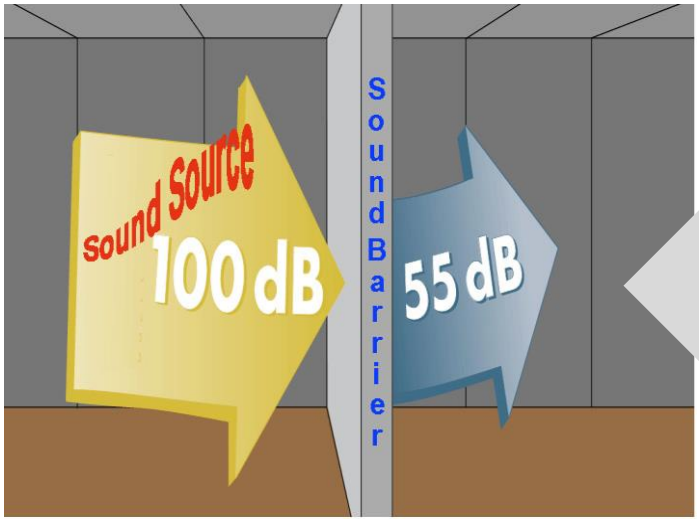
Acoustic Foam vs Acoustic Blankets

What is NRC?

Noise Reduction Coefficient.

NRC is a single number coefficent to measure sound absorptionn efficency of material. To test NRC measures how long it takes for the sound to die out (sound decay).





Sound Transmission Class.

It is a single number indicator of how much sound gets lost as it goes through a barrier. STC is indicator of soundblocking efficiency of a barrier.

What is STC?

Why is it important to treat the room acoustically?

To get clear sounding recordingit is important to have a room, that does not have any interfering sound, such as outside noise or sound reflections.

When actors/musicians try to create a recording studio, they are obsessed with getting the best microphone and software. But the best microphone is more sensitive to the way the room sounds!

Unlike humans, microphones don't have the same ability to select correct sound, they record everything that reaches it's membrane.

Sound reflections coming with a slight delay after direct sound will overlap and will cause the recorded sound to be inaudible.

Professionals pay very close attention to how their room sounds.

PRINCIPLES OF SOUNDPROOFING

Sound energy distributes through a medium such as air, water, steel etc. it transmits by vibrating molecules next to each other.

There is **NO SOUND IN VACUUM**.

But since we do not live in vacuum, to stop sound transmission, one must utilize the following general principles:

MASS - Use heavy materials

AIR-TIGHTNESS - Cover the whole enclosure airtight.

ISOLATION - Separate (decouple) from surrounding structure

and composite layers – use different density and structure materials

Why MASS? ➔ The heavier the barrier the sound has to go through – the more energy is spent on getting the molecules to vibrate, This is why heavy objects block sound better.

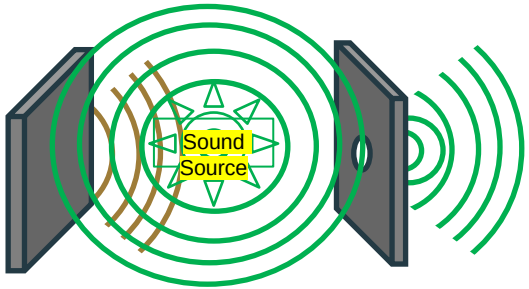
Why AirTight? ➔ Airborne sound is the sound energy that goes through the air – so if there is an opening in a sound barrier – the sound goes through unobstracted.

Why Isolate /Decouple? ➔ because the sound vibrations especialy of low frequency, can also transmit through metal and building structures. Decoupling helps break that connection.

Why Layered structure? ➔ rigid structures tend to resonate when joined together. This is why two barriers with an air gap in between are more efficinet than the same two attached together. Limp barriers, such as Mass Loaded Vynil do not resonate.

MASS

Sound transfers through a medium by vibrating its molecules. It takes more energy to vibrate heavy objects. Therefore the more massive the barrier, the better the sound blocking. Example: Brick is better than Plywood.



AIR-TIGHTNESS

A crack or opening in a sound barrier, creates an easy way for sound to get through. A hole the size of a quarter (about 1 inch diameter) reduces the soundblocking efficiency of a concrete wall by about 75%! If yo can see light passing through a barrier, then the sound can travel through it

FLEXIBILITY

Rigid barriers can vibrate as a sounding board. If attached together they will resonate together. High rigidity of the barrier can cause loss of insulation at certain frequencies due to resonances and coincidence effects.

An air-gap or layer of elastic liner such as loose Mass Loaded Vinyl (MLV) or non-hardening glue, will break the connection and barriers will not resonate.

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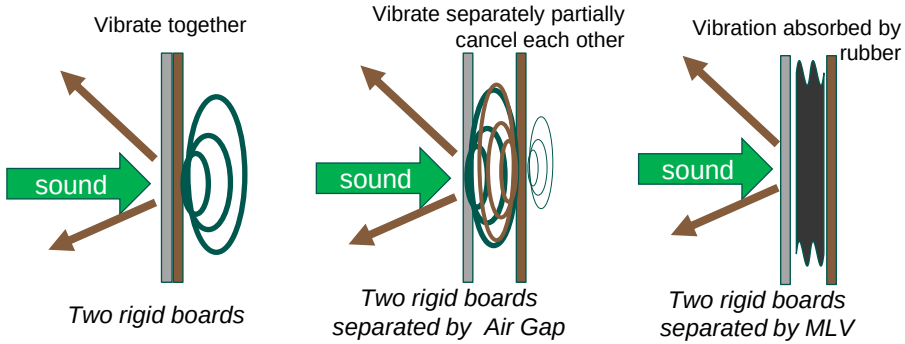

PRINCIPLES OF SOUND-ABSORPTION

POROCITY – Sound Has to get into a material to get absorbed

DENSITY – denser material tend to be more absorbent, except when they are too dense and become reflective. There is a balance.

SURFACE AREA – the more absorption material is in the room – the more sound it will absorb. The larger the surface area for the sound to get in the better

THICKNESS – the thicker the material – the lower frequency it will absorb (it would still absorb the higher frequency sound)

Sound is energy – it distributes by vibrating molecules next to each other. When the sound gets in contact with absorption material it spends its energy by vibrating fibers like in acoustic blankets, or by going through channels like in acoustic foam.

Why POROCITY? ➔ Non-porous materials are reflective.
Why DENSITY? ➔ in fibrous absorbers denser materials have more fibers to agitate, so more energy is spent within the same volume of material.
Why SURFACE AREA? ➔ Larger surface provides more opportunity for the sound to get in, this is why Acoustic foam has egg-shaped form.
Why THICKNESS? ➔ there is absorption correlation between the thickness of absorber and the length of a soundwave. In order to be effective (nearly anechoic) at a given frequency, the material thickness must equal to at least ¼ of a wavelength.

Rule of Thumb: *the lowest frequency that will be effectively absorbed by a porous material has a wavelength of* ***four (4)*** *times the absorbent thickness.*

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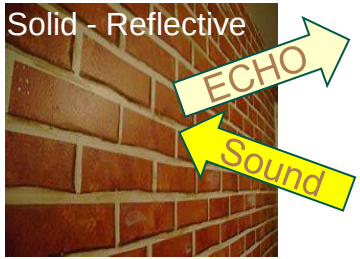

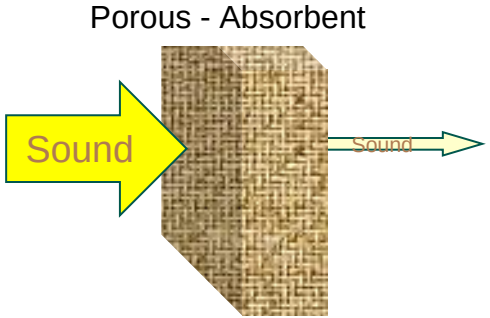

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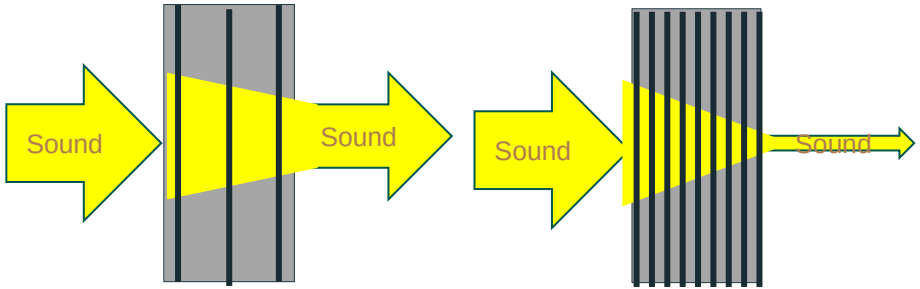

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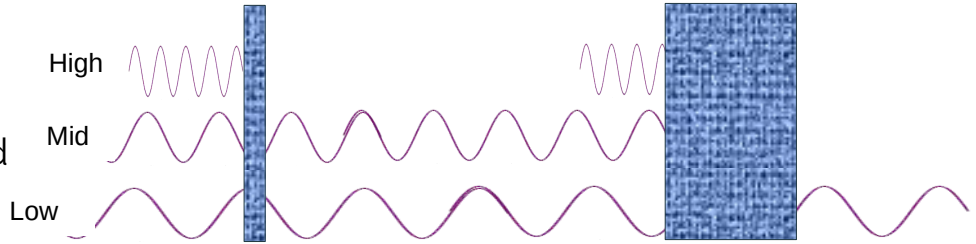

What is LOUD?

PHON is a unit of loudness.

PHON = to the number of decibels of a pure 1,000-hertz tone judged by the listener to be equally loud.

Loudness, in acoustics, attribute of sound that determines the intensity of auditory sensation produced.

The loudness of sound as perceived by human ears is roughly proportional to the logarithm of sound intensity: when the intensity is very small, the sound is not audible; when it is too great, it becomes painful and dangerous to the ear. It is different from person to person

Difference between DECIBEL, PHON and SONE:

The decibel scale is objective in that the intensity is defined physically and any intensity can be compared directly with the physically defined reference point

The phon scale is partially subjective in that the judgment of a listener is involved in comparing any arbitrary sound with the physically defined reference in order to establish its loudness in phons. Phon is an average of a judgement of loudness by many people.

Sone is a third, more-subjective loudness scale. It involves listener judgment as to what constitutes “doubling” of the loudness of a sound. A tone having a loudness of 40 phons is defined as having a subjective loudness of one sone; a tone judged by the listener to be “twice as loud” would have a loudness of two sones, three times as loud would be three sones, and so forth. It determined by the average values from observations by a large number of people.

How loud is too LOUD?

- In general, noise levels below 70 dBA (decibels) are considered safe, Working in the environment with 85dBA for 8 hours requires ear protection.

- Anything above 85 dBA will cause hearing loss. According to the Center for Hearing and Communication, the volume (dBA) and the length of exposure to the sound will tell you how harmful the noise is. The louder the noise, the less time it takes before hearing loss will occur.

For reference:

- 0 decibels is the softest sound a person can hear with normal hearing.
- 10 dBA is regular breathing.
- a normal conversation is 60.

- 110 dBA would include something like shouting in someone's ear;
- 120 decibels rock concert or a Thunder

Correlation between Decibels and sound Energy

Change in dB	Change in sound energy
3 dB increase	sound energy is doubled
3 dB decrease	sound energy is halved
10 dB increase	sound energy is increased by a factor of 10
10 dB decrease	sound energy is decreased by a factor of 10
20 dB increase	sound energy is increased by a factor of 100
20 dB decrease	sound energy is decreased by a factor of 100

Correlation between decibels and Loudness

Decibel Changes, Loudness, and Energy Loss

Sound Level Change	Relative Loudness	Acoustic Energy Loss
0 dBA	Reference	0
-3 dBA	Barely Perceptible Change	50%
-5 dBA	Readily Perceptible Change	67%
-10 dBA	Half as Loud	90%
-20 dBA	1/4 as Loud	99%
-30 dBA	1/8 as Loud	99.9%