CRAFTING THE PERFECT SOUNDSCAPE: VIJAY BENEGAL and MUJEEB DADARKAR Dive into Control Room Acoustics

When two industry stalwarts join forces, the results are bound to resonate—literally and metaphorically. ***Vijay Benegal*** *and* ***Mujeeb Dadarkar****, co-founders of* ***Odble****, acoustics and audio systems consultants and esteemed members of the* ***IRAA 2024 Jury****, brought their deep expertise to the stage at* ***PALM Expo 2024*** *in May. With decades of experience in acoustics and sound design, the duo shared their insights on optimising control room acoustics in an engaging session that left the audience inspired and informed. Known for their work behind the scenes to recognise the industry's top talent at the* ***IRAA Awards****, Benegal and Dadarkar are no strangers to the intricacies of sound. From the key principles of acoustic treatment to practical advice on designing control rooms, read on to uncover how these visionaries are shaping the future of audio.*

Why Control Room Acoustics Matter

Setting the tone for the session, **Mujeeb Dadarkar** explained the importance of accurate acoustics in control rooms. "You need a control room which gives you repeatable results," he stated. "This means you hear something in that control room, you mix based on it, and that mix should sound correct elsewhere."

He elaborated that achieving this requires addressing three critical factors: the room itself, the speaker system, and their interaction. "You do not always have the best speakers in the world. And even if you do, you might not have the best room. Together, they determine the sound of your control room," he added.

Understanding Isolation vs Internal Acoustics

A key highlight of the discussion was the distinction between isolation and internal acoustics, often misunderstood as a single entity. **Vijay Benegal** clarified:

"Isolation essentially means we are trying to prevent sounds from outside the room entering the room and sounds from inside the room should not go outside. Internal acoustics, on the other hand, is about the quality of sound within the room—how it bounces off walls, gets absorbed, or remains neutral."

Dadarkar added a humorous analogy to debunk common misconceptions:

"People ask if soundproofing can be 80 per cent effective. That's meaningless. Soundproofing isn't like waterproofing. Imagine someone telling you a window is 99 per cent waterproof. Would you accept that? Soundproofing either works, or it doesn't."

L to R: Mujeeb Dadarkar and Vijay Benegal at the Control Room Acoustics at PALM Expo 2024

The Science Behind Ratings: STC and NC

The duo spoke about the metrics used to quantify isolation and internal noise: **STC (Sound Transmission Class)** and **NC (Noise Criterion)**. Dadarkar explained:

"STC measures the difference in sound levels between the outside and inside of a room. For instance, if the outside level is 80 dB and inside it's 50 dB, that's STC 30." He noted that achieving high STC ratings, particularly over 60, is both challenging and expensive.

NC, on the other hand, gauges residual noise within the room, often stemming from equipment like fans or air conditioning systems. Benegal emphasised:

"While STC focuses on external-to-internal isolation, NC includes internal factors like the noise from your AC or other machinery. Achieving an NC rating of less than 20 is excellent, and 20–30 is ideal for a control room."

Building for Isolation: Techniques and Challenges

Discussing construction methods, Dadarkar introduced the concept of a floating floor. “It’s essentially creating a slab isolated from the existing structure. This can be done through civil engineering or carpentry. Civil work is cheaper and more effective, but carpentry might be necessary due to load constraints.”

He cautioned against hiring generic contractors, stating, “Commercial contractors, even if skilled at building offices, often lack the precision required for studio construction. Studio construction demands expertise across disciplines, including structural engineering, air conditioning, and electrical design.”

Benegal stressed the importance of location in isolation: “A lower floor or a basement is often better for reducing noise, but even basements have challenges, like sound transmitted through the ground from nearby railway stations or heavy machinery.”

The Battle with Air Conditioning

One of the most overlooked aspects of control room design is air conditioning. Benegal highlighted its dual role as both a necessity and a source of noise. “Air conditioning means airflow, and airflow means turbulence, which generates noise. Properly designed duct systems with acoustic silencers are essential,” he noted.

He elaborated on the types of systems, “A ducted setup is preferable. Split air conditioners can be adapted for ducting, reducing noise. Window units, and unducted split units while common, often have to be turned off during recording sessions to avoid interference.”

The Imperfect Science of Acoustics

Dadarkar acknowledged that despite advancements, acoustics remains an imperfect science. “We know a lot, but we can’t control everything. Even in well-designed rooms, there’s always hope that the room turns out neutral. If you’re lucky, it’s good. Mostly, you end up fixing problems that shouldn’t have existed in the first place.”

The unpredictability is particularly pronounced in small rooms. “Designing large rooms is easier. In small rooms, it’s impossible to fix all problems, especially with the rise of home studios where people expect professional results in compromised spaces,” he said.

Balancing Efficiency with Silence: The Air Conditioning Dilemma

Dadarkar opened the session by addressing a common but significant challenge in control room acoustics – air conditioning. While air conditioning consultants prioritise efficiency, requiring high-velocity airflow to cool spaces quickly, this is at odds with the acoustic requirement for low-noise environments.

"The AC consultants are preoccupied with efficiency, which makes sense because they want to cool the room as quickly as possible with the least energy expenditure," said Dadarkar. "On the other hand, we prioritise low noise, and high-velocity air is our enemy in this regard. The two objectives don’t shake hands."

He highlighted the ongoing tug-of-war between acousticians and AC consultants, noting that acousticians often have to insist on systems that prioritise noise control. "At the end of the day, the NC rating will rule. If we need NC 25, the AC system must align with that requirement."

Sealing the Deal: Doors, Windows, and Sound Locks

Dadarkar shifted focus to architectural features, particularly doors and windows, which are common culprits for noise leakage. He explained the importance of soundproof doors, characterised by stepped profiles and frames on all four sides.

"Regular doors have a gap at the bottom, which is a prime source of air and noise leakage. Soundproof doors eliminate this with proper seals," he noted.

The conversation also touched on the need for sound locks – intermediary spaces between the control room and the external environment – to act as air seals. Where space is limited, installing dual doors can serve as an alternative.

Windows, too, are a critical component. "Sliding windows are a no-go for studios. Casement windows, with solid or laminated glass, are the preferred choice," Dadarkar emphasised. He further elaborated on the necessity of using panes of different thicknesses to avoid vibrational frequencies passing through. "If both panes are of the same thickness, they will vibrate at the same frequency, allowing sound to travel through easily."

Geometry and Modes: The Role of Room Design

Turning to room acoustics, Vijay Benegal delved into the importance of room geometry in influencing spectral response and reverberation. He explained how room modes – frequencies amplified due to room dimensions – can cause resonance.

"Parallel walls are particularly troublesome as they support standing waves. If dimensions coincide or align in multiples, resonances overlap, making the room sound terrible," Benegal said. He discussed solutions like avoiding parallel walls or adhering to "golden ratios" for room dimensions to minimise coincidental modes.

The shape and material of the surfaces further affect reverb time (RT60), a key metric in acoustic design. "RT60 measures how long sound energy takes to decay by 60 dB. A cathedral may have a reverb time of 6 seconds, while control rooms typically aim for 0.2 to 0.5 seconds," he explained.

Tools of the Trade: Absorbers and Their Functions

Benegal and Dadarkar introduced the audience to different acoustic treatments, including broadband and tuned absorbers. Broadband absorbers work across a wide frequency range but are less effective for low frequencies due to their size constraints. "For instance, a one-inch-thick broadband absorber only works for frequencies above 6 kHz. To absorb 100 Hz, you’d need an absorber at least 4 feet thick," Benegal remarked.

Tuned absorbers, though more complex and costly, target specific problematic frequencies. "Helmholtz resonators, membrane absorbers, and tube traps are examples of these. They are designed for precision and occupy less space, making them indispensable in professional setups," Dadarkar added.

Reverberation and Echo: Striking the Right Balance

The session also addressed the difference between reverb and echo. While echoes are distinct reflections delayed by over 100 milliseconds, reverb is a collection of closely spaced reflections that blend together.

"Musicians often prefer some reverb as a dead room can feel uninspiring. However, in a control room, you need minimal reverb to ensure accurate monitoring of the studio’s acoustics," Benegal explained. He noted the current standards, suggesting reverb times of 1 to 1.2 seconds for recording studios and 0.2 to 0.5 seconds for control rooms.

Sound Science Meets Art

Dadarkar and Benegal concluded the session by emphasising the interplay of science and artistry in acoustic design. While technical specifications and measurements provide the foundation, the ultimate goal is to create spaces that enhance creativity and productivity.

"Acoustics is a blend of science and intuition. You need the numbers, but you also need to understand the context – who’s using the space and how," said Dadarkar.

The Science of Absorption: Materials and Their Role

“Absorptive materials play a pivotal role in controlling sound in a room,” explained Benegal. He elaborated on the concept of the absorption coefficient, a parameter ranging from zero to one that indicates how much sound a material absorbs.

“For instance, a large open window has an absorption coefficient of one, as all the sound escapes and doesn’t reflect back. But, of course, you can't rely on open windows because neighbours won’t appreciate the noise!” he quipped, adding a touch of humour to the technical discussion.

Benegal clarified that different materials perform differently across frequency ranges:

“Something that absorbs well at high frequencies may not work as effectively at lower frequencies. This variability is critical, which is why we rely on

charts showing absorption coefficients across different octave bands. The closer the coefficient is to one, the better the material absorbs sound."

Diffusers and Diffraction: Scattering Sound

Switching focus to diffusion, Dadarkar explained the role of diffusers in scattering sound waves. "Diffusers prevent sound from reflecting specularly by bouncing waves in random directions," he said, displaying visuals of various diffuser designs. "Their purpose is to scatter sound and avoid direct reflections that could muddy the mix."

Dadarkar also touched upon diffraction, the phenomenon of sound waves bending around obstacles. "Diffraction can cause problems, especially with monitor speakers," he noted. "At the edges of speakers, secondary waves are created, leading to cancellations and blurring. Rounded edges on speaker designs help mitigate this issue."

Monitors and Mounting: Practical Guidelines

The discussion moved to monitor placement, with Dadarkar offering valuable insights: "Main monitors should be placed as far back as possible, while near-fields need to be closer to the desk to minimise reflections from walls."

He introduced the concept of soffit mounting, a technique where speakers are embedded into a massive, flush surface within the control room. "Proper soffit mounting ensures the speaker surface is flush with the wall, reducing diffraction and enhancing efficiency," Dadarkar said. However, he cautioned that such setups are expensive and require precise room size calculations to avoid issues with room modes.

Simulating Spaces: Software Solutions for Design and Analysis

Benegal highlighted the role of simulation software in designing acoustically sound spaces. "Tools like Ease by **AFMG**, **Catt Acoustics**, and **Odeon** are invaluable for visualising sound distribution in a room before it's built," he said. However, he added a caveat: "These programs are more effective for large spaces than smaller studios, and they come with a hefty price tag."

Once a room is constructed, real-time analysis tools take over to assess its acoustic properties. "Modern analysers, such as **Brüel & Kjær**, provide precise measurements," Dadarkar explained. He demonstrated how these tools generate detailed reports to guide adjustments in speaker calibration and room tuning.

Electronic Corrections: Hardware and Software Approaches

Room tuning isn't limited to acoustic treatments. Dadarkar discussed electronic correction methods using hardware like crossovers, speaker management systems, and programmable EQs. "**Genelec**, for instance, offers in-built DSP with calibration software like **GLM**," he said. "Alternatively, third-party software like **Sonarworks** provides real-time calibration to correct room responses."

He illustrated how these tools transform frequency responses, turning problematic room acoustics into optimised soundscapes. "The goal is to achieve a balanced and accurate listening environment, whether through acoustic treatments or electronic correction," Dadarkar concluded.

Final Takeaways: Merging Science with Practice

The session reinforced the importance of merging scientific principles with practical applications in control room acoustics. From selecting the right materials to leveraging cutting-edge software, Dadarkar and Benegal provided attendees with a comprehensive toolkit to tackle acoustic challenges.

As Vijay Benegal aptly summarised, "Good acoustics don't happen by chance; they are the result of meticulous planning, precise calculations, and a deep understanding of sound behaviour."

The session provided attendees with not just theoretical knowledge but practical insights into tackling real-world challenges in control room acoustics. With their expertise, Mujeeb Dadarkar and Vijay Benegal underscored why careful attention to detail can make all the difference in creating spaces that sound as good as they look.

PALM Expo 2024 once again proved to be an unmissable event for audio professionals, offering valuable lessons for anyone striving to create the perfect sound space.

To view the full conference session, visit the link - https://www.youtube.com/watch?v=CsYGwQdr9ts
*Head to the **PALM Expo Official YouTube channel** for more conference videos on industry pathbreakers!*