Noise Reduction Coefficient-Sound Absorption

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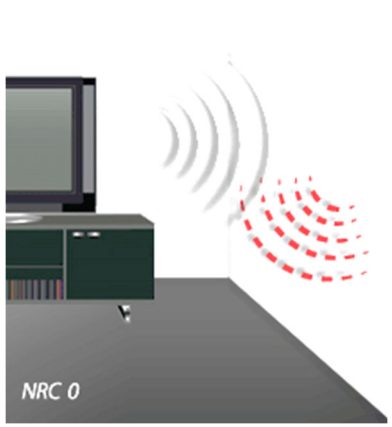
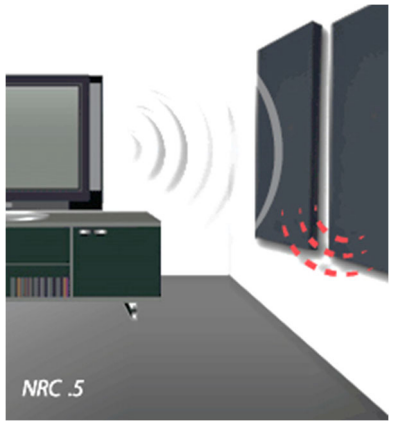
Silence through Science

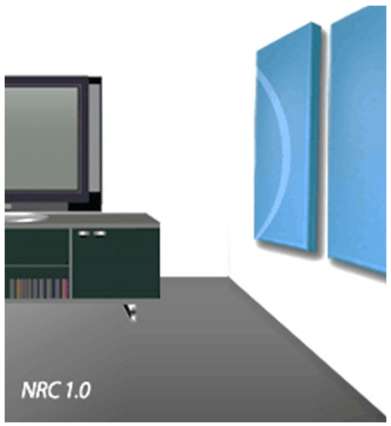
Noise Reduction Coefficient (NRC) -

- The **Noise Reduction Coefficient** (**NRC**) is a single number rating starting from 0.0 - 1.0.
- It describes the average sound absorption performance of a material.

$$NRC = \frac{\alpha_{250} + \alpha_{500} + \alpha_{1000} + \alpha_{2000}}{4} \quad [-]$$







NRC is being replaced by the **Sound Absorption Average (SAA),** which is described in the standard version 1999 and later versions of the ASTM C423 standard

Sound Absorption Average (SAA) -

- The SAA is a single-number rating of sound absorption properties of a material identical to NRC.

$$SAA = \frac{\alpha_{200} + \alpha_{250} + \alpha_{315} + \alpha_{400} + \alpha_{500} + \alpha_{630} + \alpha_{800} + \alpha_{1000} + \alpha_{1250} + \alpha_{1600} + \alpha_{2000} + \alpha_{2500}}{12} \quad [-]$$

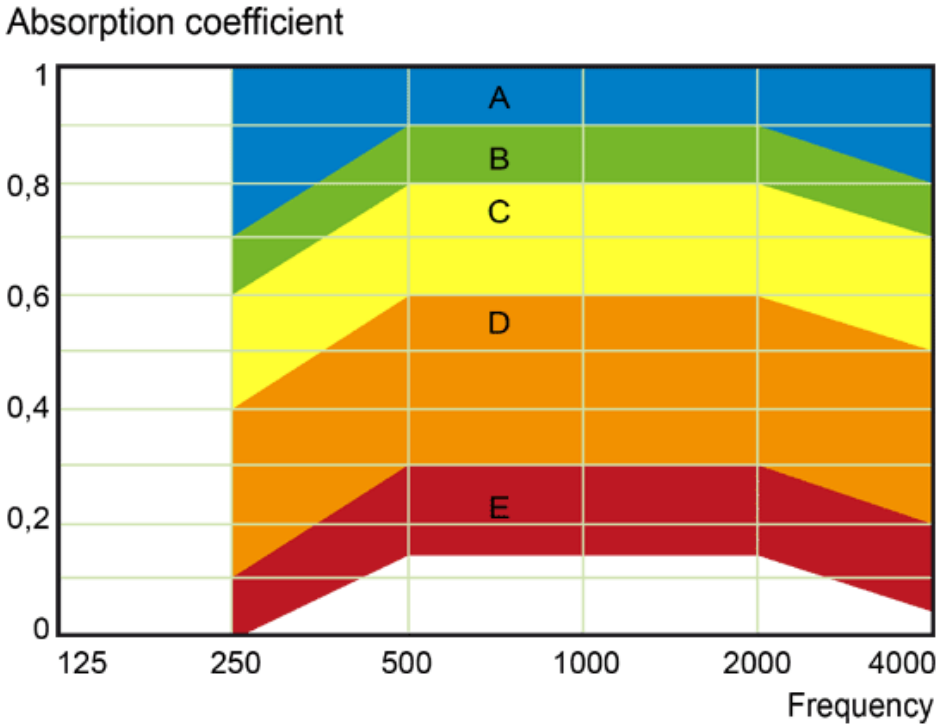
- SAA averages more points over a slightly larger range, the SAA can be a better indicator of low frequency sound absorption performance.

- It is calculated as per ASTM C423

ASTM C423-17 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

Sound Absorption Class -

- It is the weighted sound absorption coefficient α_ω is defined as the value of the shifted reference curve at 500 Hz
- It is calculated from SAC results of ISO 354
- The frequency range of calculation 125 Hz to 4000 Hz
- It is calculated as per standard ISO 11654.



ISO 11654:1997 Acoustics — Sound absorbers for use in buildings — Rating of sound absorption

Sound Absorption Measurement –Reverberation Room

- ASTM C423 — Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- ISO 354 — Measurement of sound absorption in a reverberation room

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Sound Transmission Class - STC

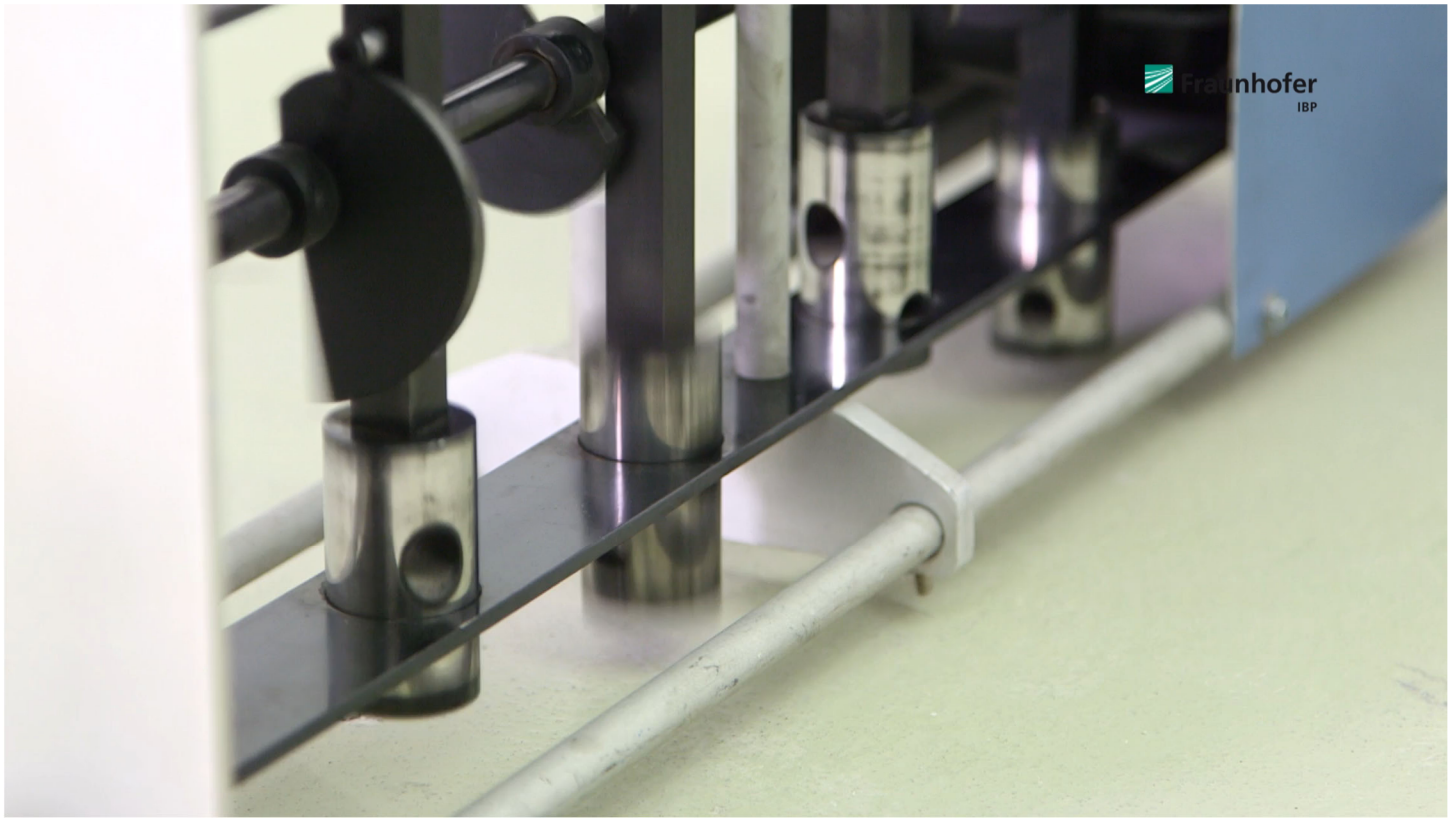
- It is an integer rating of how well a building component attenuates airborne sound.
- The STC provides a standardized way to compare products such as doors and windows made by competing manufacturers.
- It is calculated from Sound Transmission Loss (STL) results measured as per ASTM E90 in Lab.
- The STC standard is ASTM E413.
- On site, the sound transmission loss is measured as per ASTM E336

Sound Reduction Index-Rw

- It is used to measure the level of sound insulation provided by a structure such as a wall, window, door, or ventilator.
- It is calculated as per the standard ISO 717-1
- The Sound Transmission loss is measured as per test standards ISO 16283 (parts 1-3) and the older ISO 10140 (parts 1-5)

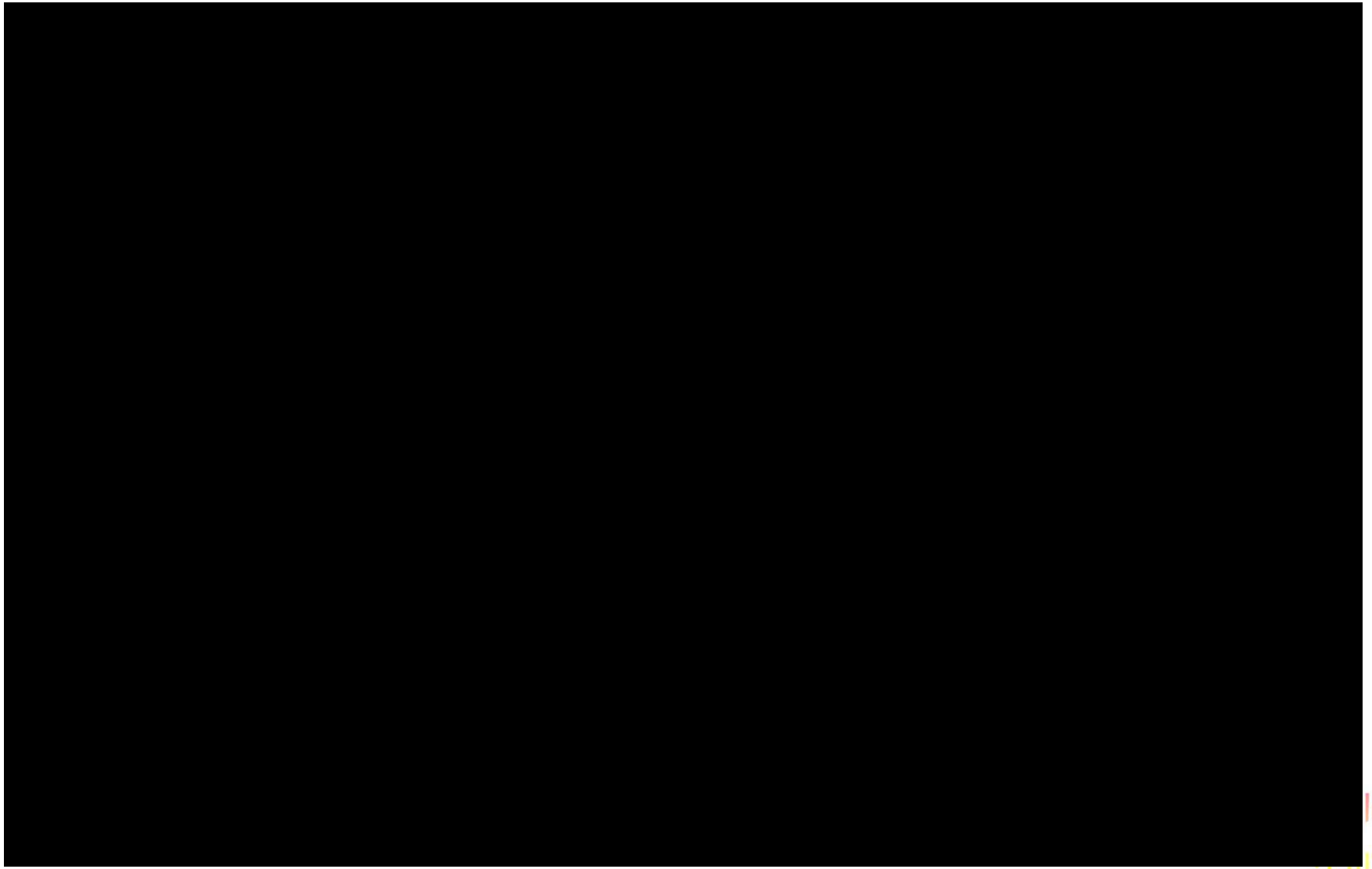
Impact Sound Insulation-

- Impact sound insulation relates to the reduction of footstep sound from people walking on a floor structure.
- It is determined by the impact sound level in the room below.
- It is measured as per ASTM E492 and calculated from standard ASTM E989.



Rain Noise Testing -

- ISO 10140-1:2016 Acoustics — Laboratory measurement of sound insulation of building elements — Part 1 to 5



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Acoustic Test Standards-

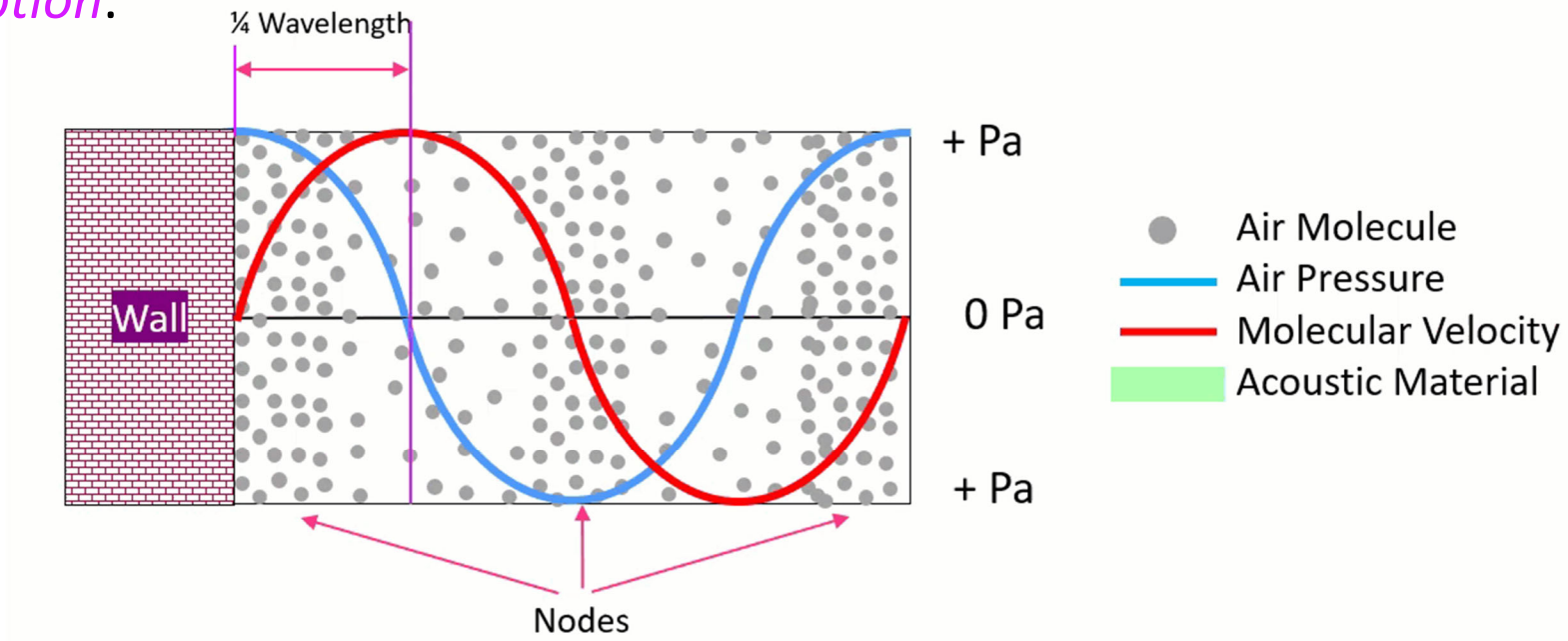
ASTM	Year	Title	ISO
ASTM E90	2016	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	ISO 10140-2
ASTM E336	2020	Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings	ISO 16283-1
ASTM E413	2016	Classification for Rating Sound Insulation	ISO 717-1
ASTM E596	2016	Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures	ISO 15667 ISO 11546
ASTM E966	2018	Standard Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements	ISO 16283-3
ASTM E1289	2016	Standard Specification for Reference Specimen for Sound Transmission Loss	ISO 10140-5
ASTM E1332	2016	Standard Classification for Rating Outdoor-Indoor Sound Attenuation	ISO 717-1
ASTM E1414	2016	Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum	ISO 10848-2
ASTM E1704	2018	Standard Guide for Specifying Acoustical Performance of Sound-Isolating Enclosures	ISO 15667 ISO 11546
ASTM E2249	2019	Standard Test Method for Laboratory Measurement of Airborne Transmission Loss of Building Partitions and Elements Using Sound Intensity	ISO 15186-1
ASTM E2964	2019	Standard Test Method for Measurement of the Normalized Insertion Loss of Doors	ISO 16283-1

Acoustic Test Standards-

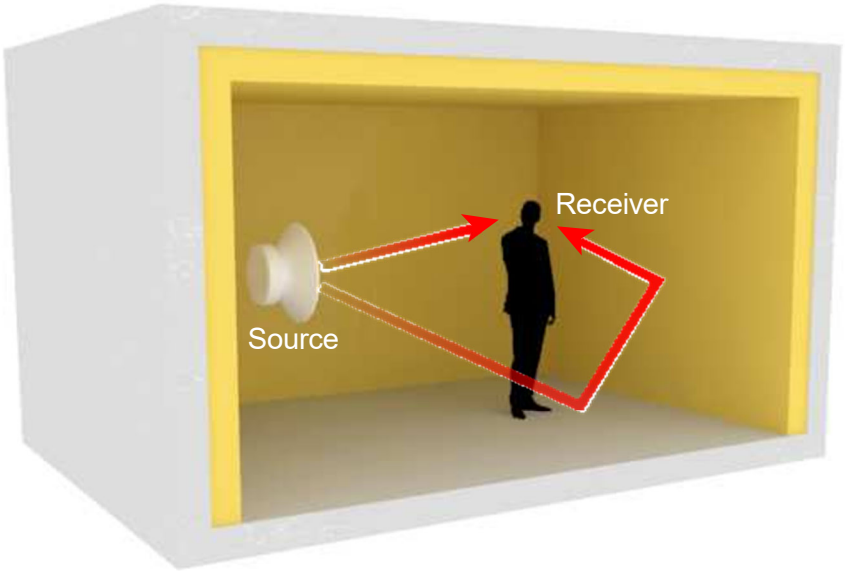
ASTM	Year	Title	ISO
ASTM E492	2016	Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	ISO 10140-3
ASTM E989	2018	Standard Classification for Determination of Single-Number Metrics for Impact Noise	ISO 717-2
ASTM E1007	2019	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures	ISO 16283-2
ASTM E2179	2016	Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors	ISO 16251-1
ASTM E3133	2018	Standard Test Method for Laboratory Measurement of Floor Impact Sound Radiation Using the Tapping Machine	

Sound Absorption Treatment - Placement

- Maximum sound absorption can be achieved by leaving one quarter of a wavelength gap between the wall and the absorptive sample.
- At wall, the molecule velocity will be low. But pressure is a high, In the areas of low pressure, the molecules are less densely spaced. So the molecules can move more freely and at higher velocities.
- The *higher the velocity of the air molecules*, the *more friction and the more absorption*.
- The *lower the velocity of the air molecules*, the *less friction and the less absorption*.

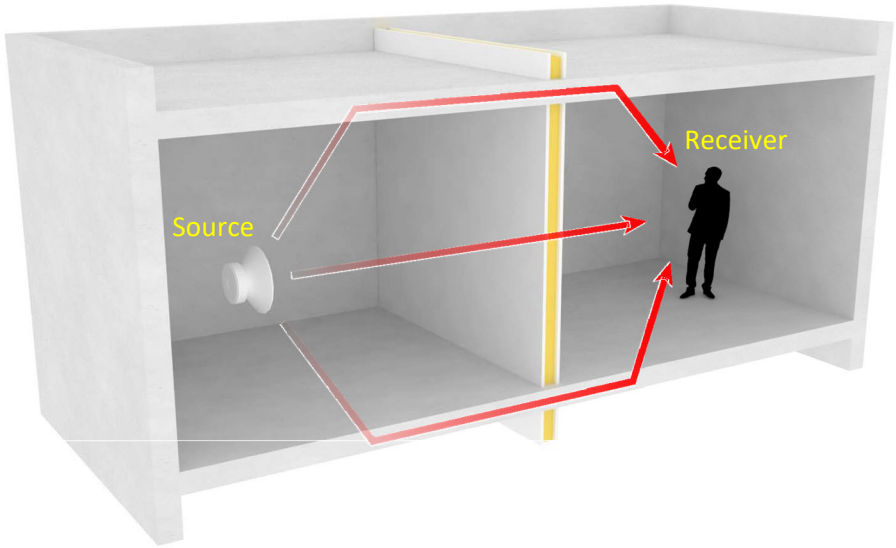


Sound Absorption and Insulation-



Acoustical correction

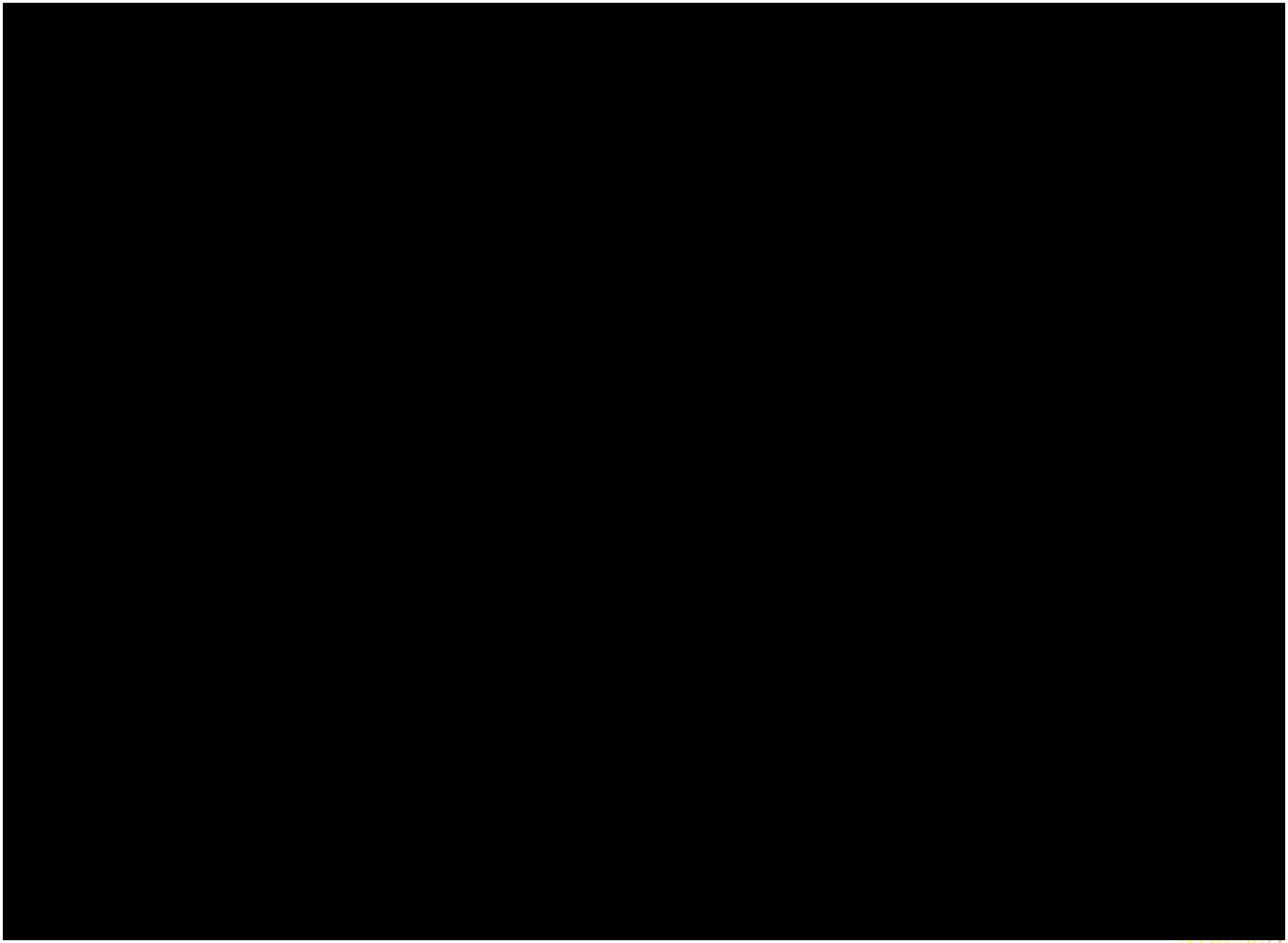
Source(s) and receiver(s) are in the same room



<u>Acoustical insulation</u>

Source(s) and receiver(s) are separated

Effect of NRC – Reverberation Time



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Effect of STC –

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Thank you for being with us. 

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