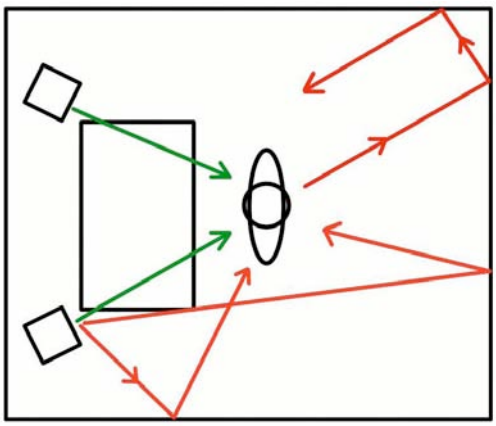
What is room acoustics?



Reverb, reflection and flutter are terms used to describe the way sound bounces off the walls of a room. Sound reflected from the walls of a room arrives at your ears a split second after the direct sound from your speakers, strongly influencing the quality of the sound you hear.

In a normal room around 80 % of the sound you hear is reflected off the walls and ceiling. This 'secondary' sound combines with the direct sound to blur, muddy and distort the original sound.

Reflection is a term used to describe sound that bounces directly off a surface before reaching the listener. **Flutter** (or slap echo) is used to describe short echoes that occur between two parallel surfaces. **Reverb** is the persistence of multi-directional reflected waves reaching the listener and decaying over a period of time.

The aim of treating the acoustics of a room, for the purpose of critical listening, is to absorb some of the sound that doesn't come directly from your speakers, in order to improve the accuracy of what you hear.

It is particularly important that the treatment material absorbs all frequencies evenly. In other words, to create a 'flat' room that does not increase or decrease the perception of particular frequencies. Just as a good pair of monitors should have a flat frequency response, or a good microphone has a flat recording frequency response, a mixing or listening room should also absorb and reflect sound evenly across the spectrum, exhibiting a flat frequency response.

Treating room acoustics across the entire range: 'Avoiding the boom box' effect.

The single most common mistake in home studios (and some professional ones) is to not treat all frequencies effectively. For example mid/high frequency panels (such as the AT600/40) should be used in conjunction with a bass trap or broadband absorber. The characteristics of low frequencies make controlling them effectively the most challenging aspect of treating room acoustics.

A very common scenario is a home studio with all the walls covered with an acoustic treatment like carpet or egg shell foam.

The frequency absorption characteristics of 50mm (or less) acoustic foam will decrease rapidly below 500Hz, leaving the lower frequencies free to reflect and reverberate. A room treated in this way will absorb all the frequencies above 500 Hz (sounding very dead) but with uncontrolled lower frequencies resulting in a 'boomy' sounding room.

Why are listening or recording rooms commonly only treated with thin acoustic foam (50 mm or less)? Mainly because the limited frequency response of thin acoustic foam is not common knowledge. The second reason takes a bit of explanation. The human ear and the way we perceive sound is very sensitive to the acoustics of our environment (psycho-acoustics). We receive many subtle cues from the sounds of our environment that allow us to process and understand our surroundings.

For example, if we were blindfolded and placed in a stair well, we would almost certainly recognise the sound characteristics of that environment. Producers add reverb to tracks to create depth because our brain intuitively understands what reverb decay means. When we walk into a room treated even with thin acoustic panels it still feels radically different from our normal environment. Talking feels strange - the overall effect is dramatic. It is easy to interpret this as good room acoustics.

Unfortunately a room with no control of lower frequencies is a very difficult environment to mix and listen to music in. Low frequency problems due to poor room acoustics are typically not obvious. Sometimes the reason for mudiness is attributed to the performance of the monitors or the recorded source, such as a bass guitar. Low frequency problems in a mixing room also become apparent when a track mixed in this environment is played on another system. The result is a poor balance of low frequencies, or the vocal mixed to loudly to cut through the apparent 'mud'.

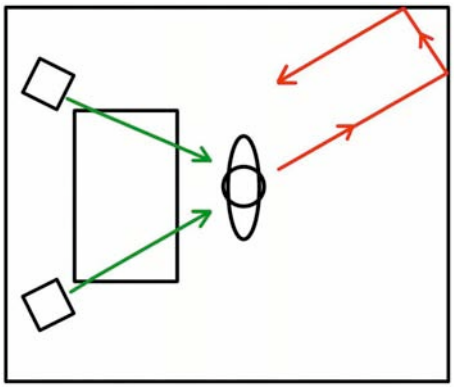
Much of the 'boominess' of this type of room is due to low frequencies forming standing waves (otherwise known as room modes) a situation where sound waves travel backwards and forwards along the same path, between parallel walls. Thin acoustic foam is excellent in dealing with mid and high frequencies but should be used in conjunction low frequency controls, in order to create a 'flat' accurate room.

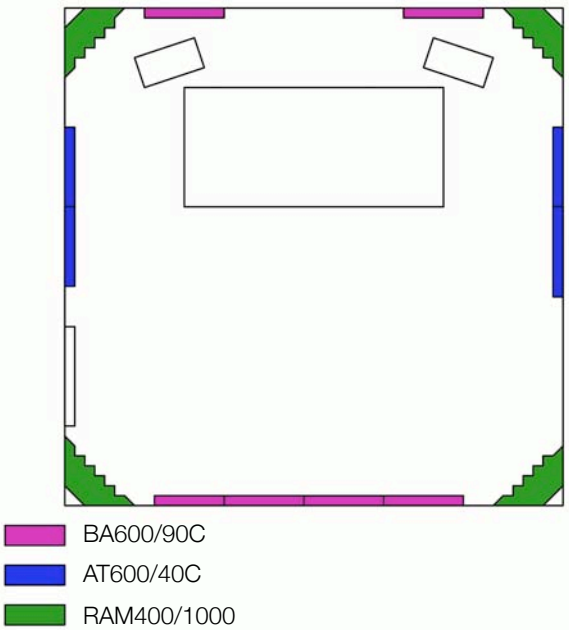
Clearing out the mud: the 200 Hz region.

When mixing a track of multiple instruments and voice there is often an accumulation of frequencies around the 200 Hz region, that begin to make a track muddy. Judicious application of equalisation is generally required to allow the instruments to 'sit' together without losing the 'body' that comes from this area of the audio spectrum. To compound this problem smaller rooms (with parallel walls) will tend to resonate around 200 Hz further confusing the issue. To avoid these problems it is necessary that at least part of room acoustic treatment includes panels capable of absorbing below 200Hz.

Dealing with low frequencies: Bass traps

Corner mounted bass traps (or pressure zone traps) are an effective way of improving room acoustics. In the corners of a room sound pressure is doubled (due to additive reflections). The corners of a room reflect 'out of phase' sound waves back to the listening position, which combine with direct information from the speakers, resulting in degraded sound. Bass traps are placed in the corners and ceilings to reduce this 'pressure zone' effect.





How much acoustic foam is required?

It is rarely necessary to treat all the room surface area. As a general rule about 40 - 50% coverage of surfaces is a good place to start. The process of treating the acoustics of a room is very much an art and a science, and often requires some experimentation. In saying that, it is usually not to difficult to obtain good results. As we have already mentioned, the aim is to absorb all frequencies evenly and deal with any problem frequencies (usually related to room dimensions and parallel walls). It is preferable for the room to retain some 'life' in order to create a pleasant listening environment. A totally dead space is a fairly unpleasant place to be in.

As human beings, to be deprived of information about the acoustic characteristics of our environment (sensory deprivation) makes us feel uncomfortable.

Secondly, a mixing suite should not sound that far removed from the type of environment the music is likely to be played back in.

For example, when mastering a track the aim is to make final decisions that will translate to playback in a multitude of environments, most of them 'live'. A totally dead space is an artificial environment to mix in, usually resulting in over-compensation with equalisation and effects.

The construction of the room, floor coverings and furniture will have an impact on room acoustics, as will the physical dimensions of the room. Acoustic treatment can be applied in a graduated way until you find the right balance.

Treating the acoustics of a small to medium sized room.

1. Acoustic panels should first be installed on surfaces (including ceiling) of the room that reflect directly from your speakers. This is sometimes called the 'mirror test'. If you place a mirror on the wall and can see your speakers (from your listening position), that area should be treated. This will deal with reflection and a considerable amount of reverberation. Broadband absorbers are preferable on the rear wall.

2. Next, bass traps should be placed in all four corners of the room. For a critical listening area the ceiling/wall corners should be treated as well. If space allows use larger bass traps.

3. Panels should be installed behind the monitors (preferably broadband absorbers).

3. If additional control of mid/high reverberation is required install more panels evenly around the room. Occasionally more than 50 % coverage may be required.

4. Some rooms will exhibit persistent low frequency problems related to the shape and dimensions of the room. To deal with persistent low frequency problems the RAM400/1000 bass trap can be installed as a panel array. This forms a 180mm thick layer of acoustic foam.