

# “Green” Strategies for Noise Control

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# Unique Perspectives

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- Noise control at the source
  - ✓ Reduce space req'd for equipment
  - ✓ Reduce energy consumption
  - ✓ Reduce amount of materials
- Sound absorption measurements
  - ✓ Reduce amount of materials
- Perception (sound quality)
  - ✓ Reduce complexity of assemblies
  - ✓ Reduce amount of materials

# Noise Control at the Source

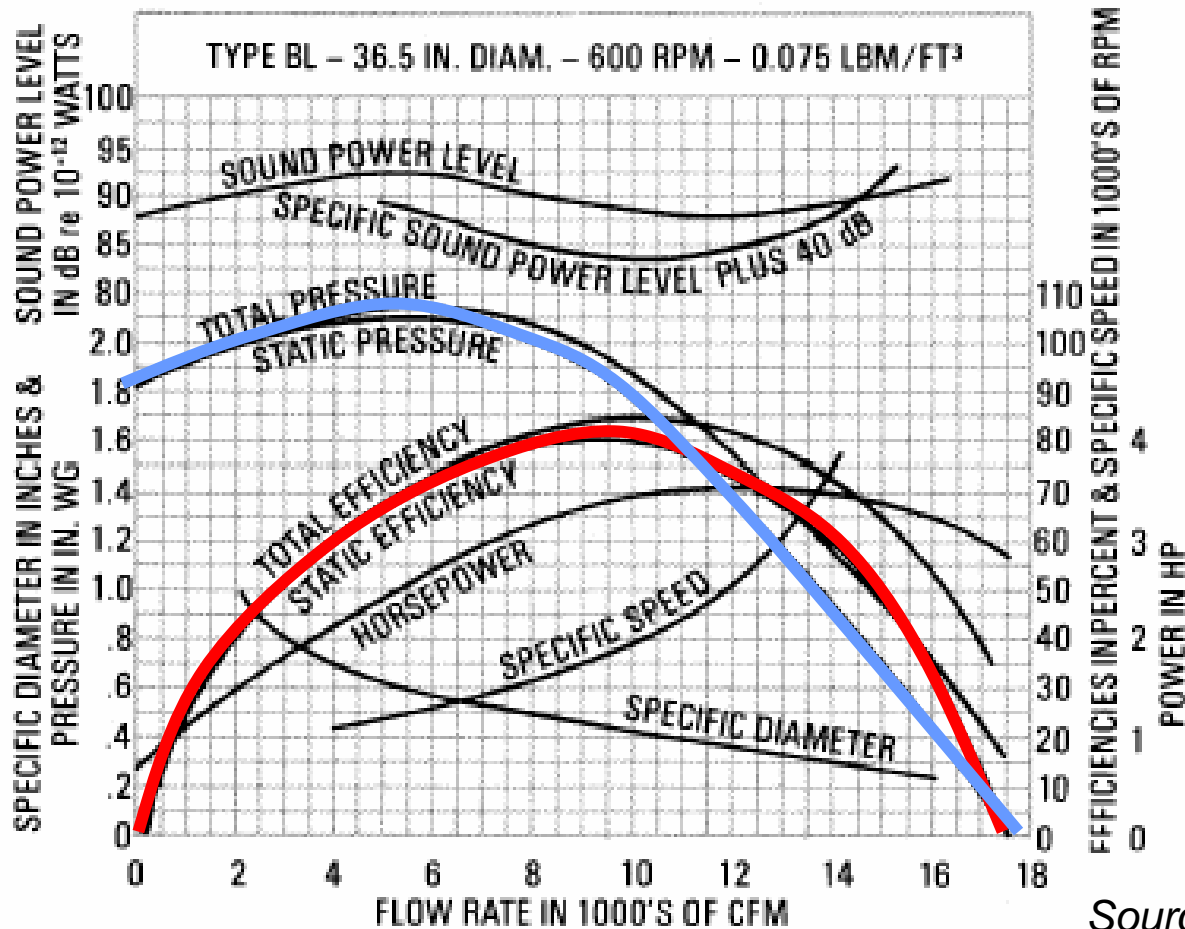
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- Applies to all mechanical equipment
- HVAC Blower

$$L_{PA} = K_{WA} + 10 \times \log(QP_s^2) + \text{Efficiency} + \text{Sys} + \text{Room}$$

- ✓ Select quiet fan type
- ✓ Select for maximum static efficiency operation
- ✓ Minimize pressure drop
- ✓ Avoid poor inlet conditions
- ✓ Avoid poor exit ductwork arrangements

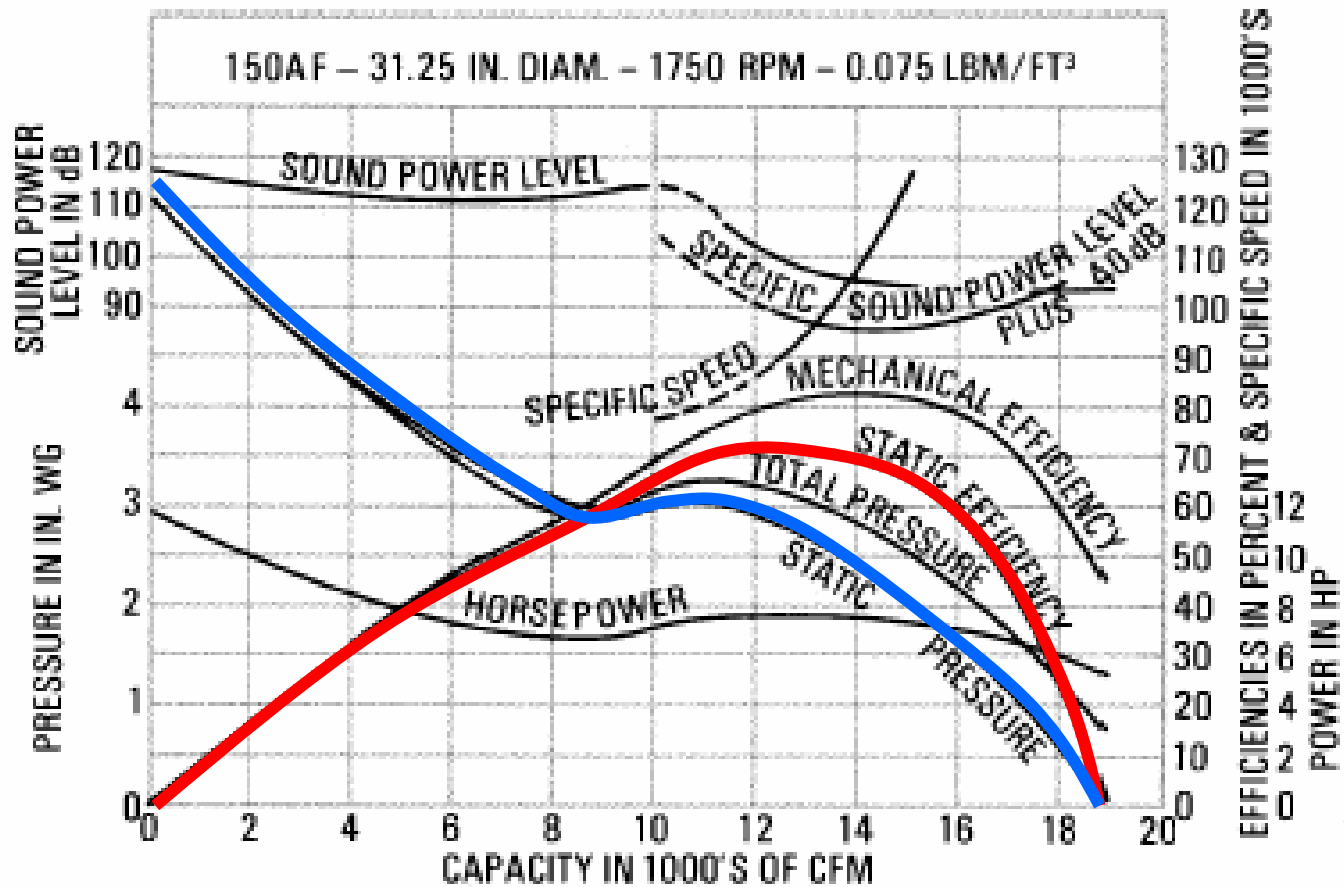
# Typical Fan Curve Shapes for Centrifugal Fans



Source: Fan Engineering

Figure 16.1 Typical Constant Speed Performance Curves for Centrifugal Fans

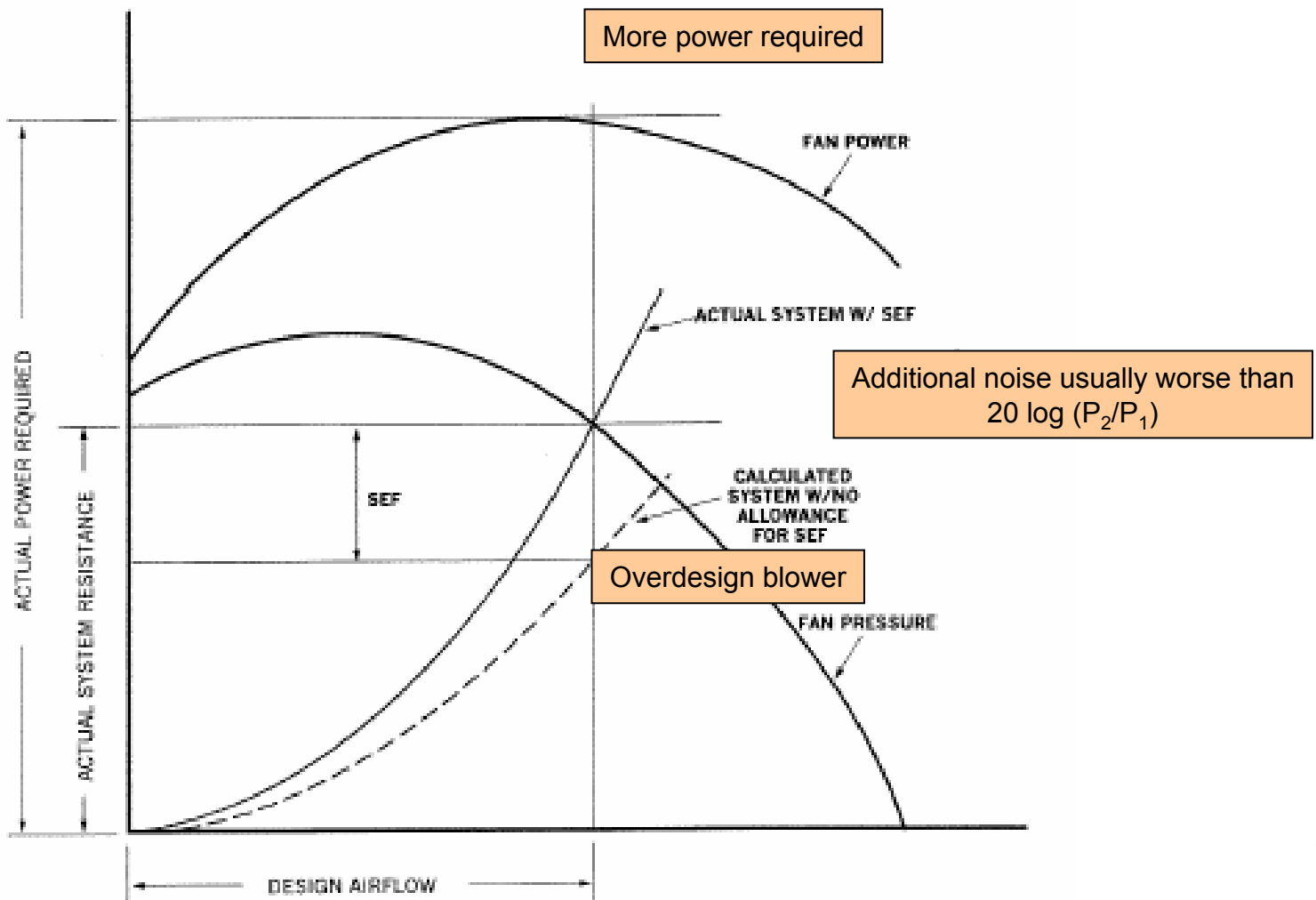
# Typical Fan Curve Shapes for Vaneaxial Fans



Source: Fan Engineering

Figure 16.2 Typical Constant Speed Performance Curves for Vaneaxial Fans

# Allowing for System Effect



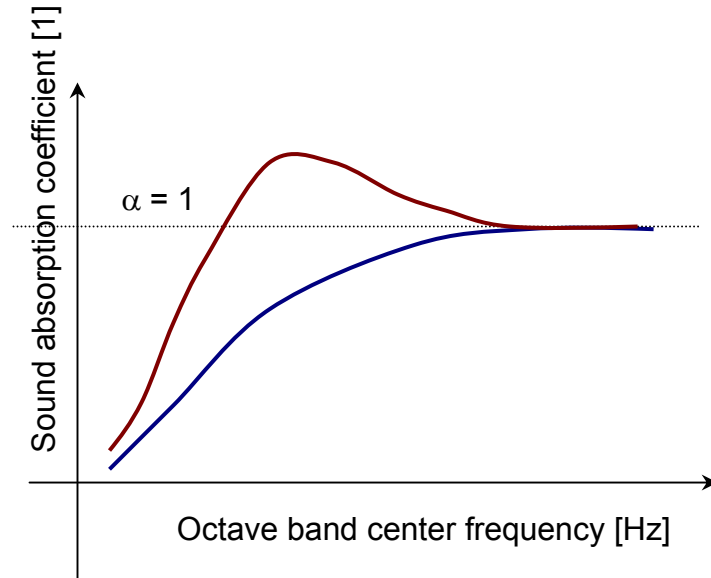
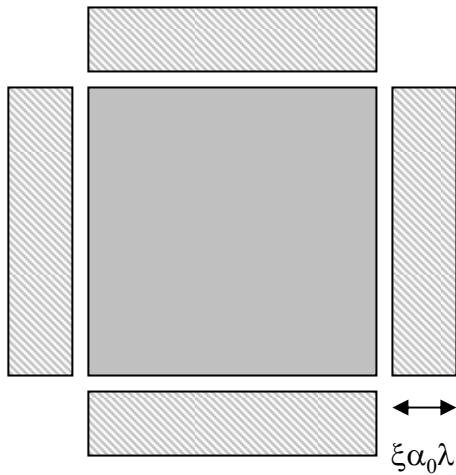
# Sound Absorption

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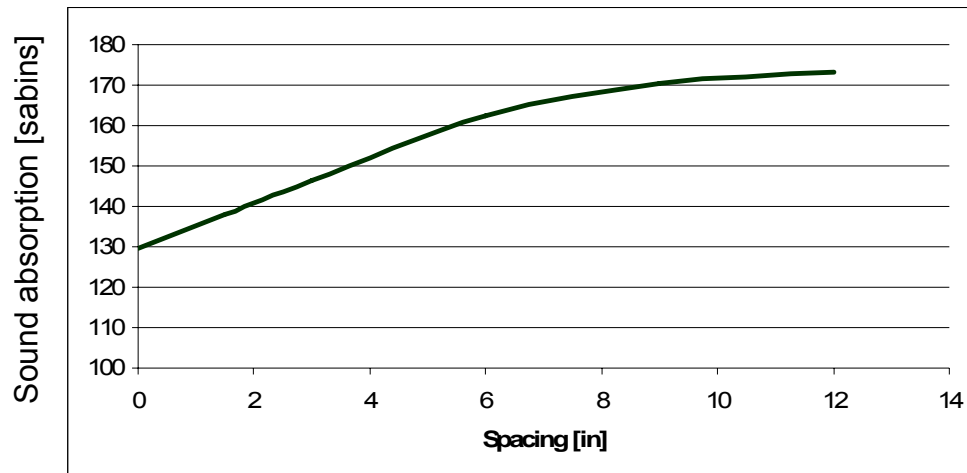
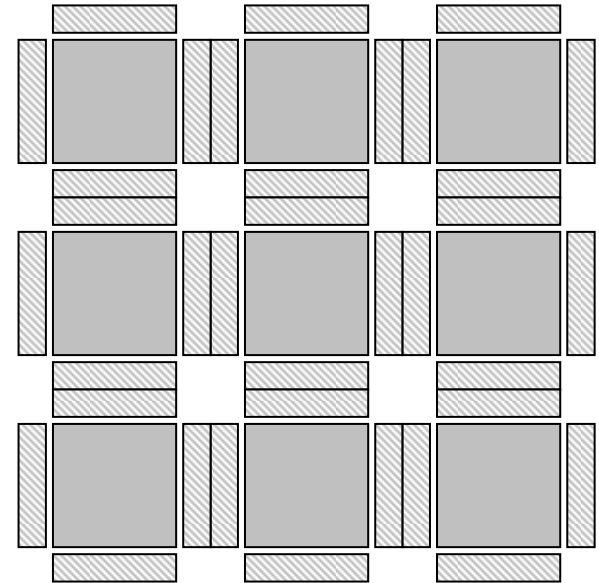
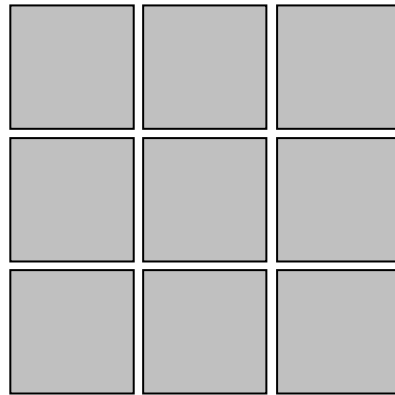
## ➤ ASTM C423

- ✓ Measure change in sound decay rate in a reverberation chamber before and after introduction of a patch of material
- ✓ Sound absorption of a patch tends to be greater than that of an extended area.
  - Sometimes  $> 100\%$ . NOT WRONG.
- ✓ Diffraction effect
  - Perimeter (not exposed edges) more powerful.
- ✓ Studied in 1930s, forgotten by 1980s

# Diagram of Edge Diffraction



# Harnessing edge diffraction



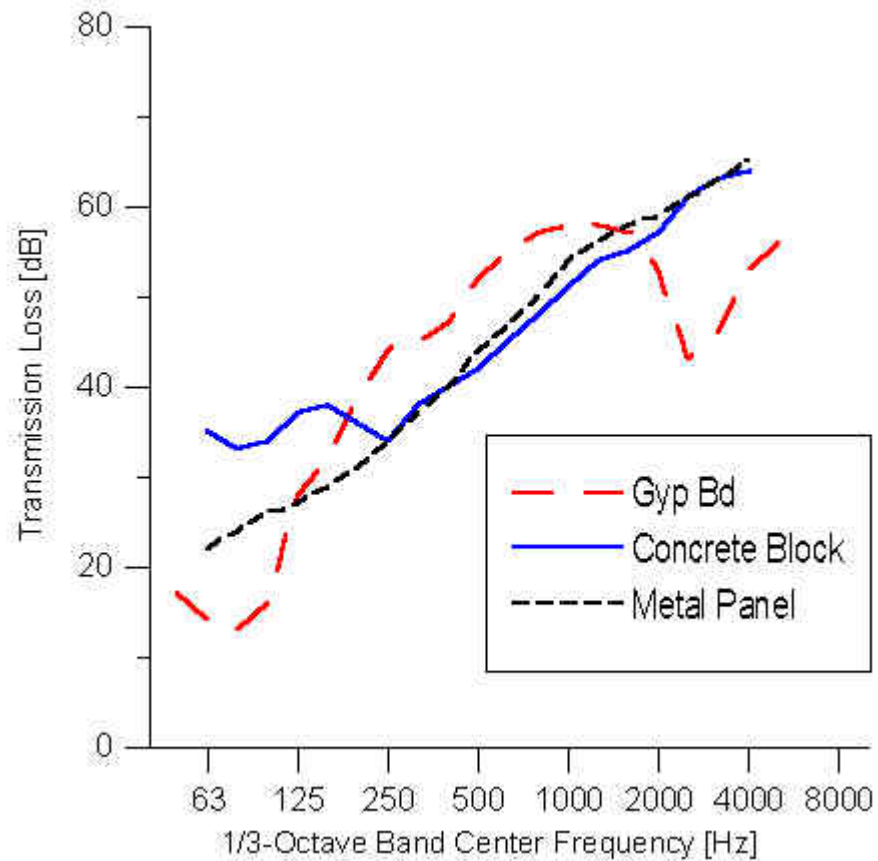
33% more absorption at full expansion,  
less material needed to treat room

# Perception/Sound Quality

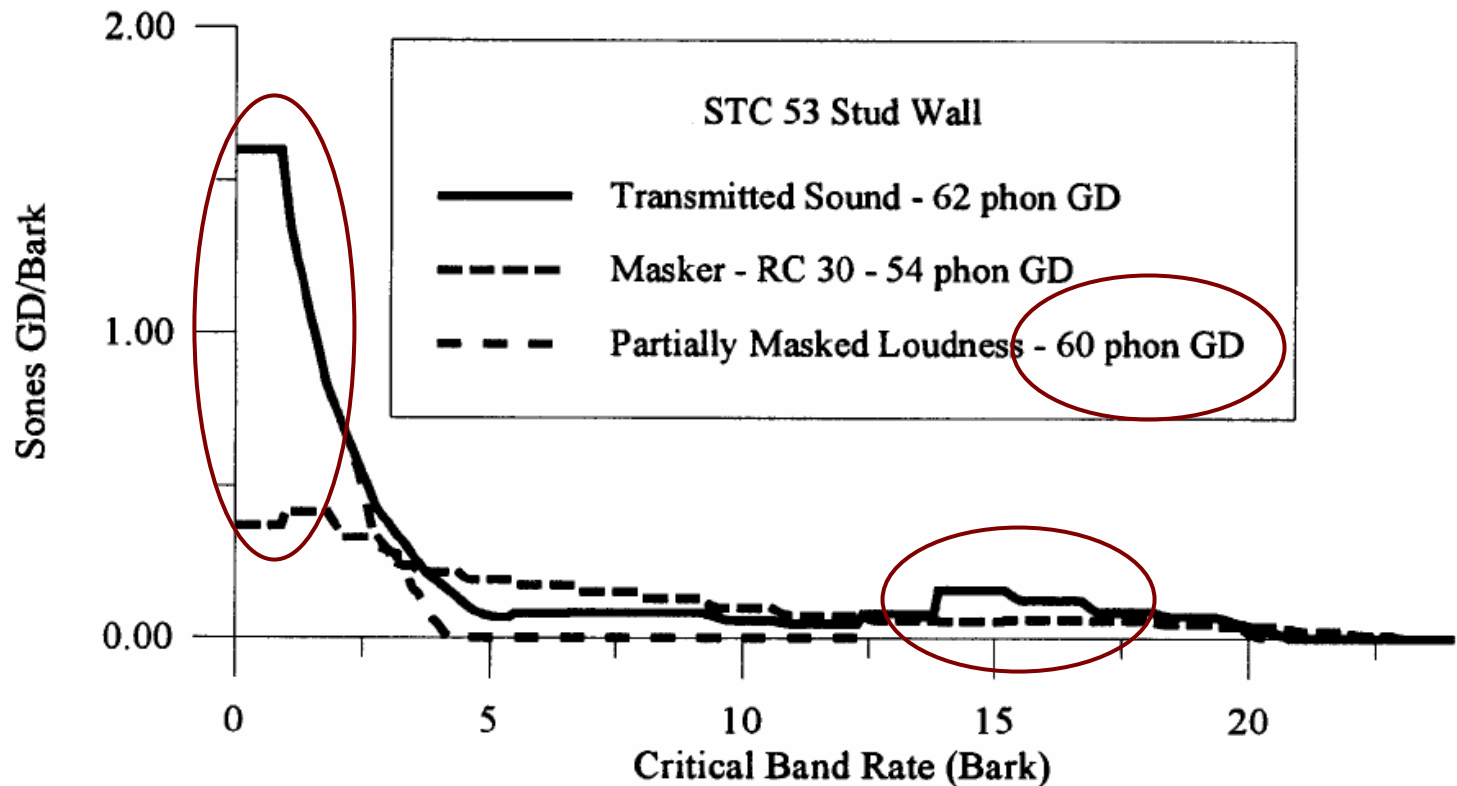
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- All walls of same STC are not created equal
  - ✓ Sound Transmission Class should be “Speech” Transmission Class.
  - ✓ Typical transmission loss results for walls in multi-family buildings in Germany in the 1950s.
    - masonry construction
    - Speech, radio, dishwashing, etc.
  - ✓ STC ignores performance below 100 Hz, doesn’t give detail at other frequencies
- There is no such thing as soundproof!
  - ✓ Intruding sound is (hopefully) masked by acceptable noise in the receiving space

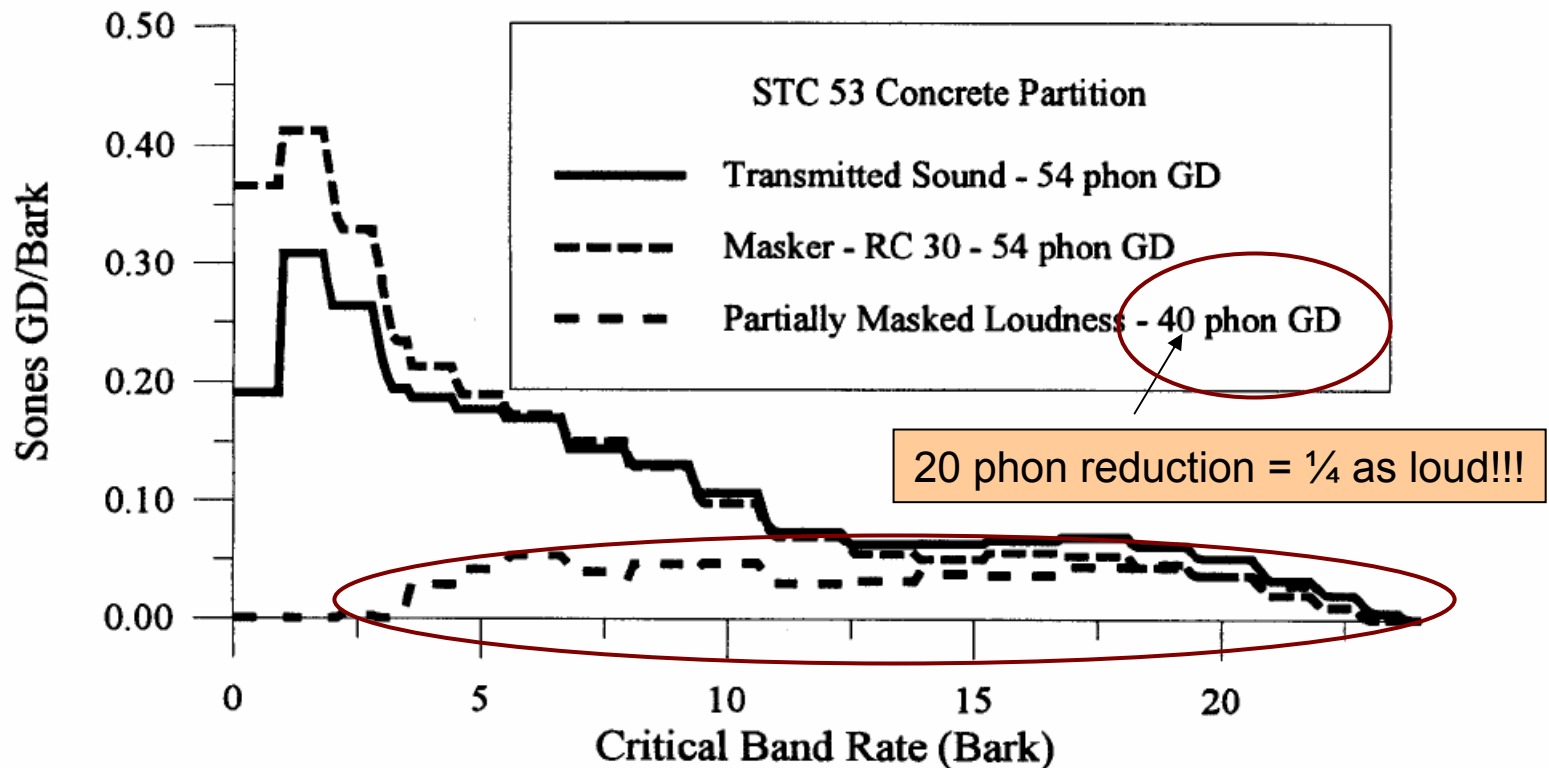
# STC 47 ≠ STC 47



# Music Intruding through stud wall



# Music intruding through concrete wall



# Conclusion

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- Green building practices should include an improved understanding of
  - ✓ Equipment noise control at the source
  - ✓ What measurement data *really* means
  - ✓ How occupants perceive noise
- Designing based on “single number ratings” can lead to performance shortfalls and waste.