Don’t listen to this

Acoustics, privacy and the workplace...
...it's not a concert hall, why worry?

- Confidential discussions:
  - Counseling
  - Personnel issues
  - Family/private conversations

- Business secrets
  - Deals in the works
  - Proprietary technology or processes
  - Confidential customer data
Sound is energy

- Measured in tenths of “bels”
  - A ratio of two power quantities to two field quantities…its a proportion

- A decibel (dB) is one tenth of a bel (B), i.e. 1B = 10dB. The bel is the logarithm of the ratio between two power quantities of 10:1, and between two field quantities in the ratio.[14] A field quantity is a quantity such as voltage, current, sound pressure, electric field strength, velocity and charge density, the square of which in linear systems is proportional to power.
Energy moves molecules

- An ultrasonically welded shoe (upper)
- An LRAD Long Range Acoustic Device (hurts you before it melts you...)

![Image of an orange shoe and an LRAD device]
People and Sound
mechanical, fluid, electrical transmission

Sound energy moves air molecules in waves towards your ear.

The eardrum membrane is vibrated by these waves.

The anvil and stirrup bones move fluid in your inner ear.

The minute hairs in your inner ear flex with the sound, transmitting an electrical signal to your brain.

• Normal conversation: 60 dB
• Lawn mower: 90 dB
• Threshold of pain: 130 dB, depending on the person's tolerance
• LRAD maximum continuous volume: 162dB
How loud am I talking?

<table>
<thead>
<tr>
<th>Distance (feet)</th>
<th>Distance (m)</th>
<th>Voice Level (dB)</th>
<th>Normal</th>
<th>Raised</th>
<th>Very Loud</th>
<th>Shouting</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0.3</td>
<td></td>
<td>70</td>
<td>76</td>
<td>82</td>
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<tr>
<td>3</td>
<td>0.9</td>
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<td>60</td>
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<td>6</td>
<td>1.8</td>
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<tr>
<td>12</td>
<td>3.7</td>
<td></td>
<td>48</td>
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<td>24</td>
<td>7.3</td>
<td></td>
<td>42</td>
<td>48</td>
<td>54</td>
<td>60</td>
</tr>
</tbody>
</table>
Sound and construction...
STC, Sound Transmission Class

- It’s a measure of attenuation (reduction) of sound.
- Our industry uses it as a measure of sound attenuation across a partition or wall... and it’s an imperfect measure.
- It’s only measured between 125 hz and 4000 hz.
- So it leaves out a lot of low frequency sound (mechanical equipment, music, …).
- But it’s about all we have to compare construction.
What does STC mean to us?

STC... What can be heard

25  Normal speech can be understood quite easily and distinctly through wall
30  Loud speech can be understood fairly well, normal speech heard but not understood
35  Loud speech audible but not intelligible
40  **Onset of "privacy"**
42  Loud speech audible as a murmur
45  Loud speech not audible; 90% of statistical population not annoyed
50  Very loud sounds such as musical instruments or a stereo can be faintly heard; 99% of population not annoyed. *(minimum required for party walls, floors by IBC code)*
60+  Superior soundproofing; most sounds inaudible
Paper thin!

- ½” gwb each side of 2x4
- No insulation
- No suspension system
- No perimeter sealants
- Electrical boxes in same stud space

STC 33 Loud speech can be understood fairly well, normal speech heard but not understood
Thicker Paper!

- ½” gwb each side of 2x4
- R-13 fiberglass insulation
- No suspension system
- No perimeter sealants
- Electrical boxes in same stud space

STC 39 Loud speech audible but not intelligible
Mass Helps

- 4” CMU (concrete masonry unit)
- No insulation
- No suspension system
- No perimeter sealants
- Electrical boxes compromise integrity

STC 44 Onset of “privacy,” Loud speech audible as a murmur
Even Sheetrock Mass

- **2 layers!** ½” gwb each side of 2x4
- R-13 fiberglass insulation
- No suspension system
- No perimeter sealants
- Electrical boxes in same stud space

STC 45 Onset of “privacy,” Loud speech audible as a murmur
CMU + Sheetrock = low annoyance!

- ½" gwb **one** side of 6" cmu
- **Paint** both sides
- No insulation
- No suspension system
- No perimeter sealants
- Electrical boxes in same stud space

STC 46 Loud speech not audible; 90% of statistical population not annoyed
…can’t hear you...you’re not transmitting...

- Two 2x4 staggered stud walls on plates 1” apart
- Two layers ½” gwbi each side of staggered studs
- Paint both sides
- fiberglass insulation
- No suspension system
- Perimeter acoustical sealant
- Stagger Electrical boxes

STC 55 Very loud sounds such as musical instruments or a stereo can be faintly heard; 99% of population not annoyed.
...can’t hear you...you’re not transmitting...

* Two 2x4 staggered stud walls on plates 1” apart
* **Two layers** ½” gwb each side of staggered studs
* **Paint** both sides
* **Two layers** fiberglass insulation
* No suspension system
* **Perimeter** acoustical sealant
* **Stagger** Electrical boxes

STC 55 Very loud sounds such as musical instruments or a stereo can be faintly heard; 99% of population not annoyed.
For an even better wall... add suspenders
USG RC-1 Channel

- Floats the GWB away from the stud
- Prevents direct sound conduction
- Requires flexible acoustical sealant at GWB edges
Significant improvements

- Isolating the GWB from the stud makes it harder for sound that’s vibrating the GWB to begin moving the air molecules on the opposite side of the wall...no eardrum membrane = no hearing
A great wall is only as good as its edges

- Sound leaks
  - Over the wall where the ceiling runs across it
  - Through the wall at electrical outlets
    - Pipes passing through wall
  - Around the wall where ductwork serving adjacent spaces
  - Around its edges where it meets other materials and structure
Seal the edges

Acoustical sealant...always stays flexible
M. David Egan, the master of acoustics...buy this book!

"Architectural Acoustics"