

Designing for Better Acoustics in the Built Environment

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Acoustics Matter
More Than Ever

Why Acoustics Matter More Than Ever

Sound isn't just a background detail—it shapes how people feel, focus, learn, heal, and interact. Whether it's the quiet hum of a hospital hallway or the lively buzz of a co-working space, the acoustic environment plays a vital role in health, productivity, and comfort.



Acoustics & Human Wellbeing

Poor acoustics can lead to stress, fatigue, and distraction. Studies show that excessive noise affects cognitive performance in students, raises stress levels in hospital patients, and reduces productivity in offices. Conversely, a well-controlled sound environment supports learning, healing, and workplace satisfaction.



Why Acoustic Performance Is Now a Priority

In today's design world, acoustics are no longer an afterthought—they're a core part of creating functional and human-centered spaces. Here's why:

- **Education:** Schools now prioritize noise reduction to improve focus and learning outcomes.
- **Healthcare:** Quiet environments promote faster recovery and protect patient privacy.
- **Hospitality:** Guest satisfaction is tied to peaceful, comfortable experiences—soundproofing is key.
- **Workplaces:** As open-plan offices evolve, acoustic zoning and private areas are essential for concentration.

What You'll Gain from This eBook

This eBook will guide you through:

- **Best practices** for specifying acoustic doors in different environments.
- **Relevant standards** and how they apply to architectural design.
- **Practical solutions** to balance aesthetics, performance, and compliance.

Whether you're designing a school, clinic, hotel, or office, understanding the role of acoustic doors will help you create spaces that sound as good as they look.

Understanding Acoustic Basics—What Every Architect or Designer Should Know

You don't need to be an acoustical engineer to design with sound in mind. Understanding a few essential acoustic principles can elevate your projects—especially when specifying **acoustic doors** or designing for multi-use, noise-sensitive environments like offices, schools, healthcare, or hospitality.

The Science of Sound Transmission

Sound moves through buildings in two primary ways:

Airborne Sound: This travels through the air—think voices, traffic, ringing phones. It passes through gaps, walls, ceilings, and of course, **doors**. Acoustic doors with a high STC rating and effective sealing systems are designed to block airborne sound transmission.

Structure-Borne (Impact) Sound: This travels through the building structure (e.g., footfall, plumbing, HVAC, or nearby trains). While doors mainly block airborne sound, flanking paths through walls or floors must also be managed to maintain performance.



SOUND CHECK: If you're investing in high-STC doors, also ensure adjacent wall systems and construction details prevent flanking transmission, or the door's effectiveness will be compromised.

Key Acoustic Terms Every Architect Should Know

Decibels (dB)

Sound pressure is measured in decibels. A 10 dB increase is **perceived as twice as loud**. So, improving a door assembly by just 5–10 dB can make a major difference in acoustic comfort.

Frequency

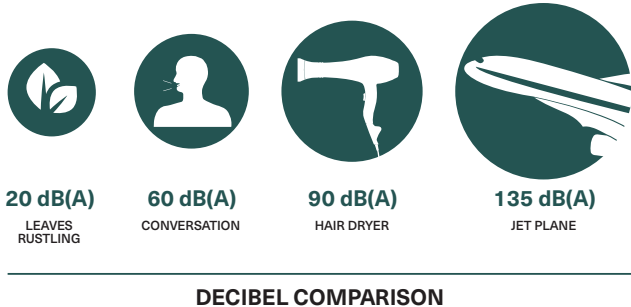
Also known as pitch, frequency refers to the number of times per second that a sound pressure wave repeats itself. Sound frequencies are measured in hertz (Hz). A very high-pitched sound, like a flute, registers at 2,000 Hz whereas a very low-pitched sound, like a tuba, registers under 30 Hz. Human speech can range from about 125 to 8,000 Hz. Humans can only hear sounds between 20 and 20,000 Hz, and each person's range shrinks as they get older.

Transmission Loss (TL)

Transmission loss is the difference in sound level (dB) between source and receiving rooms, indicating how well a partition blocks noise. Higher TL means better sound isolation. TL varies by frequency, so multiple tests across different sounds are needed for an accurate measure.

Impact Insulation Class (IIC)

While IIC applies to **floor/ceiling assemblies**, it's critical when designing full acoustic environments. No door can fully control sound if impact noise above or flanking noise around is left untreated.



Sound Transmission Class (STC)

STC measures how well a building element blocks airborne sound. A higher STC rating = better sound isolation. It's the primary metric used when selecting acoustic doors.

- **STC 30–35:** Offers fair soundproofing; loud speech can be understood, and normal speech is audible but unclear.
- **STC 35–40:** Provides good soundproofing; loud speech is audible but unintelligible.
- **STC 40–50:** Gives very good soundproofing; loud speech can only be heard faintly.
- **STC 50+:** Loud speech not audible; impact-vibration noise significantly reduced.



SOUND CHECK: Always verify if the STC rating is based on **operable testing** (the door opens and closes) rather than **sealed-in-place**. Operable ratings reflect real-world performance and are more relevant for architectural applications.



Sound Transmission vs. Sound Absorption

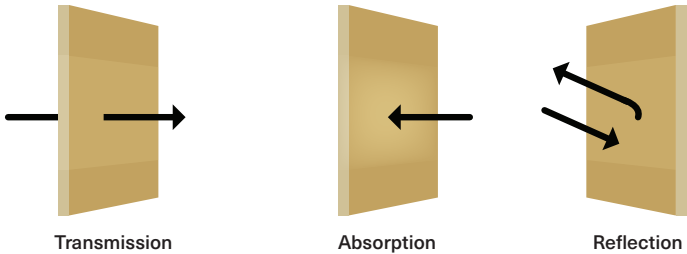
Effective sound control requires two approaches—blocking sound between rooms and absorbing sound within a room. Because sound transmission and absorption solve different problems, both are essential to creating private, distraction-free, and clear environments.

Sound Transmission	Sound Absorption
Blocks sound <i>between rooms</i>	Controls sound <i>within</i> a room
Relevant to doors, walls, seals	Relevant to finishes, ceilings, furniture
Prevents distractions, enhances privacy	Reduces echo, improves clarity



SOUND CHECK: Acoustic doors control transmission. To optimize performance, combine them with sound-absorptive materials in the interior space to manage reverberation.

How Sound Interacts with Surfaces



Acoustic Standards and Certifications in Architecture

Why Acoustic Design Matters

The built environment plays a crucial role in supporting human health, productivity, and well-being. Among the many elements that influence occupant experience, acoustic comfort is increasingly recognized as a critical factor. Noise distractions, poor sound insulation, and excessive reverberation can hinder concentration, disturb sleep, and even contribute to long-term stress.

In response, several leading industry standards and certification programs have established clear guidelines and criteria for acoustic performance. For architects, understanding and implementing these requirements not only improves occupant satisfaction—it also facilitates compliance with building codes and contributes to achieving green building certifications.



SOUND CHECK: Prioritize acoustic comfort early in design. Meeting industry standards not only reduces noise-related stress and boosts occupant wellbeing, but also supports code compliance and green building certifications.



LEED and Acoustic Performance

LEED v5: A Shift in Acoustic Credit Approach

The Leadership in Energy and Environmental Design (LEED) program, developed by the U.S. Green Building Council (USGBC), is one of the world's most recognized frameworks for sustainable building design. On **April 28, 2025**, LEED v5 was officially released, marking the most significant update to the rating system in over a decade.

With this release, the treatment of acoustics has shifted significantly. Instead of relying on specific, measurable criteria—as seen in **LEED v4/4.1**—the new system adopts a broader, **planning-focused approach**. This change introduces new considerations, such as **external noise** and **impact noise**, but many industry experts view the update as a **reduction in rigor** compared to earlier versions.

To better understand these changes, the table below highlights the key differences between LEED v4/4.1 and LEED v5:

Category	LEED v4/4.1	LEED v5	Design Benefit
Credit Structure	Dedicated "Acoustic Performance" credit under EQ	Part of Occupant Experience credit (optional)	Encourages integrated acoustic planning
Approach	Prescriptive, performance-based	Planning-focused, qualitative	Supports early-stage acoustic strategy
Key Metrics	HVAC noise limits – STC targets – Reverberation time	No strict targets (35 dB(A) HVAC in select spaces)	Allows flexible, context-specific solutions
Documentation	Acoustic report showing metric compliance	Acoustic plan mapping zones and mitigation	Highlights potential acoustic issues early
New Considerations	Limited external noise focus	External noise, impact noise, and zoning	Improves occupant comfort by managing sound sources
Scoring Weight	Standalone credit with measurable points	Reduced weight in larger credit	Focus on qualitative design impact
Alignment with Other Standards	Measurable, stringent	Loosely aligned with WELL	Easier integration with occupant-centric standards





WELL v2: Wellness Through Sound Design

The WELL Building Standard (WELL v2) by the International WELL Building Institute (IWBI) is a health-centered certification that integrates science-backed strategies into architectural design. Within WELL v2, sound is one of the 10 core concepts, focusing on:

- Acoustic comfort and speech privacy
- Noise reduction between adjacent spaces
- STC minimums for walls, doors, and partitions depending on occupancy type
- Surface finishes that reduce reverberation



SOUND CHECK: WELL v2 emphasizes that acoustic design isn't just about blocking unwanted noise—it's about creating environments that reduce cognitive fatigue, enhance productivity, and support mental health.



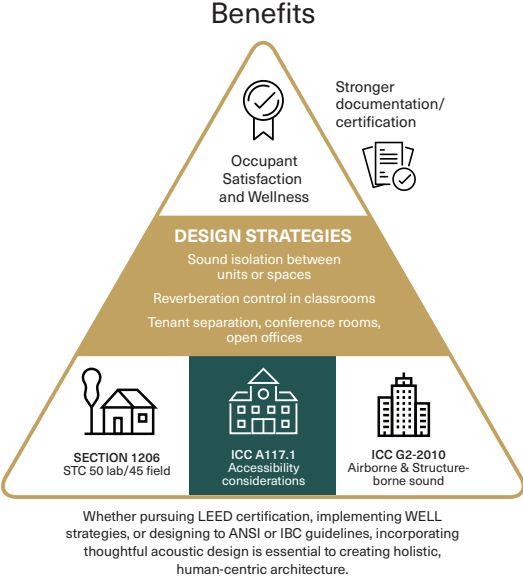
ANSI/ASA Acoustic Standards

The American National Standards Institute (ANSI), working with the Acoustical Society of America (ASA), publishes a range of standards that guide architectural acoustics. Two particularly relevant examples include:

- **ANSI/ASA S12.2 – Criteria for Evaluating Room Noise:** Establishes acceptable noise levels in different types of rooms to promote comfort and functionality.
- **ANSI/ASA S12.60 – Acoustic Performance Criteria for Schools:** Sets maximum allowable background noise and reverberation time in classrooms to support speech intelligibility and learning.

Although ANSI standards are voluntary, they are often referenced by other frameworks (including LEED and WELL) and can be used to demonstrate best practice compliance during project documentation or acoustic certification.

Holistic Acoustic Design for Architects



IBC and ICC Guidelines for Architects

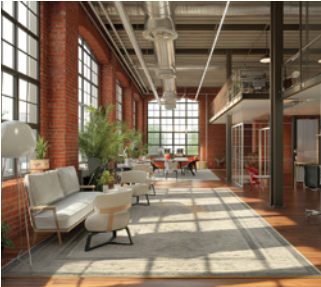
The International Building Code (IBC), developed by the ICC, forms the basis of most U.S. building codes. While it doesn't set universal acoustic performance standards, key provisions include:

- **Section 1206 – Sound Transmission:** Primarily a residential requirement for apartments, condos, and mixed-use with dwelling units, mandates that walls and floor/ceiling assemblies between units must meet minimum STC ratings (50 lab, 45 field). Although it doesn't directly apply, similar sound isolation strategies can improve tenant comfort in offices, retail spaces, or mixed-use areas.
- **Accessibility Considerations:** ICC A117.1 sets accessibility requirements for hearing assistive technology in schools, and other commercial settings. Spaces should be designed to control noise and reverberation to ensure clear speech intelligibility and effective system performance.

The ICC G2-2010 Guidelines provide additional recommendations for controlling airborne and structure-borne sound in multifamily and commercial buildings, offering useful guidance for conference rooms, open offices, and tenant separations.

Sound Transmission Reduction Strategies

Effective sound control is essential in architectural design to ensure comfort, privacy, and functionality across various spaces. Noise can travel through air and structure, making it critical to apply appropriate sound mitigation methods. This chapter outlines the four primary methods used in building construction to reduce sound transmission: decoupling, absorption, damping, and mass.



Decoupling: Interrupting Sound Paths

Decoupling is one of the most effective techniques for isolating sound. It involves mechanically separating the two sides of a structure so they vibrate independently, reducing the transfer of sound vibrations through solid materials—primarily used in wall assemblies.

Technique	Description	Effectiveness	STC Rating	How it Works
Double Stud Walls	Uses two separate sets of studs, creating a physical break between inner and outer wall layers.	High	56-59	The gap between the two stud sets limits vibration transfer.
Staggered Stud Walls	Studs are offset so each face of the wall is attached to different studs without touching the other side.	Moderate	46-47	Staggering prevents a direct line of sound transmission.
Doors and Limited Decoupling	Conventional wood doors, or communicating door sets (two doors within a shared frame separated by a gap).	High (for certain applications)	N/A	The air gap acts as a sound trap between spaces.



SOUND CHECK: A conventional coupled wall (with connected studs) usually yields a lower STC rating, typically 34–39.

Absorption: Softening the Sound

Absorption reduces airborne noise by transforming sound energy into heat as it passes through various materials. This is achieved through either soft or porous materials.

Soft Materials

Examples include carpet, acoustic foam, and fabric panels. Their fibrous texture disrupts sound waves, reducing echo and reverberation.

- **Use Cases:** Offices, studios, theaters
- **Mechanism:** Friction between fibers and air particles dissipates energy.

Porous Materials

Materials like mineral wool or fiberglass panels allow sound waves to penetrate and bounce within, breaking down acoustic energy.

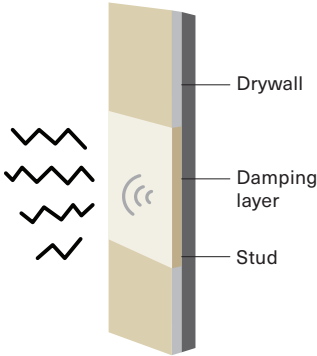
- **Use Cases:** Walls, ceilings, duct liners
- **Mechanism:** Internal air movement and surface irregularity help trap sound.

Damping: Controlling Structural Vibration

Unlike absorption, which targets airborne sound, damping mitigates structural sound—vibrations traveling through walls, floors, and ceilings.

- **Application:** Multi-layer drywall systems, viscoelastic damping compounds
- **Mechanism:** Damping materials absorb mechanical energy, reducing vibration and sound transmission.

Often used in conjunction with other methods like mass and decoupling for maximum effectiveness.



Mass: Blocking with Density

Mass is one of the oldest and most straightforward ways to control sound. Denser materials are less prone to vibration and more resistant to sound penetration.

Dense Materials

Examples: Concrete, gypsum board, MDF, laminated glass

- **Effectiveness:** Excellent against mid- to high-frequency sounds.
- **Limitations:** Less effective against low-frequency (bass) sounds.

Applications

- **Walls:** Additional layers of drywall or mass-loaded vinyl
- **Doors:** Solid core or high-density composite doors
- **Floors:** Concrete slabs, layered sub-floors



SOUND CHECK: Combine mass with absorption or damping to address a wider frequency range.

Conclusion: A Holistic Approach

Successful acoustic design requires combining multiple methods. For example, a decoupled wall with added mass and internal absorption layers offers far superior performance than a wall that relies on a single method. Architects should assess the use-case, desired STC rating, and frequency range when selecting strategies.



Effective Sound Control for Architects

Understanding the Acoustical Partition System

In building design, **sound control** is not merely a matter of isolated elements. Sound travels like water—**always taking the path of least resistance**. That’s why it’s critical to think **holistically** about partitions: walls, doors, ceilings, floors, and flanking paths must all be considered **as a system**.

If even one element—such as the door—is weak acoustically, it will **compromise the entire sound barrier**, no matter how strong the wall construction is.

Wall Construction and STC Ratings

The **Sound Transmission Class (STC)** is a standard rating for measuring how well a building partition attenuates airborne sound.



SOUND CHECK: Adding mass, increasing cavity depth, and reducing structural connections (decoupling) are the most effective ways to improve STC.

Table: Common wall construction types and their approximate STC ratings, showing how different materials and assemblies impact sound attenuation.

Construction Type	Approximate STC Rating
½" Drywall on wood studs	STC 33
With fiberglass insulation	STC 36
4" thick concrete wall	STC 40
8" thick concrete wall	STC 50
Decoupled double stud with insulation	STC 55–65

The Impact of Door Openings

No matter how high-performing a wall is acoustically, the **door opening** can become the **weakest link** in the system if not treated properly. Architects should:

- **Specify acoustically-rated doors** (e.g., STC 35–55 depending on the need).
- Use **full perimeter acoustic seals** and **automatic door bottoms**.
- Avoid glass doors unless they meet the same STC requirement as the wall.



SOUND CHECK: The STC rating of a partition is only as strong as its weakest component.

Flanking: The Hidden Culprit of Sound Leakage

Flanking occurs when sound travels around, under, or through a partition by paths other than the direct wall or door. It is often the **unseen failure point** in acoustical design.

Common Flanking Paths:

- **Ceiling plenums** in drop ceilings
- **Continuous ductwork** between rooms
- **Unsealed wall-floor or wall-ceiling intersections**
- **Electrical boxes and lighting fixtures**
- **Concrete slabs and framing connections**

Architectural Solutions:

- Use **acoustic sealant** at junctions and penetrations.
- Place electrical boxes on **staggered studs** or **back-to-back with putty pads**.
- Add **acoustic baffles** or **duct silencers** in HVAC systems.
- Ensure partition walls **extend to the deck** above ceilings.

Designing an Effective Sound Control System

To achieve effective sound isolation, all elements of the partition must perform together. Here's a holistic approach for architects:

Wall

- Choose high-STC wall assemblies (minimum STC 45–50 for offices; 55+ for confidential spaces).
- Consider mass-loaded materials, air gaps, and resilient channels.

Door

- Match door STC to wall.
- Use gasketing, acoustic thresholds, and automatic door bottoms.

Floor/Ceiling

- Prevent flanking with underlayments and ceiling plenums sealed or blocked.
- Ensure partitions extend to structural floors/ceilings.

Sealing & Finishing

- Seal all penetrations, joints, and edges with acoustic caulk or putty.
- Avoid air gaps — even small ones drastically reduce sound performance.



Architect's Checklist for Acoustical Partitions		
✓	Element	Key Action
☐	Wall	Choose construction with high STC, use insulation, decoupling, or mass
☐	Door	Specify acoustic doors with seals and matched STC
☐	Flanking	Identify all alternate sound paths, including ceilings, floors, ducts
☐	Sealing	Apply acoustical sealant at all joints, edges, and penetrations
☐	Integration	Ensure the partition functions as a complete acoustic system



Conclusion

In architectural acoustics, no component exists in isolation. A wall is only as good as its weakest junction. A high STC partition means nothing if sound bypasses it through an unsealed duct or door gap.

Effective sound control demands system-level thinking, attention to construction detail, and informed product selection.

By anticipating sound behavior and treating every part of a partition as acoustically active, architects can deliver spaces that are both private and peaceful.

Designing Effective Acoustic Door Assemblies

Why Doors Matter in Sound Control

In acoustical architecture, the **door opening is often the weakest point** in a partition. It can undo the performance of a carefully engineered STC-rated wall if not treated as part of a complete acoustical system.

Effective sound isolation in doors **depends not just on the door panel**, but on how all components—**door, frame, gasketing, and hardware**—function together.

Sound moves through any available path—**cracks, gaps, seams, and rigid connections**. Even the most massive door won't perform acoustically if it lacks quality seals or is poorly integrated into the wall.

Industry Standard for Door Assemblies

When evaluating acoustic performance, architects should reference **ASTM E90-09**—the *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements*. This is the standard by which complete door assemblies (not individual parts) are tested.



SOUND CHECK: Always look for third-party lab-tested, rated door assemblies—not just individual door slabs with claimed “soundproof” characteristics.

Start with Solid-Core Doors

When seeking to improve sound isolation, a solid-core door is an effective first step before investing in specialized acoustic doors. Hollow-core doors allow sound to pass easily, while solid-core doors provide greater mass and density—key factors in reducing sound transmission. In many interior applications, especially offices, classrooms, and patient areas, upgrading to a solid-core door alone can provide a noticeable improvement in acoustic performance. For projects with higher sound isolation requirements, this foundation can then be enhanced with seals, thresholds, and, if needed, fully tested acoustic door assemblies.

Key Components of an Acoustic Door Assembly

Effective sound control in doors relies on four interdependent components—door surface materials, core construction, perimeter seals and frame design—that work together to block, absorb, and contain sound.



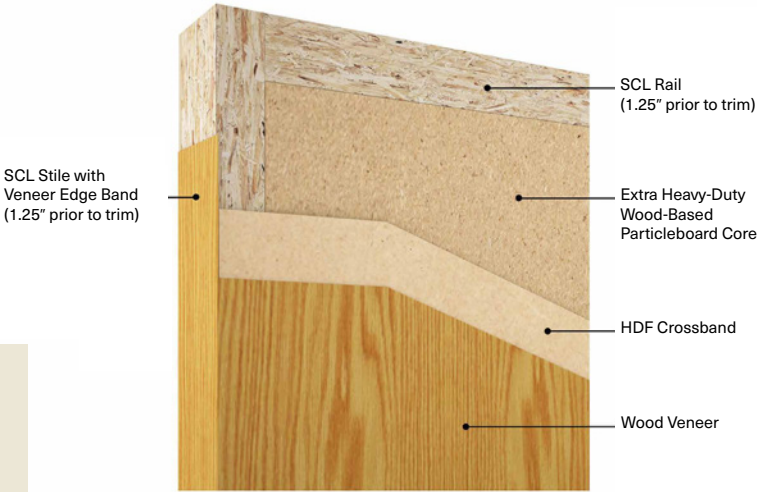
Surface Materials

The surface materials of an acoustic-rated door play a crucial role in its performance, as the choice of outer material directly affects both sound reflection and damping properties. The following table highlights common door surface materials and their impact on sound behavior.

Material Type	Sound Behavior
Metal or solid wood	Reflective; blocks but doesn't absorb
Fiberboard	Absorptive; helps dampen sound
HPDL	Slightly absorptive; performance varies
Wood Veneer	Reflective; similar to solid wood



SOUND CHECK: Choose door surfaces based on both aesthetic and acoustic context— reflective materials may be suitable in office corridors, while absorptive ones fit private offices or studios.



Common Door Construction Materials

Absorption Core

The **core** plays a critical role in **dissipating sound energy** as it passes through the door.

Common Core Materials:

- **Gypsum or mass loaded vinyl sheets:** Excellent for absorbing high-frequency sounds
- **High-density fiberboard (HDF):** Blocks and damps low-frequency noise
- **Natural fiber composites:** Sustainable options with good performance

Look for doors with certified acoustic cores designed for STC 35, 40, 45, or higher.



Portion of an STC-rated door

Perimeter Seals

Even **small gaps around the door frame** can drastically reduce STC performance.

Key Considerations:

- **Continuous perimeter gasketing (top and sides)**
- **Automatic drop seals for the bottom edge**
- **Flat, uniform contact surfaces between door and frame**
- **Correct compression**—too tight or loose reduces performance

A 1% air gap around the door can reduce sound isolation by up to 50%.



Pemko Acoustic Seal

Door Frame Design

The **frame** must be considered as part of the assembly. A poor frame detail can create vibration paths or air gaps that ruin isolation.

Options & Techniques:

- **Single rabbet frame:** Basic isolation on one side
- **Double rabbet frame:** Better seal on both latch and hinge sides
- **Split frame:** Decouples interior and exterior structure for higher STC
- **Frame fill:** Use of grout or sound-deadening fibrous material
- **Sealing frame voids:** With caulking or damping compound



SOUND CHECK: For STC ratings above 40, specialized acoustic frames are recommended.

Design Integration Tips for Architects

To ensure the door assembly meets the acoustic goals of the space, here are some recommendations for each design phase of your project:

Design Phase	Action Item
Specification	Use lab-tested assemblies with published STC ratings
Detailing	Coordinate jamb and threshold conditions to accept seals
Scheduling	Match the door's STC with the wall partition's STC for continuity
Installation	Ensure precise alignment, frame plumbness, and seal compression

Below is an example of recommended specifications for a door and wall assembly designed to improve acoustic performance.

Component	Recommended Specification
Wall Construction	Double layer gypsum + insulation (STC 45)
Door Leaf	Solid-core door with HDF, gypsum, or mass loaded vinyl core (STC 45)
Frame	Double rabbet hollow metal, grout-filled
Perimeter Seal System	Magnetic gasketing + automatic drop seal
Threshold	Raised threshold or full acoustic saddle



Conclusion: Don't Let the Door Be the Weak Link

A common architectural mistake is to spec a high-STC wall and a standard door, compromising the entire partition system. Acoustic door assemblies are **not just doors**—they are precision-engineered **systems** of material, hardware, and seals, designed to perform together.

By selecting and integrating properly rated door assemblies, architects can maintain acoustic integrity, uphold privacy, and meet code or client expectations—whether for offices, education, hospitality, or healthcare.

Sound Control in Commercial Applications

Designing for Acoustic Performance Across Industries

Good acoustics are essential in a wide range of commercial environments, directly influencing comfort, functionality, and even profitability. Whether it's ensuring privacy in healthcare settings, providing tranquility in hotels, enhancing focus in educational institutions, or supporting productivity in offices, architects must be intentional about acoustic design—particularly in the selection and integration of **STC-rated door assemblies**.



Why Acoustics Matter in Commercial Spaces

Sound waves travel like water—they seek the path of least resistance. This makes comprehensive design critical: the performance of any acoustic partition is only as good as its weakest element. For example, if a wall has a high STC (Sound Transmission Class) rating but is paired with a low-rated door assembly, the overall sound control will suffer. Effective acoustic management requires every element—walls, doors, floors, frames, and seals—to work in concert.



Acoustic Applications by Industry

Healthcare Facilities

Hospitals are dynamic, high-noise environments. Machines, alarms, and human activity all contribute to a soundscape that can hinder recovery, disrupt sleep, and interfere with privacy.

Key Acoustic Priorities:

- **Patient Wellbeing:** Quieter environments improve rest and recovery, positively affecting patient satisfaction scores and outcomes.
- **Staff Performance:** Reducing distractions helps clinicians focus.
- **Confidentiality:** HIPAA regulations demand protection of sensitive conversations.

The World Health Organization (WHO) recommends hospital noise levels should not exceed 35 dB. Yet many hospital environments exceed 68 dB, with peaks over 90 dB.

Acoustic Strategies:

- **Same-handed patient room layout:** Increases spacing between doors, minimizing sound transmission.
- **Sound-rated door assemblies:** Limit noise in corridors, offices, meditation spaces, and patient rooms.
- **Silencer pads & soft-closing hardware:** Reduce door closing noise.



Hospitality Settings

Guests expect peace, quiet, and comfort. In hotels, noise is among the top five guest complaints, which can directly affect brand perception and revenue.

Key Acoustic Priorities:

- **Guest Satisfaction:** Business travelers need quiet for productivity; leisure travelers for relaxation.
- **Operational Shielding:** Reduce noise transmission from laundry rooms, kitchens, and back-of-house operations.

Acoustic Strategies:

- **STC-rated guest room doors:** Especially exterior and connecting doors.
- **Back-of-house separation:** Acoustically isolate service areas.
- **Double-door solutions:** Vestibule-style doors improve isolation.

Data collected from a wide variety of hotel properties show that sound masking can reduce noise complaints by up to 85% and dramatically improve guest scores for comfort and sleep.



Educational Environments

Learning environments must support speech clarity and concentration. Yet schools are often built with hard, reflective surfaces that create echo and amplify noise.

Key Acoustic Priorities:

- **Student Comprehension:** Noise interferes with learning and retention.
- **Teacher Communication:** Vital for instruction clarity.

Acoustic Strategies:

- **STC-rated doors:** For classrooms, libraries, music rooms, and dormitories.
- **Layout considerations:** Avoid placing doors directly across from one another.
- **Material enhancements:** Acoustic ceiling tiles, panels, carpeting, and soft dividers help absorb sound.

ANSI S12.60-2010 sets strict acoustic standards for schools due to the link between noise control and academic performance.



Office Environments

Acoustic control is becoming a key factor in workplace satisfaction and productivity—especially in the post-COVID era of hybrid work.

Key Acoustic Priorities:

- **Concentration:** Excess noise decreases productivity.
- **Wellbeing:** Affects stress levels and overall morale.
- **Confidentiality:** Especially important in meeting rooms and executive offices.

A study published by npj Digital Medicine reveals that optimal workplace sound levels are around 50 dBA.

Acoustic Strategies:

- **STC-Rated Doors:** Essential for private offices and conference rooms.
- **Design Spacing:** Avoid placing office doors directly across from each other.
- **Absorptive Materials:** Use ceiling tiles, carpets, wall panels, and modern desk dividers.

According to Interface, Inc. "What's That Sound?" workplace acoustics study, 50% of employees have rejected job opportunities due to poor office acoustics, and 16% moved to remote work to avoid noise.

Holistic Acoustic Design for Architects

When specifying acoustic doors for commercial use, architects must go beyond just door selection. Consider the complete door opening assembly, including:

SURFACE MATERIALS	ABSORPTION CORE	PERIMETER SEALS	DOOR FRAMES
Reflective surfaces like metal and wood can block sound, while materials like fiberboard offer absorption.	Use dense or fibrous cores like mass loaded vinyl, gypsum, fiberglass, or high-density fiberboard (HDF) for improved sound control.	Properly fitted gaskets and seals at the frame and threshold prevent sound leakage—a critical factor in achieving high STC ratings.	Use acoustic-rated metal or wood frames. Double rabbets and filled cavities (with grout or fibrous material) significantly improve performance.

Always verify door assemblies with STC ratings based on ASTM E90-09 — the industry standard for measuring airborne sound transmission.

Final Thought

Architectural acoustics aren’t just about science—they’re about experience. From the serenity of a hotel room to the focused silence of a school exam room, effective sound control enriches lives and improves functionality. It’s up to architects to ensure that these expectations are met through thoughtful design and proven acoustic strategies.



Practical Considerations for Designing and Specifying Materials for Optimal Building Acoustics

Understanding STC Ratings and Acoustic Doors

When evaluating acoustic doors, it's important to remember that performance is determined by the **entire assembly**—not just the core. The combination of the door, frame, seals, and gasketing defines how much sound is blocked. The corresponding table outlines typical STC ranges for door assemblies and what level of sound control each provides.



Typical STC Ratings Based on Core Type

Different solid core materials deliver varying levels of acoustic performance. It's helpful to know what to expect when weighing available products:

Acoustic Door Assemblies by STC Rating			
Tier	STC Range	Assembly Features	Performance
Good	30-34	Standard commercial interior hollow-core wood or metal door	Suitable for general interiors; minimal sound control
Better	34-39	Solid-core door + gasketing and seals	Blocks low speech, but not loud voices or higher noise
Best	40-50	Acoustic core + gasketing and seals	Blocks loud speech; stronger sound isolation
High-Performance	50-60	High STC core + gasketing and seals + filled frame (grout/fibrous)	Maximum sound reduction; stops noise leakage through gaps



SOUND CHECK: It's worth noting that STC differences of a point or two are generally imperceptible to the human ear. For example, a door with an STC rating of 43 versus 44 is unlikely to significantly impact occupants.

Specifying STC-Rated Doors and ASTM Standards

When choosing doors, it's important to understand how the Sound Transmission Class (STC) rating is established. Doors should be tested according to the latest ASTM standards, ideally by an independent laboratory to ensure objectivity and accuracy. The STC rating is determined through standardized laboratory methods defined by ASTM International, including:

ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E413 – Classification for Rating Sound Insulation

These standards outline how building elements, including doors, are tested across frequencies and how their sound insulation performance is expressed as a single-number STC rating.

Two Types of STC Ratings

Acoustic-rated doors can carry **two types of STC ratings**, and the difference is significant:

- **Sealed-in-place rating:** This rating is based on laboratory testing under perfect conditions (e.g., completely sealed with no air gaps). It represents the **best-case** performance but may not reflect real-world use.
- **Operable rating:** Tested in a real-world scenario, including opening and closing. It factors in **seals, hardware, and installation quality**, and provides a more **accurate depiction** of expected in-field performance.



Importance of the Complete Door Assembly

An STC rating reflects the performance of the entire tested door assembly—not just the core, slab, or individual components. Substituting elements such as glazing, seals, or hardware that were not included in the original tested assembly can compromise sound performance and invalidate the STC rating.

Such substitutions often arise from miscommunication among architects, builders, distributors, and manufacturers. When a component is changed, the manufacturer must inform all stakeholders that the original STC rating no longer applies. To maintain compliance, options may include revising the specifications or commissioning an engineering evaluation through a certified testing agency, which may incur additional costs.



SOUND CHECK: Swapping out components like seals, glazing, or hardware can reduce sound performance and void the rating. Always confirm changes with the manufacturer before making substitutions.

The Role of Acoustical Consultants

As mentioned earlier, it is recommended that **architects consult with acoustical engineers** to ensure their designs meet acoustic performance requirements. These professionals specialize in noise and vibration management and can:

- Design **noise-reducing treatments**
- Conduct **sound studies**
- Identify **acoustical weaknesses**
- Collaborate with architects, contractors, and manufacturers on **custom sound control solutions**

In projects with **strict acoustical criteria**, **post-installation testing** may be required. This involves testing the installed door system to ensure it performs **within 3 to 5 STC points** of its rating. Acoustical consultants can help plan, manage, and verify STC-rated installations.



The Necessity of Trusted Contractors

Sometimes, a project uses all the right materials and ratings, yet still delivers **inadequate sound performance**. This is typically due to:

- Poor assembly connections
- Improper installation techniques
- Inexperienced builders

Therefore, it's **vital to vet construction teams** for experience with **STC-rated assemblies**. Choosing **qualified contractors** with a track record of success in acoustic installations can prevent costly post-construction corrections and ensure intended performance is met.



SOUND CHECK: Installation errors that create gaps, poor seals, misaligned frames or wrong fasteners can reduce performance by 5-10 STC points or more.

The Value of Acoustic Awareness in Design



A comprehensive understanding of the critical role acoustics play in **commercial environments** — both the science behind sound control and its impact on occupant **health and wellness** — can provide valuable insight into the design and construction process. Sound travels through many potential pathways in building assemblies, and **door systems** have a measurable impact on overall **acoustic performance**. Especially when planning **healthcare, hospitality, education, and office buildings**, equipping architects with practical knowledge and strategies for **designing and specifying** door systems can greatly improve acoustic comfort, reduce occupant complaints, and ensure buildings meet or exceed their performance targets.



NEXT STEPS

To take the next step in delivering high-performance acoustics in your projects:

- **Access acoustic product specifications and BIM files** to streamline planning and integration.
- **Request a consultation** with an acoustical expert or obtain **acoustic lab test data** to ensure the right solution for your application.
- **Continue your education** by enrolling in a **CEU course or webinar on architectural acoustics** to deepen your understanding of best practices, compliance standards, and innovative solutions.

Prioritizing acoustics from the early design phase through construction ensures your projects deliver environments that are healthier, more private, and better suited to the needs of occupants.

Appendix

Glossary of Key Acoustic Terms

- Absorption** – The process by which soft or porous materials reduce sound reflections and reverberation within a room by converting sound energy into heat.
- Airborne Sound** – Noise transmitted through the air (voices, music, traffic) that passes through walls, doors, ceilings, and gaps.
- Decibels (dB)** – A logarithmic unit for measuring sound intensity. A 10 dB increase is perceived as roughly twice as loud.
- Decoupling** – A sound isolation strategy that physically separates structural components to limit vibration transfer (e.g., double-stud walls).
- Damping** – The use of materials or compounds to reduce vibrations within structures, thereby lowering transmitted sound.
- Flanking Path** – An indirect route through which sound bypasses a partition (e.g., via ductwork, ceilings, or floors).

- Frequency (Hz)** – The pitch of a sound, measured in cycles per second. Human hearing ranges from ~20 to 20,000 Hz; speech typically spans 125–8,000 Hz.
- Impact Insulation Class (IIC)** – A measure of a floor/ceiling assembly’s ability to block structure-borne impact noise such as footsteps.
- Mass** – The use of dense materials (concrete, gypsum, laminated glass) to resist sound penetration, especially effective against mid- and high-frequency sounds.
- Reverberation** – The persistence of sound in an enclosed space due to repeated reflections, impacting speech clarity and comfort.
- Sound Transmission Class (STC)** – A single-number rating of how well a partition (wall, door, window, etc.) blocks airborne sound. Higher STC = better performance.
- Transmission Loss (TL)** – The difference in sound level (in dB) measured on either side of a partition, indicating its sound-blocking effectiveness.

Architect’s Acoustic Checklist

Design Phase

- ☐ Identify project-specific acoustic priorities (privacy, concentration, wellbeing).
- ☐ Reference applicable standards (LEED, WELL, ANSI, IBC).
- ☐ Set target STC ratings early in design documents.

Walls & Partitions

- ☐ Select high-STC assemblies appropriate for use (STC 45–65).
- ☐ Use insulation, double-stud, or staggered-stud walls to minimize transmission.
- ☐ Ensure partitions extend full height to the structural deck.

Doors & Frames

- ☐ Specify acoustic-rated door assemblies, not just slabs.
- ☐ Match door STC rating to adjacent wall rating.
- ☐ Include perimeter seals, automatic drop bottoms, and grout- or fiber-filled frames.

Floors & Ceilings

- ☐ Use underlayments or floating floors to reduce impact noise.
- ☐ Prevent plenum flanking by sealing or baffling ceiling systems.
- ☐ Coordinate with mechanical design to reduce HVAC noise.

Seals & Penetrations

- ☐ Seal all junctions, gaps, and penetrations with acoustic caulk or putty.
- ☐ Treat electrical boxes with putty pads; stagger placement.
- ☐ Confirm ductwork includes silencers or acoustic baffles.

Construction & Quality Control

- ☐ Vet contractors for experience with acoustic assemblies.
- ☐ Require third-party lab-tested assemblies and verify operable STC ratings.
- ☐ Inspect installations to confirm seal continuity, frame plumbness, and material integrity.



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