ACOUSTICS FOR HOSPITALITY 101

COMMON CAUSES OF HOTEL NOISE AND THEIR PROVEN SOLUTIONS

BY DAVID WRIGHT AND BOB WINTER

Good acoustics helps to provide a positive guest experience — perhaps the most important goal in the hospitality industry. Unfortunately, noise is a frequent hotel complaint and is becoming even harder to control with certain architectural styles. This leaves owners in the position of trying to determine what can be done to mitigate a noise problem with better design while also providing an early and reliable prediction of the results.

Architectural designs that feature large window areas and high ceilings are among some of the common causes of poor acoustics. The fallout from COVID-19 also has the potential to add noise as some designers and owners consider finishing guest rooms with hard, cleanable surfaces in lieu of sound-absorbing materials such as carpet and drapes. While helping to mitigate viral growth, hard flooring and solid surfaces also make spaces louder.

This executive guide provides a high-level examination of the acoustic challenges faced by the hospitality industry and offers a brief look at design solutions that can be considered. Understanding that every facility has unique characteristics, needs, and goals, the guide has been written not as a one-solution-fits-all document but as a starting point for any architect and owner who wish to examine ways to improve a property's guest experience.

Analyze, integrate, design

Acoustic comfort cannot be successfully addressed through a vendor's casual opinion or a simple prescription based on a product manufacturer's marketing claims. This is because acoustic products almost never provide solutions unless they are part of a comprehensive acoustic design.

To achieve the best outcome, an acoustical analysis must be conducted early in the design process to predict the appropriate design needs for noise control, clear speech, and guest privacy. This early effort provides the most effective, balanced, proactive, and seamless integration of acoustical treatments with the rest of the project design. These treatments include room-to-room sound isolation, room interior acoustics, mechanical noise control, and upper-room to lower-room footfall noise control.

Such an integrated acoustical analysis by the design team can predict and solve issues that commonly occur in a variety of hotel spaces, including:

- **Guest rooms** with poor sound isolation between adjacent rooms and footfall noise from above, both of which interfere with privacy and sleep. Typical acoustic design will rate a wall or floor barrier for the degree of abatement in advance, and balance treatments with the architectural design early in the process. For example, specifying the proper wall assembly (see Figure 1) and proper detailing of concrete floor slabs is critical to successful acoustic comfort. New and innovative approaches also can include sound masking of higher ambient noise that needs to be made less distracting.

- **Large conference rooms** that do not allow acceptable speech clarity for groups of occupants who are trying to engage naturally with one another. In addition, poorly designed sound systems in such rooms regularly make these spaces even worse. Furthermore, as virtual meetings continue to be used widely, simple rental or portable loudspeakers often used in these rooms do not have adequate impact or consistent clarity. An integrated but simple "built-in" technology solution is a best practice, with systems

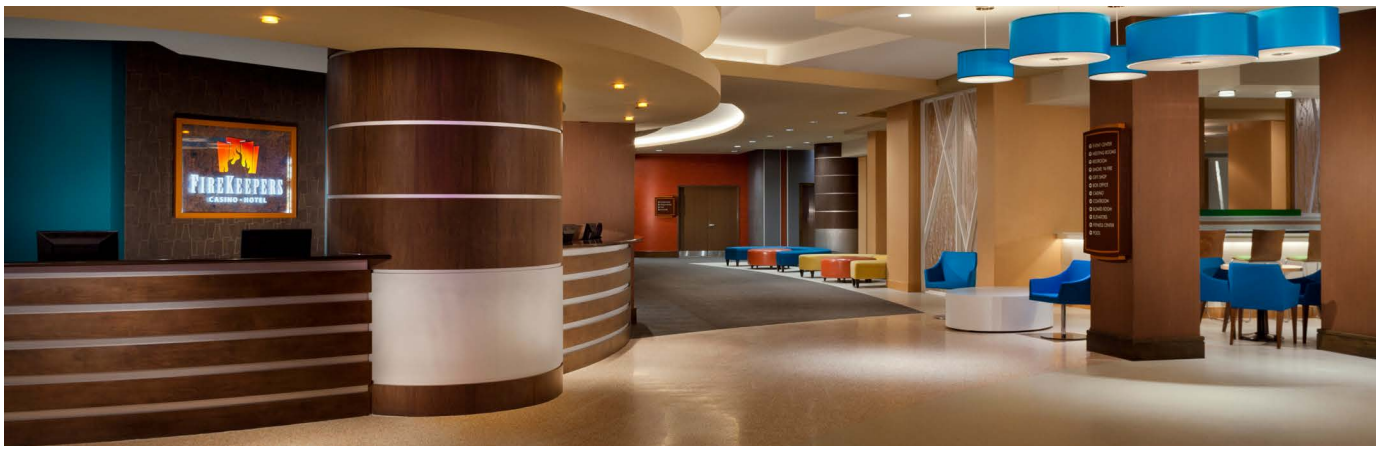
matched for room sound performance as part of the design effort.

• **Dining areas** with a preponderance of hard surfaces that often lead to a "noise avalanche" effect. This occurs when people innately talk louder to overcome higher ambient noise. Materials such as acoustic plaster, perforated wood panels, and lighting fixtures with built-in acoustical attributes are effective solutions that perform well without detracting from the aesthetic qualities of the space. Lighting designs with noise attributes are a relatively new development for noise abatement but they require an acoustical calculation in addition to a lighting designer's recommendation.

• **Spaces such as lobbies**, dining, and amenity areas with high ceilings, which can increase destructive echo and room reflection. A simple acoustic calculation can inform the design of the space, making modifications to ceiling heights and incorporating canopies and clouds that can significantly lower the need for expensive noise treatment. There is also a category of advanced ceiling systems in most ceiling vendors' palettes that have acoustical properties that provide an effective solution. Often a simple slatted, perforated, or louvered system can be used to solve an acoustical requirement without adding the ubiquitous cloth-covered wall panel.

• **Small and medium-sized conference rooms or business centers** in which small groups of people sitting around tables may not have clear speech, particularly for attendees joining from remote locations. This can be due to a variety of factors including mechanical noise or hard surfaces with glass, all of which conspire to produce more room noise due to reflection buildup. A simple approach is to remove absorptive ceiling products installed directly over a table and create a closer, hard reflecting surface such as a cap ceiling, coffer, or "cloud" nearest the seats. This results in much more speech support near the talkers and listeners while retaining noise absorption in the more distant perimeters of the room. New audio-visual technology with discrete, flat-ceiling mics also can provide better acoustics. This eliminates the need for loose table mics or portable "hubcaps" for conference calls.

For these and other spaces, a comprehensive analysis early in the design process can provide higher performance, often at less overall cost



since fewer acoustical components are required. Following are examples of some of the most common design strategies utilized.

Interior sound isolation

Adding more mass such as extra layers of gypsum wallboard is a common approach and can somewhat increase a wall assembly's sound isolation. Going beyond one or two extra layers, however, provides diminishing improvement and adds unnecessary additional cost and wall thickness. Adding more mass may even deteriorate sound isolation qualities. For example, adding a third pane of glass to a window can be a consideration for energy improvement but does little to improve noise control (as is commonly believed). This "triple pane resonance" — employing three panes of the same thickness and same air gaps between them — lowers the barrier effectiveness with respect to acoustics, and it adds cost. An approach in the construction of demising walls adds an interstitial solid panel between a double stud wall, resulting in dual cavities as illustrated in Figure 1. In this "triple leaf effect," efficient resonance inside the assembly lowers the sound isolation rating. The barrier value "STC" (sound transmission class) seen in the chart is a widely used single-number rating of barrier effectiveness; a higher number corresponds to better acoustical isolation. For example, an STC 40 barrier could result in a guest's perception of noise being twice as loud as what might be perceived with a barrier rated STC 50.

Triple Leaf Effect

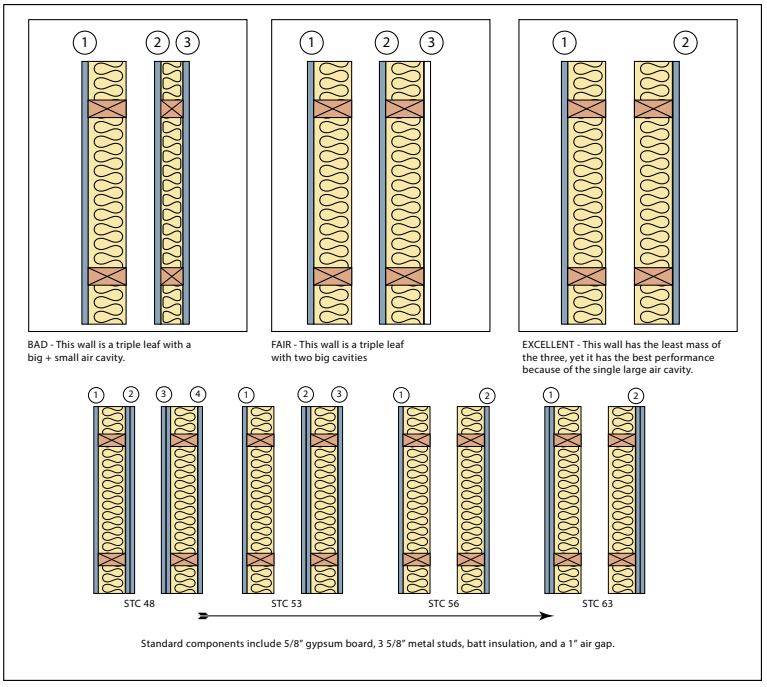


Figure 1

Figure 1 demonstrates that it is possible to build a cheaper partition with less material and better performance. In addition, simple attention to details is far more productive, again at less cost. Details that matter in the wall framing include stud spacing and stud gauges (lighter is better than heavy); other important details include gaskets, sealing, door seals, and proper spacing between glass panes. These are all essential to achieving an integrated and successful noise design.

Finally, beware of the common misconception that soft absorptive panels or batt insulation alone can be effective for sound isolation. These products are not useful when used alone, as they offer little mass and no significant acoustical barrier. When used in combination with an air gap inside a proper wall construction, uncompressed batt insulation only helps acoustical performance moderately. Soft acoustic wall panels, meanwhile, never add barrier value to the wall on which they are mounted.

Room acoustics

Every room has a characteristic acoustic "voice" or "signature" that people hear and respond to. This is determined by room size and a total of the surfaces. For example, rooms with large glass areas, hard floors, and fewer soft elements reflect more sound and have reverberance that builds noise. For a conference room or ballroom this can have a positive or negative effect for speech clarity, depending on where talkers and listeners are seated. Excess room reflection or echo reduces speech clarity and undermines a good conference call that needs to sound professional.

Room noise control is also a factor of the external environment. For example, resort spaces with large doors that open to a quiet exterior (for example, a golf course or beach) enable the outdoors to act as a large absorption element. Opening the doors can reduce the noise impact of the room's hard elements since the noise, upon leaving the space, never returns. A similar room in an urban environment — with solid walls all around or large windows that remain closed — will present much more room noise. Fortunately, these variables are predictable during the design phase.

Acoustic balance is always the solution. This means predicting and incorporating the right combination of various treatments to achieve acoustic comfort in context with the programming. For example, adequate, but not too much, room reflection is needed for a conference space. Likewise, some reflection makes a dining room feel lively, but excessive reverberation quickly results in a negative experience. Achieving acoustic balance, therefore, is neither prescriptive nor a cut-and-paste product approach. Early analysis, attention to detail, and integration with the architectural palette with appropriate materials will result in a more discerning and successful outcome that can be aligned with the owner's budget.

Sound scaping

Though it may seem counterintuitive, making additional noise can provide better acoustic comfort if applied properly. This approach, called "sound scaping" (technically different from "sound masking"), can be used to generate innocuous but controlled noise in guest rooms. Such simple yet carefully adjusted ambient noise can provide a significant improvement and overcome noise intrusion, leading to fewer noise-related complaints and an improved guest experience. The approach can be used to address issues identified during the design phase or for remediation of an existing problem.

Sound scaping covers up speech and TV noise transmitted from an adjacent room. It also can cover up environmental sound from a poorly sealed or thin window assembly, or from an undercut on the entry door. It should never be visible, however, and can be achieved by utilizing a small speaker discretely installed or hidden in an outside corner of the space. The sound from the speaker — if carefully preset and low — moderates the "too-quiet" levels within the room that "expose" the neighboring noise intrusion.

Such sound scaping also can be used to cover annoying intermittent noise that can disturb sleep. For example, a thin window assembly directly facing a highway (typically 75 to 80 decibels) will let in too much noise for many guests to be able to rest. Sound scaping would moderate the room noise to be a consistent level and reduce impulse sounds that intrude.

Mechanical noise control

Noise control for a positive guest experience cannot ignore the effect of mechanical noise from HVAC systems. Though such systems are strategically located to be remote from guest rooms, noise issues still can occur whether they originate from roof-mounted equipment above the top floor units or from mechanical equipment rooms located below the guest rooms on a lower level.

For example, air handling units that are not well isolated can spread fan and AHU housing noise to nearby rooms. Chillers and other major equipment also can produce grating machinery tones. Adding a "noise wrap" to the chiller compressor and to the chiller piping (since the piping acts as a conduit of the compressor noise) can be an effective solution.

Some "remedies" applied to these situations remain lacking, however. For example, architectural "screens" for rooftop-mounted mechanical equipment can be beneficial, but not if the equipment is located on a low roof with a guest tower extending above it. Additionally, screens that are slatted do little to abate noise that can disturb guests (especially at night when everything else is quieter). Likewise, surrounding the equipment with short, massive masonry walls but no roof allows an easy path for noise to travel over the tops of the walls or reflect from side walls unabated.

Again, these noise issues are all predictable if considered by an acoustic engineer and should be part of the early-design acoustical analysis on any project.

Getting started

As stated in the introduction, this guide was designed to provide a high-level introduction to the common acoustics challenges faced by the hospitality industry and the strategies and treatments that can lead to successful solutions. Using the information provided here, owners and architects can better understand the causes of poor acoustics and begin to gauge if and how their existing building or new construction project might be at risk.

For those who need acoustic solutions and decide to seek guidance for a successful outcome, it is critical to remember:

- Acoustic products alone are almost never acoustics solutions.
- A balance of acoustic treatments is almost always the better solution.
- Acoustical treatments should be integrated with the rest of the project design.

Most importantly, hospitality owners who want to minimize noise or optimize their property's acoustic performance should include an acoustics scope early in their new construction or renovation project. Having an acoustic consultant as a member of the design team results in a collaborative, integrated systems approach and leads to the best outcome at the lowest cost.

Finally, keep in mind that while a room with good acoustics may go unnoticed, poor acoustics will be recognized immediately.

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