ACOUSTIC ASSEMBLIES

REFERENCE DOCUMENTS

Greenmood®

Biophilic Design

DOCUMENT PURPOSE

SPECIFICATION & PERFORMANCE GUIDE

This document provides a clear framework to help project teams **understand**, **specify**, and **validate biophilic acoustic assemblies** in professional interior environments.

It focuses on:

- Real-world acoustic behavior, not surface claims
- Assembly logic, rather than isolated materials
- Performance conditions (positioning, air gap, backing)
- Validation through measurement, when required

This guide is intended to support architects, designers, acoustic consultants, project managers, and sustainability teams during early design and specification phases.

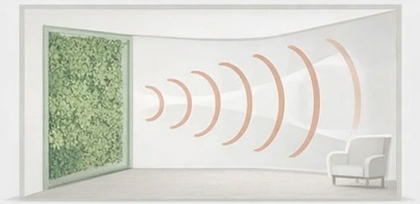
This document supports specification alignment.
Final acoustic performance depends on project conditions and should be validated by a qualified acoustic consultant.

ACOUSTIC FUNDAMENTALS FOR INTERIOR SPACES

ABSORPTION VS ISOLATION

Sound Absorption

(In-room comfort)



- Reduces echo & reverberation
- Improves speech clarity
- Affects sound inside the room

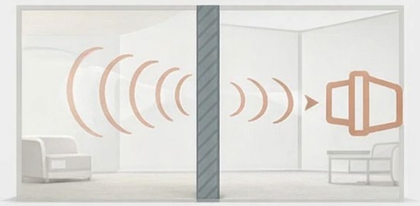
NRC / α_w

Acoustic panels

Moss walls • Cork tiles • Felt systems

Sound Isolation

(Between rooms)



- Limits sound transmission
- Protects privacy
- Affects sound betwxeen spaces

STC / Rw / $D_nT,_w$

Dense walls

Double gypsum • Resilient assemblies

Acoustic absorption

- Acts within a space
- Reduces reverberation time
- Improves speech intelligibility, comfort, and cognitive load

Acoustic isolation

- Acts between spaces
- Limits sound transmission
- Depends on mass, airtightness, and decoupling

Biophilic acoustic walls are absorptive systems, not soundproofing solutions.

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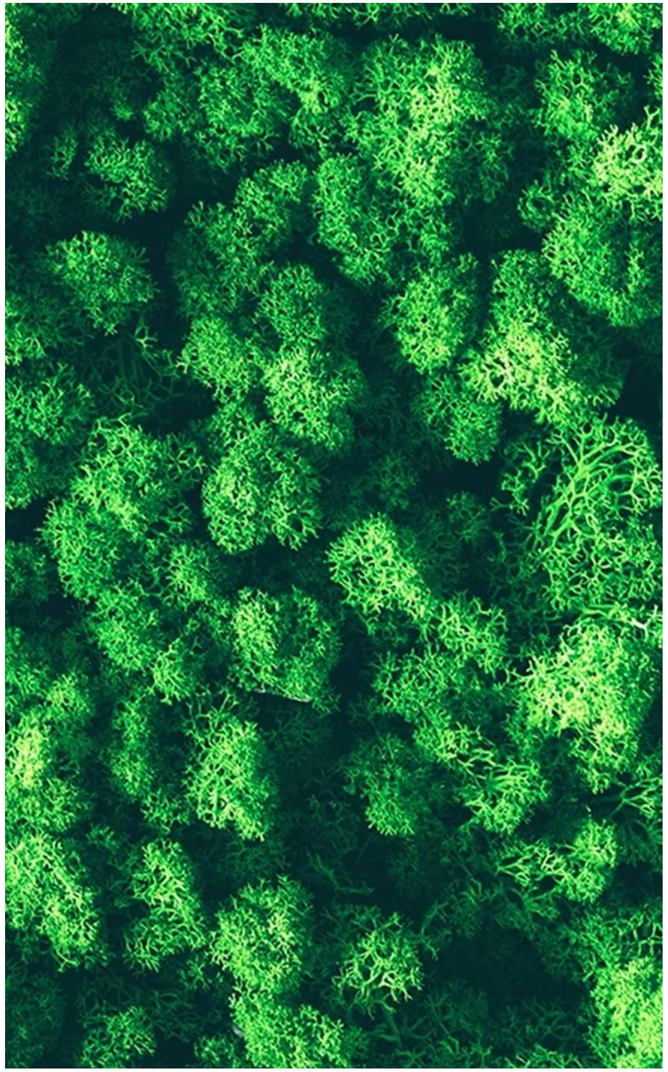

ACOUSTIC FUNDAMENTALS FOR INTERIOR SPACES

WHY POROUS MATERIALS ABSORB SOUND

Porous absorbers dissipate sound energy through:

- Air friction inside pores
- Viscothermal losses

Their effectiveness depends on:

- Effective thickness
- Airflow resistivity
- Position within the sound field

Material choice alone does not define performance.

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ACOUSTIC ASSEMBLY LOGIC

TYPICAL LAYERS OF A BIOPHILIC ACOUSTIC ASSEMBLY

Visible biophilic surface

- Preserved vegetation / moss / cork
- Visual and experiential role
- Partial acoustic contribution

Functional absorptive layer(IEQ)

- Mineral wool, PET fiber, felt, technical cork
- Primary acoustic performance driver

Air cavity (air gap)

- Unfilled space
- Shifts absorber position relative to particle velocity

Rigid backing / existing wall

- Structural support
- Reference boundary for sound pressure

Acoustic performance results from the complete assembly,
not from any single layer.

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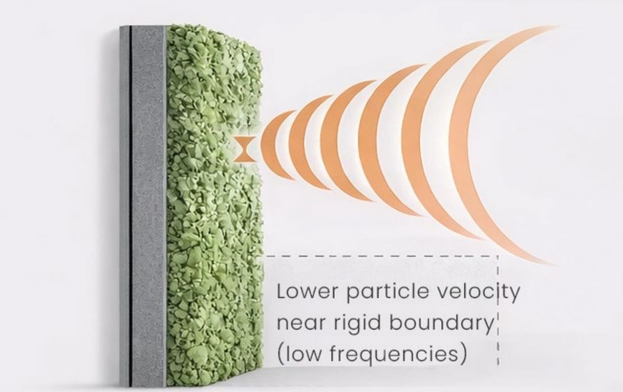
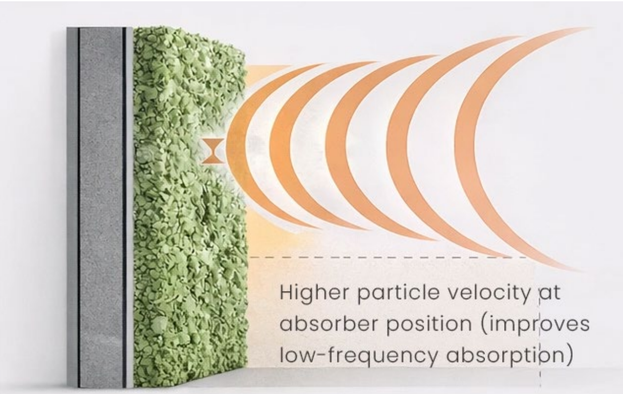
EFFECT OF AIR GAP ON ACOUSTIC ABSORPTION



Shallow air gap

- Limited low-frequency absorption
- Effective mainly at mid–high frequencies



Deeper air gap

- Improved low-frequency absorption
- Material remains effective at mid–high frequencies

Physical Principle

- Maximum sound particle velocity does not occur at the rigid wall.
- Moving the absorber away from the wall places it closer to this velocity maximum.
- Result: improved absorption, especially at lower frequencies.

Configuration	Typical Effect
Absorber directly on wall	Mainly mid–high frequency absorption
Absorber with shallow air gap	Moderate improvement
Absorber with deeper air gap	Extended low-frequency absorption

Same material, different performance.

What the Air Gap Does NOT Do

- ✕ It does not turn a weak absorber into a high-performance system
- ✕ It does not replace sufficient material thickness
- ✕ It does not provide sound isolation

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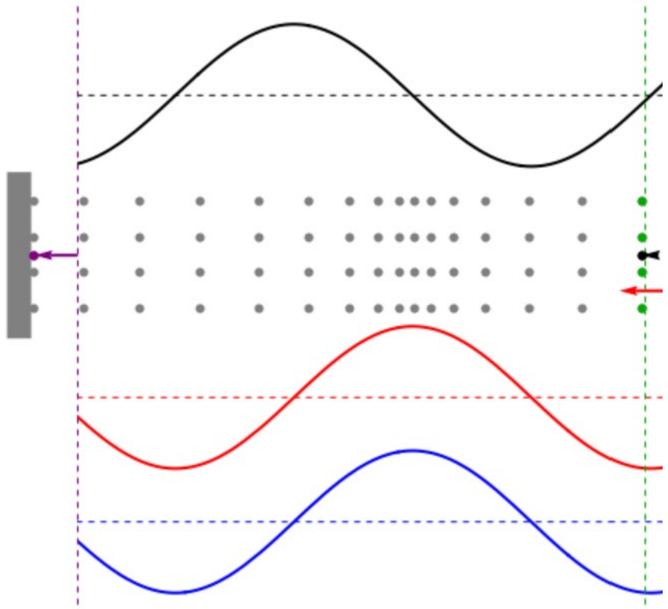
WHY THE RIGID BACKING IS ALWAYS PRESENT



Important clarification

The rigid backing does not absorb soundMoving the absorber away from the wall places it closer to this velocity maximum.

It defines the acoustic boundary condition:
- Pressure maximum
- Reference point for particle velocity distribution

The variable is absorber position, not the wall itself.

The wall remains constant.
Performance changes because the absorber is repositioned relative to the sound field.

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ROLE OF BIOPHILIC MATERIALS
ON ACOUSTIC SYSTEM

Preserved Vegetation

- Irregular porous structure
- Light-to-moderate absorption
- Strong visual diffusion and experiential value

Cork

- Semi-open cellular structure
- Progressive absorption behavior
- Strong mid-frequency performance

Key Rule

Biophilic materials do not replace technical absorptive layers.
They complement them.

ACOUSTIC PERFORMANCE

LABORATORY SOUND ABSORPTION PERFORMANCE

The table below summarizes available laboratory sound absorption data for selected Greenmood biophilic materials, based on standardized test methods.
Reported values depend on material configuration, mounting conditions, and backing strategy.

Laboratory sound absorption performance (reverberation room measurements)
Measured according to ISO 354 / ISO 11654 and ASTM C423 standards

Material	Test	Mounting	αw / NRC	Absorption class	Note
Reindeer Moss	ISO 11654	Plane absorber(Type A), directly on concrete floor	0.35 (H) / —	D	Performance primarily in mid–high frequencies
Ball Moss	ISO 11654	Plane absorber(Type A), directly on concrete floor	0.55 (MH) / —	D	Absorptive behavior influenced by depth and backing
Velvet Leaf	ISO 354 / ISO 11654 + ASTM C423	Plane absorber (Type A)	0.60 (H) / 0.65	C	Strong mid–high absorption under Type A mounting
Cork tiles - Sillon	ISO 354 / ISO 11654 + ASTM C423	Plane absorber (Type A)	0.30 (H) / 0.30	D	Reference data under standardized plane absorber mounting
Cork tiles - Morse	ISO 354 / ISO 11654 + ASTM C423	Plane absorber (Type A)	0.45 / 0.40	D	Higher absorption than Sillon in lab Type A setup
Cork tiles - Parenthese	ISO 354 / ISO 11654 + ASTM C423	Plane absorber (Type A)	0.25 / 0.20	E	Lower absorption in standardized Type A configuration

The indicators shown (αw, NRC, SAA & absorption class) describe how efficiently a material absorbs sound energy under standardized test conditions.

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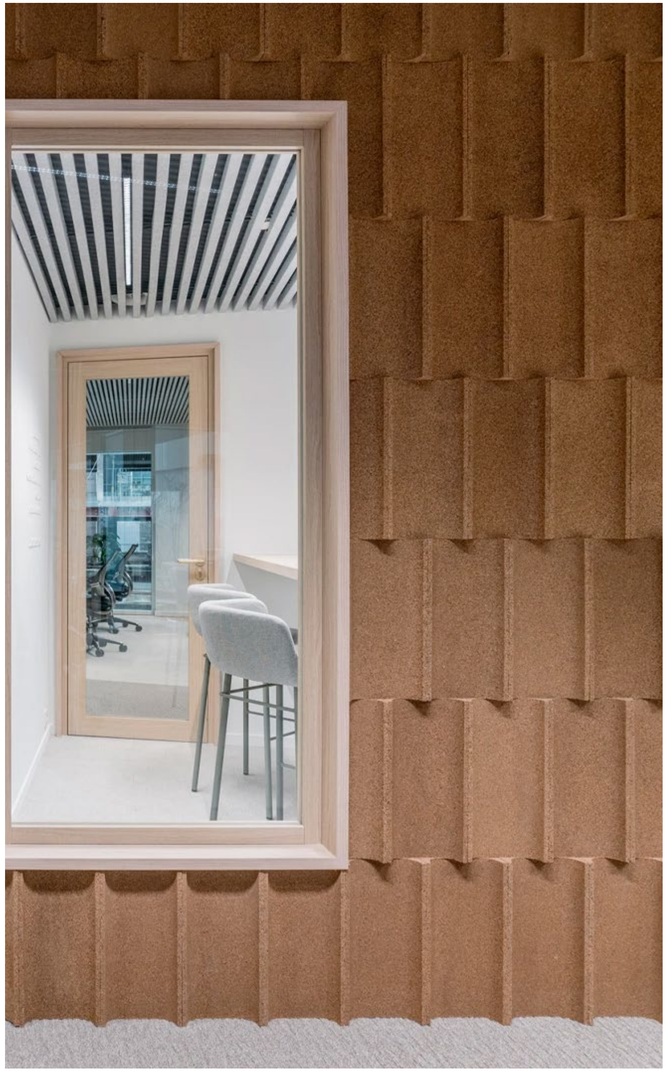

POSITIONING IN REAL SPACES

Effective zones:

- Open-plan offices
- Collaboration areas
- Large reflective wall surfaces
- Transition zones with high speech activity

Low-impact zones:

- Isolated decorative walls
- Areas far from sound sources
- Already over-absorbed spaces

Greenmood may collaborate with acoustic consultants to support validation when appropriate.

SPECIFICATION CHECKLIST

To validate before specification:

- Full assembly description
- Effective absorptive thickness
- Air gap presence and depth
- Backing / supporting wall type
- Position within the space
- Clear acoustic objective (comfort, RT, use case)

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DISCLAIMER

This document provides guidance for specification and design alignment.
Acoustic performance depends on project conditions and must be validated by qualified professionals.

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