

## WEBINAR REPORT

# ARCHITECTURAL ACOUSTICS

## HOW TO KEEP AN EAR OUT FOR IT



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## WHEN YOU THINK OF IT

- Feel Good
- Speech Intelligibility
- Warmth
- Speech Privacy
- Low Background Noise
- Productive/Healing Environment
- Norms Compliance
- Time and Cost Benefits



## WHEN YOU DON'T THINK OF IT

- NIHL
- Lack of engagement
- Lack of productivity
- Physical Strain/Elevated heart rate
- Quality of living
- S – T – R – E – S – S /Auditory Fatigue
- Retrofits and Rework
- Point of Diminishing Returns on Trials

# FUNDAMENTALS

## ACOUSTIC TERMS

1. Reverberation

2. Background Noise

3. Sound Insulation

4. Speech Intelligibility

5. Speech Privacy/Crosstalk

6. Room Modes

7. Impact Sound

## PLAIN ENGLISH

1. Too much echo/Too dead

2. Machine noise from reprographics/ pantry area, UPS/Server rooms/AHUs/traffic noise intrusion

3. Stopping sound from going across a partition

4. How much of the words one can understand in the given electroacoustic system, with given background noise and reverberation conditions

5. Speech audible through ducts/ partitions/ doors

6. Boom!

7. Sound of anything falling on the ceiling above you, or through chase walls

# TYPICAL ISSUES

## Homes

- Party Areas – high noise floor
- Home Theater- room modes, optimum reverberation
- Bedrooms /Meditation Rooms – Low background noise



## Educational

- Background Noise
- Media Rooms/Classrooms - Reverberation
- Auditoria – Speech Intelligibility
- Traffic noise intrusion control

## • Commercial

- Pubs, Lounges, Restaurants
  - Soundproofing
  - Optimum Reverberation
  - Background Noise Levels
- Malls
  - Event Areas
  - Kids Play Areas(!)

# TYPICAL ISSUES

- **Industrial**
  - Noise Isolation
  - Vibration Isolation
  - Optimum Reverberation
  - Speech Masking
- **Hospitality**
  - Look for High Privacy Zones
  - Check for Traffic Noise Intrusion
  - Impact Insulation of floor /Chase Walls
- **Airports/Metro Stations**
  - Speech Intelligibility
- **Religious Spaces**
  - Optimize for music and speech
  - Speech Intelligibility
- **Multi-Zone**
  - Gyms – Impact Sound
  - Clubhouses – Squash Courts /Theater



- **Corporate Spaces /Co-working Spaces**
  - Cross Talk
  - Background Noise
  - Leaky Rooms
  - Of Restrooms and Meeting Rooms – The Well Effect

# WHAT CAN YOU DO WITH SOUND ENERGY?

## ABSORB

- Dissipates as heat in porous material
- Absorptive materials do very little to block sound

## REFLECT

- Concrete/Gypsum/Glass are reflective
- Undulating surfaces are usually good for acoustics.

## SCATTER

- Use Uneven/Slanted surfaces
- Curved walls = focus sound = NO!

## TRANSMIT OR BLOCK

- Concrete walls are the best, but there's a limiting factor. Partition assemblies should be carefully designed.
- These are sometimes required to decouple partitions when high level of soundproofing is desired.

# 1. REVERBERATION

## ACOUSTIC TERMS

- Amount of time the sound energy takes to die out
- Early reflections = good clarity, late reflections = confusion
- RT 60, NRC

## GRAPHS, NOT NUMBERS.

Most numbers in acoustics correspond to or represent a curve or a graph line that spans over a band of frequencies.

## MOUNTING MAKES A DIFFERENCE

Absorption coefficients vary when materials are mounted at varying distances from fully reflective surfaces.

	125	250	500	1000	2000	4000
Brick	0.02	0.02	0.03	0.03	0.04	0.06
painted brick or concrete	0.01	0.01	0.01	0.02	0.02	0.02
$\frac{3}{8}$ " carpet on concrete	0.01	0.02	0.04	0.07	0.15	0.29
$\frac{3}{4}$ " carpet or carpet + pad on concrete	0.02	0.04	0.07	0.15	0.29	0.58
$\frac{3}{4}$ " carpet or carpet + pad on wood	0.16	0.12	0.13	0.18	0.32	0.61
concrete block new unpainted	0.5	0.45	0.42	0.41	0.29	0.25
concrete block painted 1-2 coats	0.22	0.12	0.08	0.09	0.09	0.08
plaster	0.03	0.02	0.02	0.04	0.06	0.07
stained glass windows	0.24	0.09	0.07	0.06	0.05	0.03
drywall	0.22	0.1	0.05	0.04	0.05	0.08
light drapes	0.05	0.15	0.25	0.45	0.5	0.5
thick drapes	0.15	0.25	0.45	0.5	0.55	0.6
audience summer	2.4	3.4	3.8	4.2	4.5	4.2
audience winter	4.2	4.8	5	5.8	6.1	6.3
pew cushion bottom only per linear foot	0.4	0.65	0.8	0.86	0.86	0.8
pew cushion bottom and back	0.8	1.2	1.5	1.6	1.7	1.5
wood seating per person empty	0.68	0.55	0.47	0.32	0.28	0.24

## 2. BACKGROUND NOISE

- MEP Equipment noise
- Xerox/ Printers
- Coffee machines
- Road noise
- Fans!
- Noise from recreation rooms

## 3. SOUND INSULATION

- Masonry /Gypsum/ heavy boards  
/Ideally not wood.
- Real life is not a lab, field performance is lower
- SRI/STC are often mistaken for 'decibels' that are blocked across a partition. There's a correlation but these are not the same.
- Graphs, not single numbers

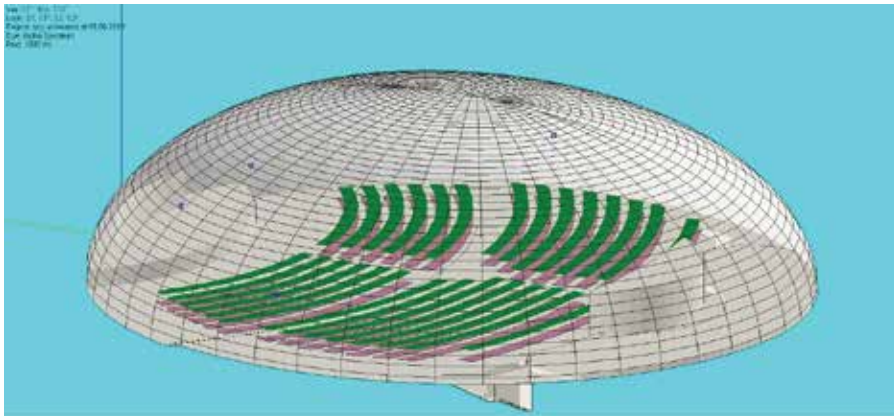
## 4. PRIVACY/CROSSTALK ISSUES

- Shared ducts, air gaps around doors
- Good quality seals, good rebated doors, quantified amounts of duct lining will help.



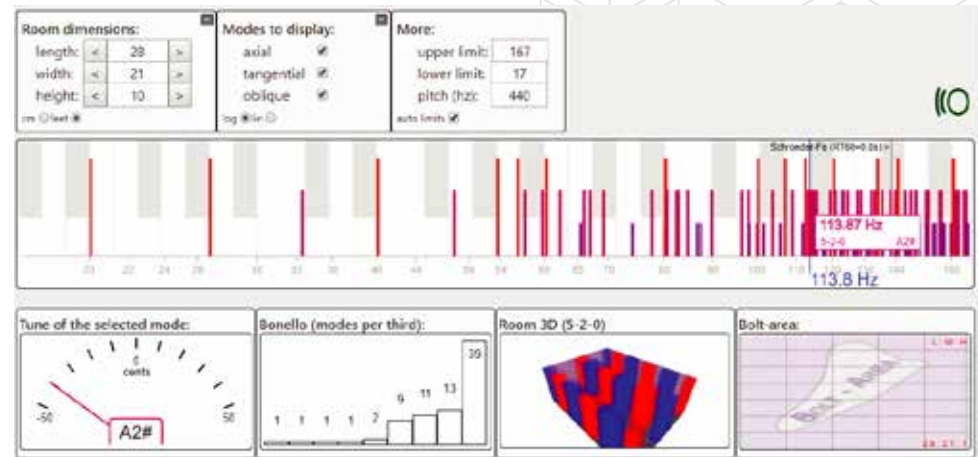
## 5. SPEECH INTELLIGIBILITY

- Depends on background noise levels, quality of audio system and reverberation properties of a space.
- Lives have depended on it especially when broadcasting evacuation messages



## 6. ROOM MODES

- Only a problem in small rooms/home theaters/ Studios/ practice rooms
- Bass booms are scattered around the room.



## IMPACT SOUND

- Structural decoupling is the only way.
- Carpets help a lot.



# THANK YOU!

Any queries?

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