Intro to Acoustics

...transmission of sound

Sound Surface Interaction

a. Transmission
b. Absorption
c. Reflection
d. Diffusion

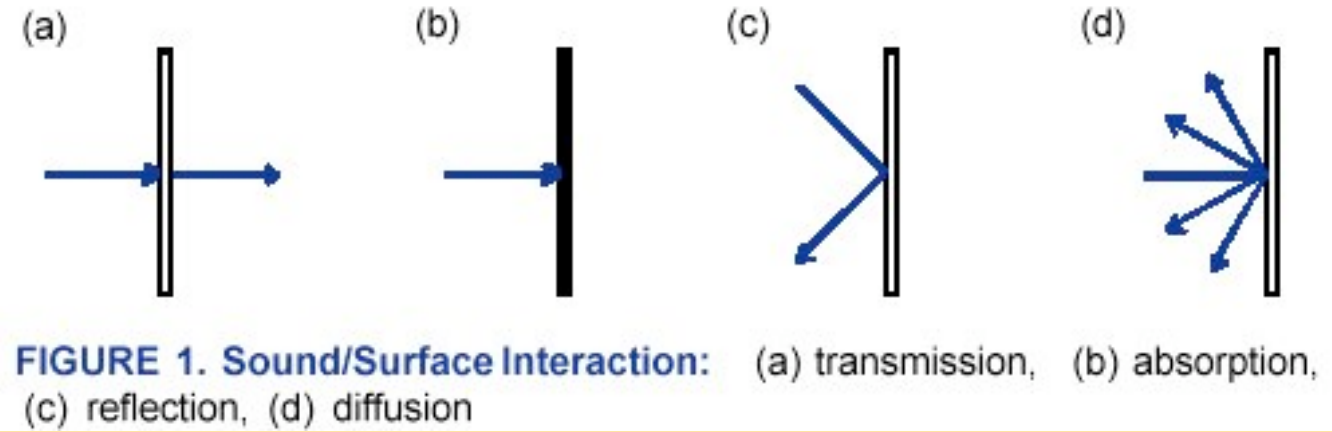
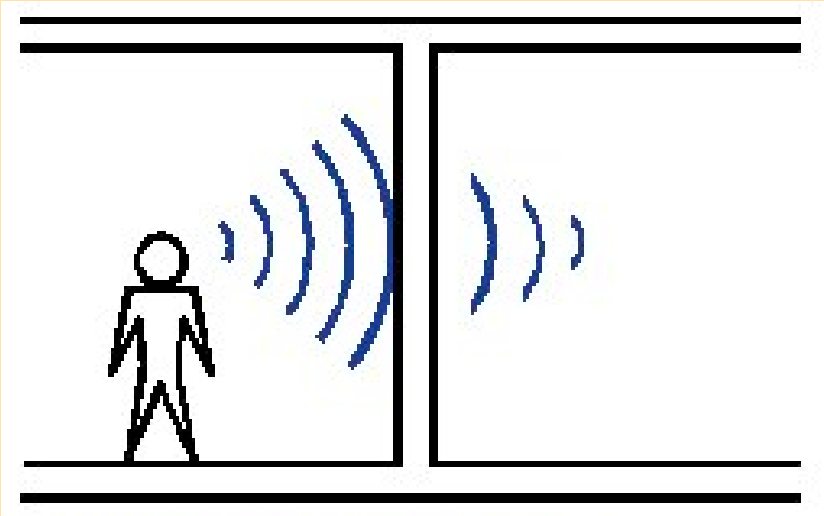


FIGURE 1. Sound/Surface Interaction: (a) transmission, (b) absorption, (c) reflection, (d) diffusion

Sound Transmission

3 factors

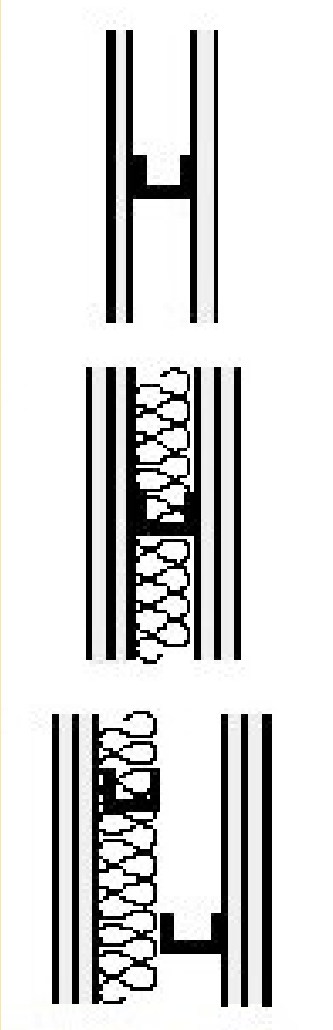


1. Air Flow
2. Barrier Mass
3. Absorption

Sound Transmission

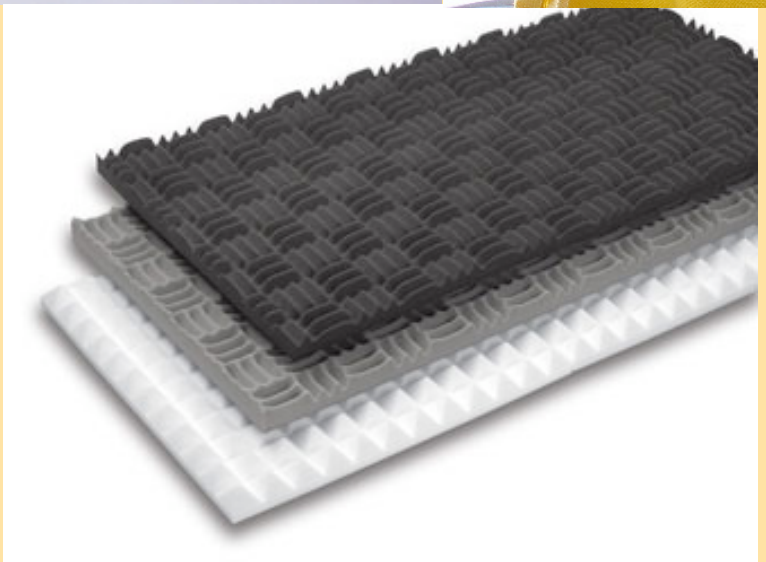
So if we want to stop transmission of sound we must...

1. Stop the air flow - air tight barriers
2. Stop vibration - mass
3. Absorb vibration - material



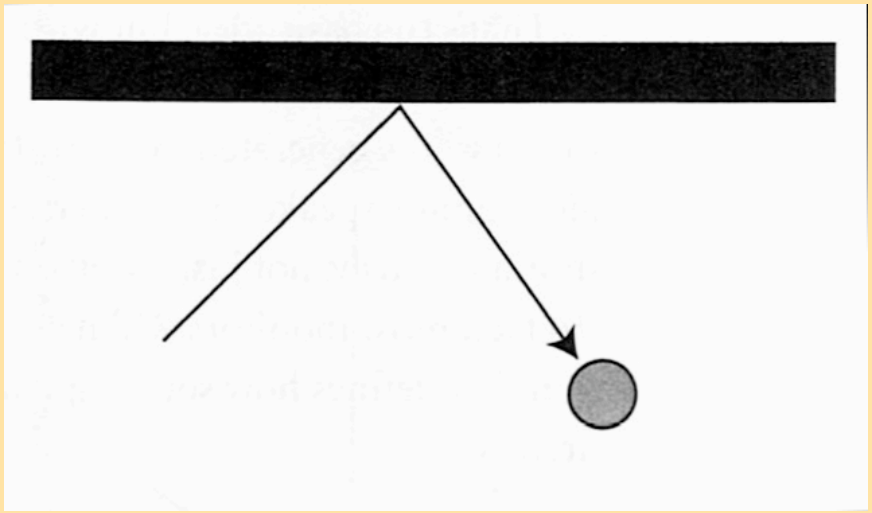
Sound Absorption

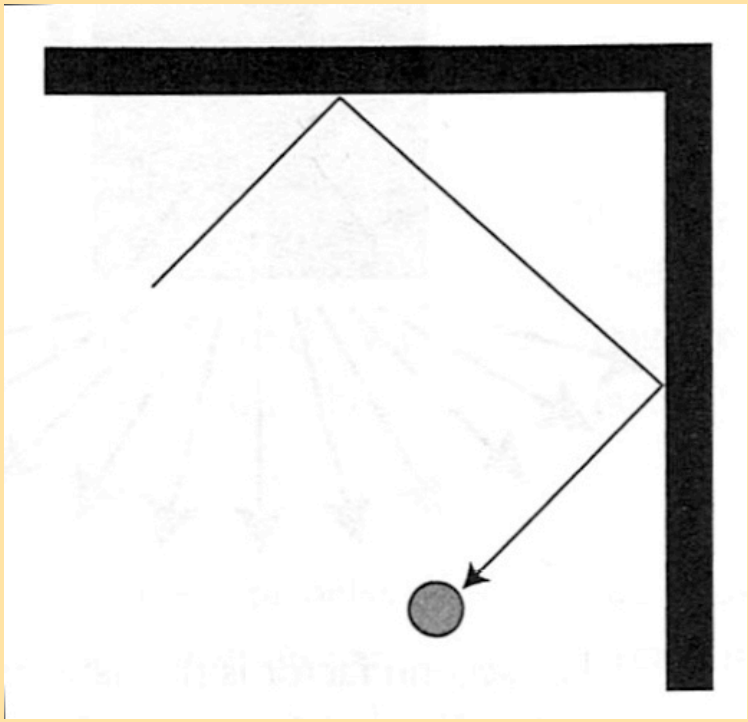
- Sound wave passes through absorptive material and it's energy is turned into heat



Sound Reflection

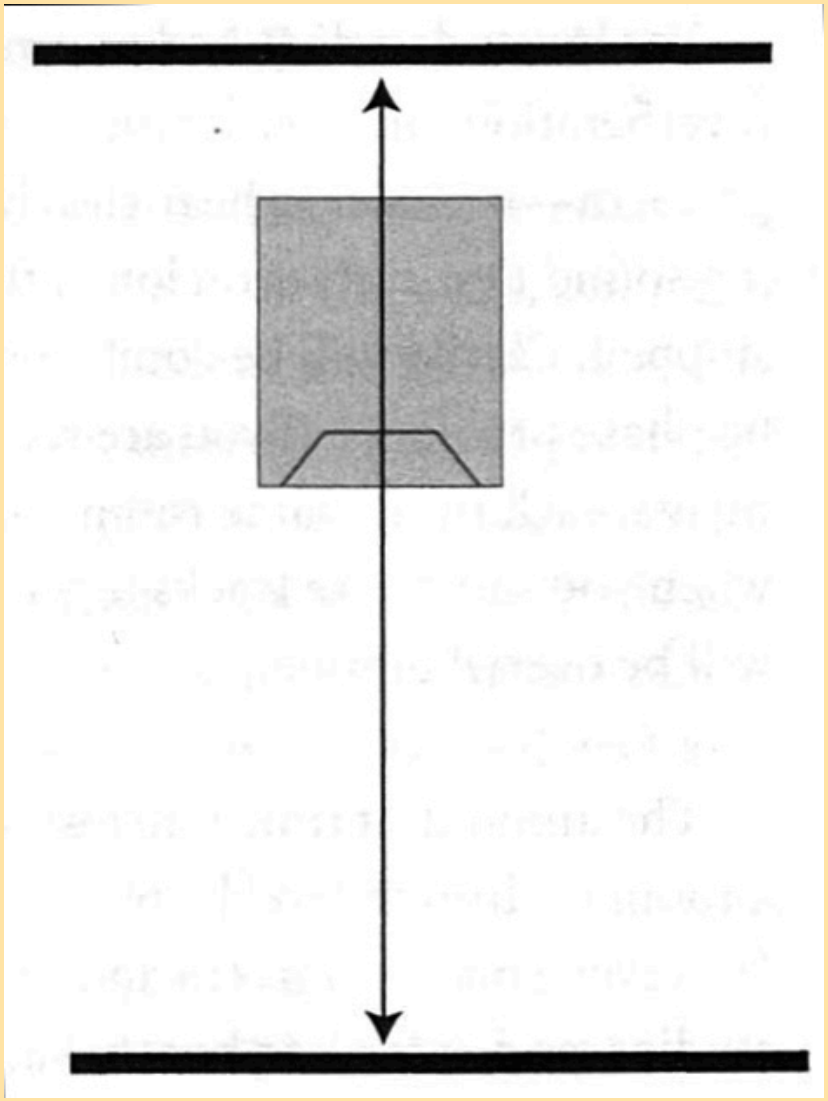
- Sound bounces off of reflective surfaces





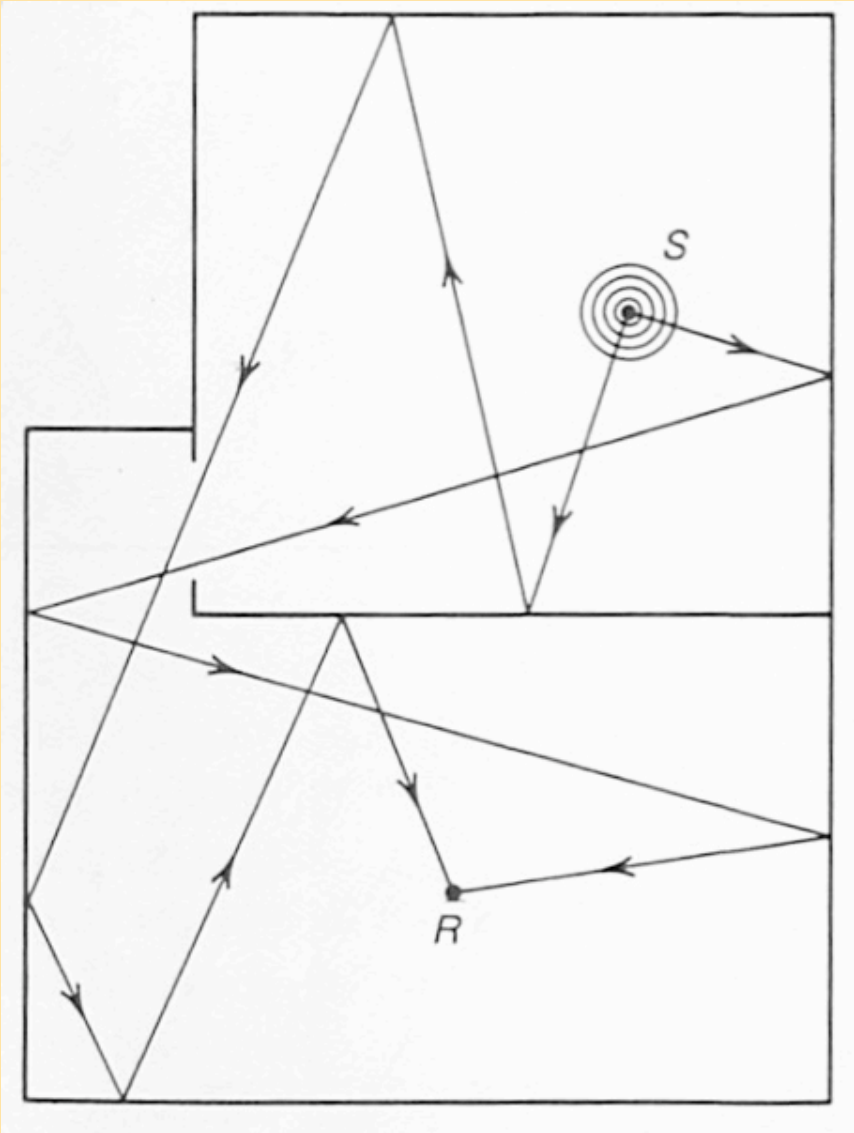
Sound Reflection

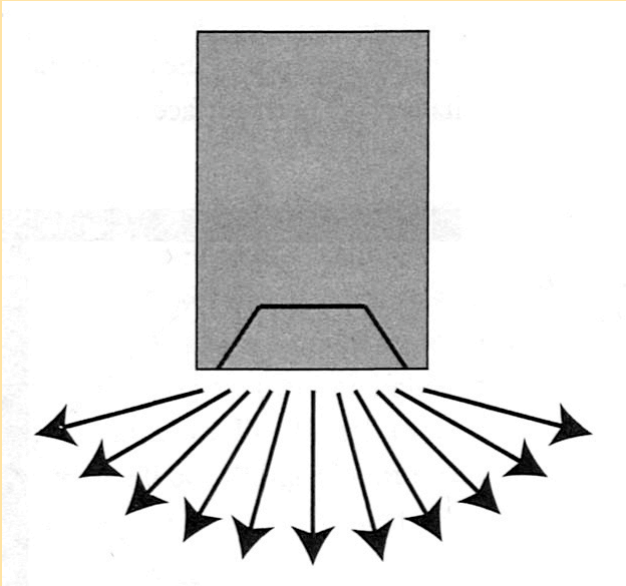
- Flutter Echo



Sound Reflection

- Reverberation

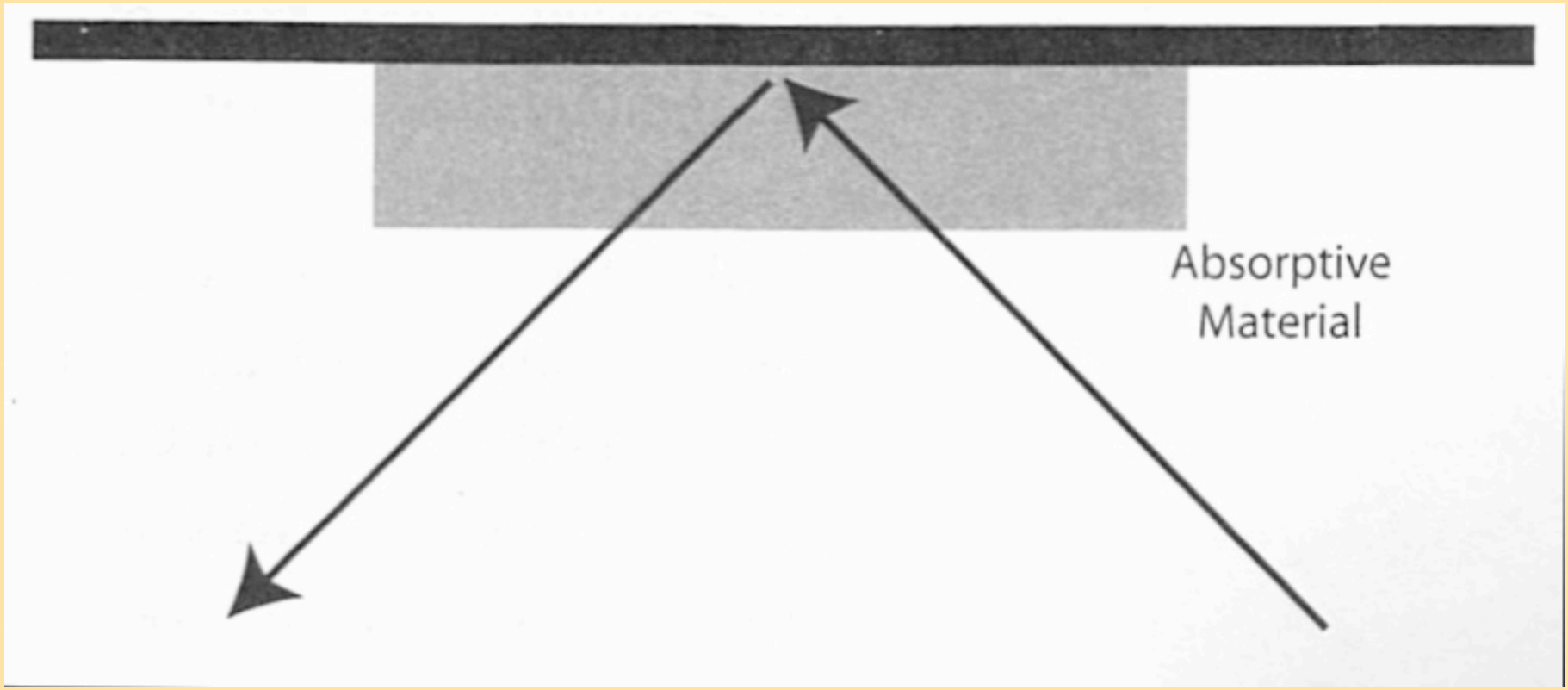




...remember how sound resonates

Sound Reflection

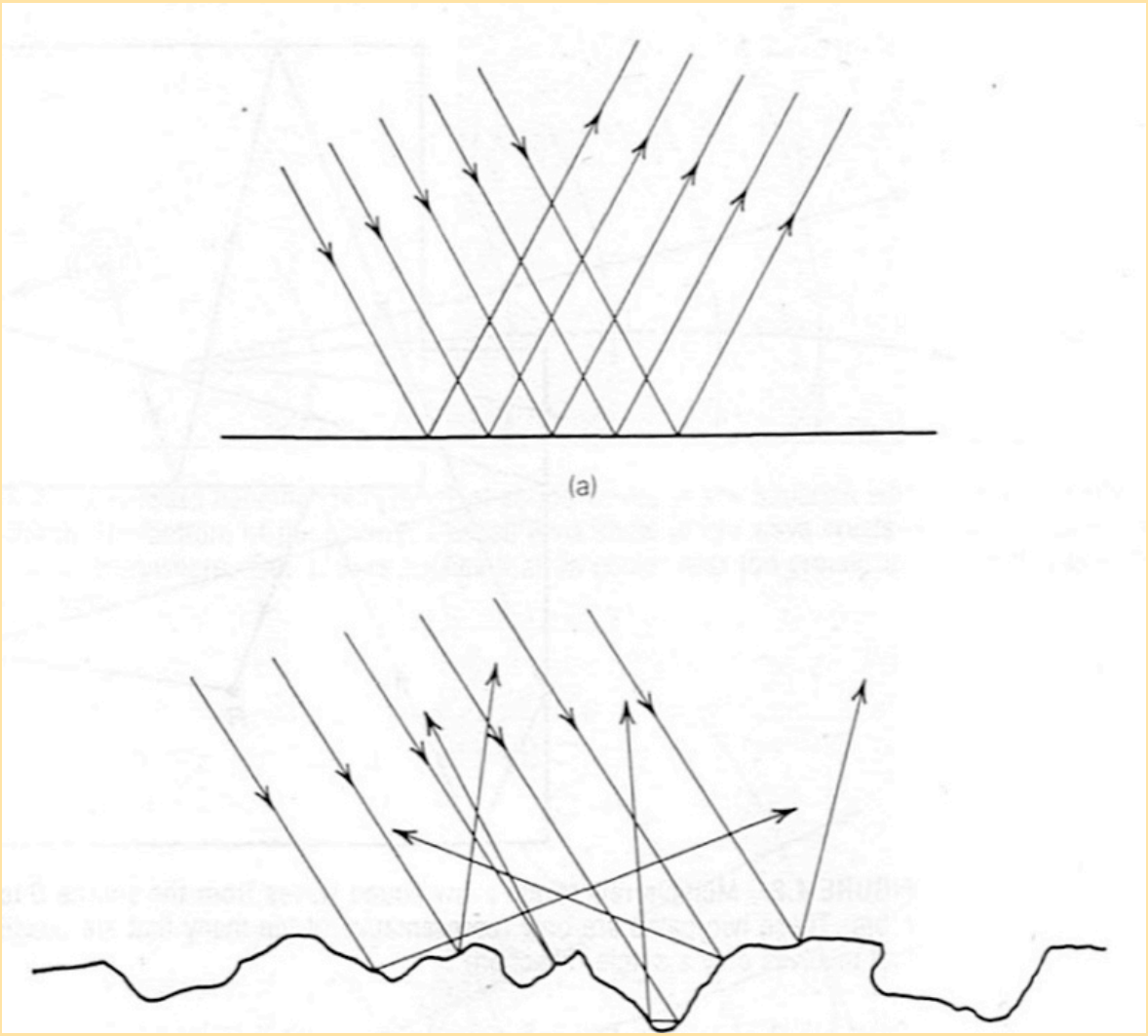
- Why do I care?
- How do I deal?



...absorptive material reduces reflection

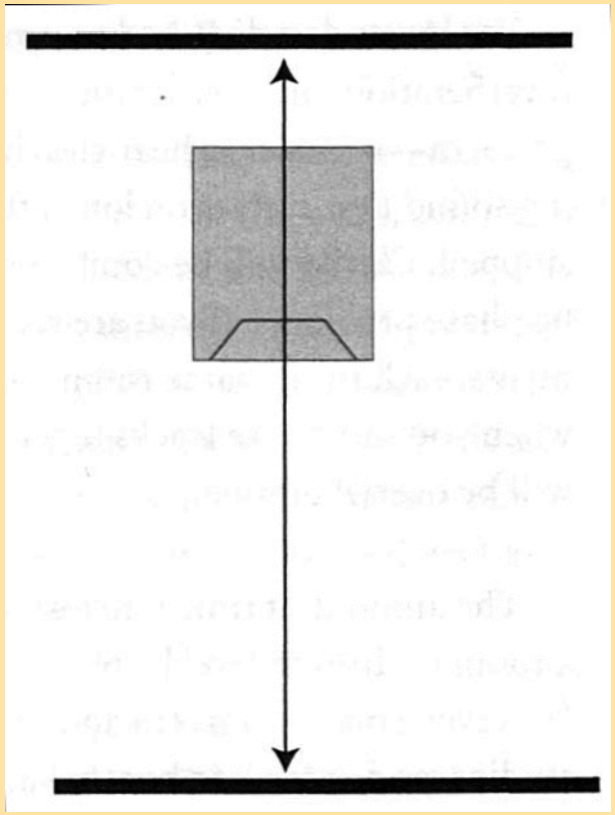
Sound Diffusion

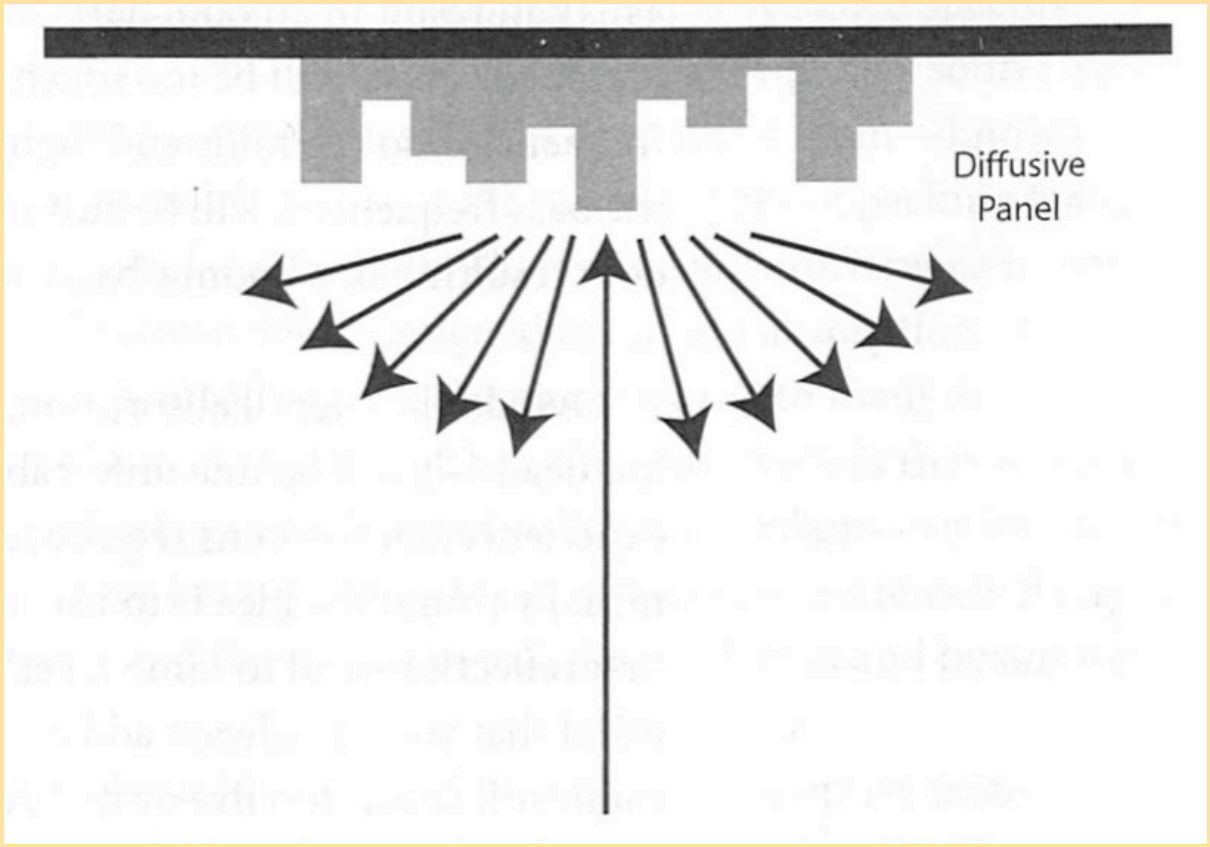
- Reorganization of sound wave propagation using wall angles or randomized surfaces

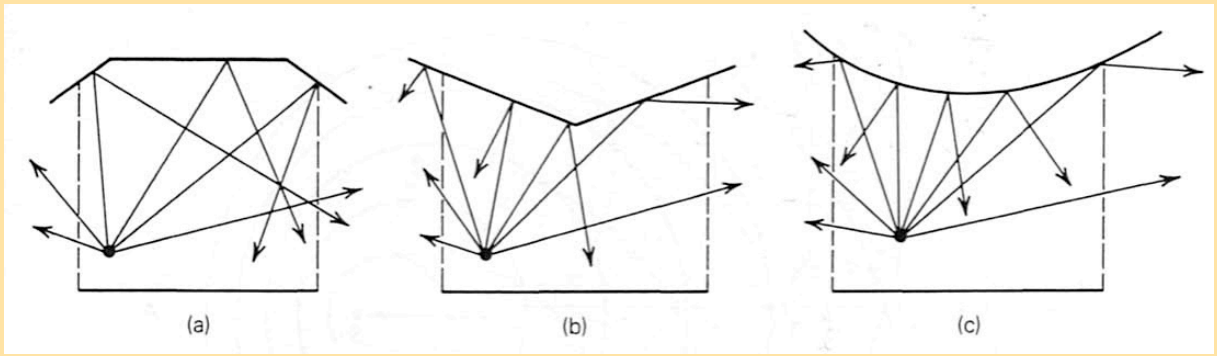


Sound Diffusion

- Why?
- How?







...the Low-Down

"standing waves"

- Inside a room , low-frequency sound waves reflect between walls and create "standing waves."
- A "standing wave" (otherwise known as a "room mode") creates a resonance or boost in a particular frequency.
- Sound at specified Hz bounces back in forth with little loss of energy.

...the Low-Down

"standing waves"

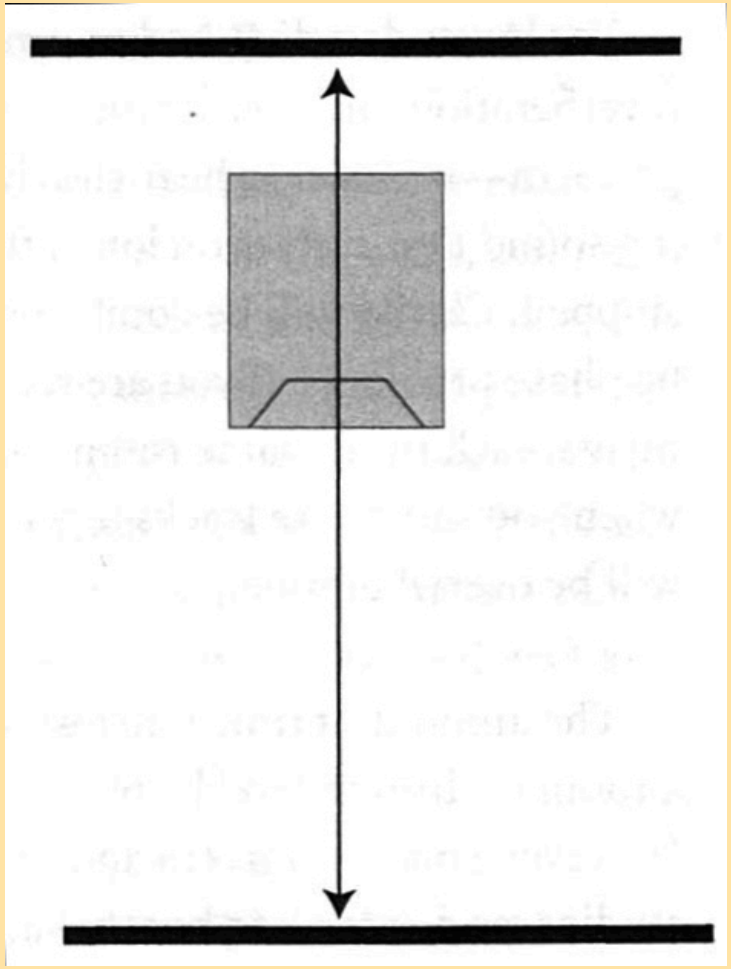
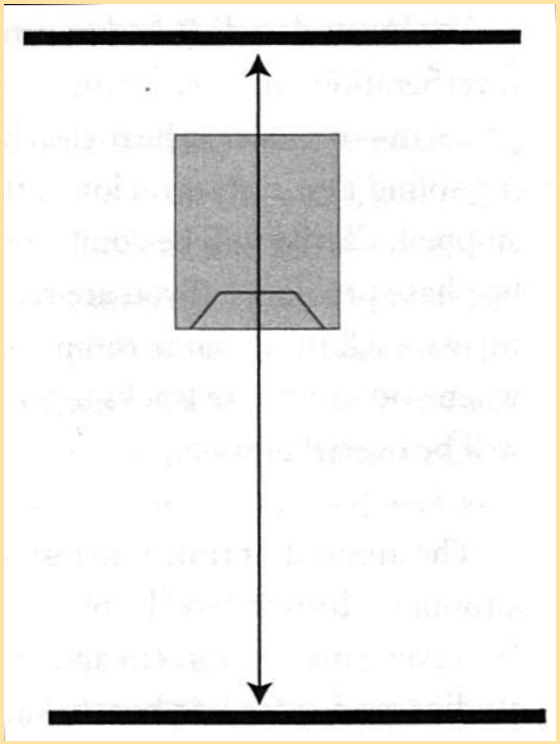


Table 1.1 Frequency versus Wavelength

Frequency	Wavelength
20 Hz	56.3 feet
60 Hz	18.8 feet
100 Hz	11.3 feet
160 Hz	7.0 feet
320 Hz	3.5 feet
500 Hz	2.3 feet
1 kHz	1.1 feet
2.5 kHz	5.4 inches
5 kHz	2.7 inches
10 kHz	1.4 inches
20 kHz	0.7 inches

...the Low-Down

"standing waves"



- Multiple Modes
- Axial Mode
- Hz = 1130 (ft/sec) / 2x Room Width

Standing Waves

- Why do I care?
- What is the solution?

"Bass Traps" absorb and prevent the vibration of standing waves.

Review...

- Sound - Surface Interaction
  - Transmission (3 factors)
  - Absorption (materials and uses)
  - Reflection (echo and reverberation)
  - Diffusion (surface types)
- Standing Waves (Room Mode)
- Bass Traps