**DESIGNING THE QUIET HOSPITAL**

Heather E. Lewis, AIA, NCARB

Animal Arts Design Studios

Boulder, Colorado, USA

Veterinarians, designers, and architects have been talking about how to improve noise control in animal hospitals for a long time. And yet, most hospitals are still loud and clattery instead of the tranquil, peaceful spaces we envision.

Traditional noise control strategies assume that noise has already occurred. What if we focused on preventing noise from occurring as our first line of defense?

* Prevent common, familiar noise. Many of the noises that occur within veterinary hospitals are so common that we don’t even consider that there are ways to prevent them. These include slamming of cage doors, rattling of equipment and furniture, and noises made by audible paging systems. The rule of thumb is that new hospitals should be designed to prevent any unnecessary noise. This should include everything from installing materials that effectively dampen noise to utilizing specially designed quiet latches and hinges on caging.
* Prevent barking. Reducing barking is an important strategy to keep the hospital quiet. For example, installing appropriately sized kennels and caging and preventing dogs from facing each other across aisles.
* Prevent noise in ranges outside of human hearing. Animals perceive frequencies well outside of the range of humans. Cats have excellent hearing in the high frequency ranges. We tend to design buildings for people, and in doing so, may allow for the presence of hideous high-frequency noises and low-frequency rumblings of which we’re not even aware. To help mitigate how this affects the animals in your care, keep all mechanical equipment far away from animal areas, especially cat wards.

If prevention is the first line of defense, then there is less sound to mitigate. This will then allow for the remaining traditional noise reduction strategies to be more effective.

* Reduction. The art and science of choosing materials that best absorb sound.
* Isolation. Constructing walls that prevent the passage of noise from space to space.
* Dissipation. Locating noisy objects at the far end of the hospital away from quiet zones.
* HVAC design. Ensuring that ducts do not act as conduits for noise between spaces.
* Masking. As a last resort, utilizing background white noise to disguise some sounds.

Reduction. Noise reduction within a room is its own unique issue. You may have done your best to prevent excessive noise around the hospital, but even so, each room is its own acoustical environment. Reverberant noise within a space is a big problem in veterinary hospitals because most sanitary finishes do not dampen sound.

The key is to select materials that dampen noise while still achieving the desired level of sanitation. Acoustic materials are rated by a Noise Reduction Coefficient (NRC), with 1.0 representing materials absorbing 100 percent of the reverberant noise that hits them within the laboratory tested frequency range. For example, a typical acoustic ceiling panel may have an NRC of 0.6. Here are some effective materials for use in your hospital:

* Rubber flooring. Rubber is naturally absorptive and has an NRC of approximately 0.5, depending on the specific product.
* Acoustic wall panels. A variety of different hanging and wall-mounted acoustic panels are available. Some are easier to clean than others. For instance, ripstop nylon covered baffles can be wiped clean. Most acoustic wall panels have fiberglass cores and have high NRC ratings. If you want to get the most bang for your buck, use thicker products, as these are more effective in the frequency ranges in which dogs bark.
* Acoustic ceilings. Acoustic "lay in" panel or “t-grid” ceilings may not be stylish but they are ubiquitous in office buildings because they provide a space to run mechanical, electrical, and plumbing systems and because they dampen noise so effectively. Today’s lay-in acoustic products can achieve excellent results. For example, we often use a medical-grade ceiling panel that has a noise reduction coefficient of 0.90, which is well above anything that was available five years ago.

Isolation. One of the most developed bodies of knowledge in architectural acoustics is the science of sound assemblies. Sound assemblies are tested and rated with a Sound Transmission Class (STC), which is a measure of how well a building partition reduces sound. You can get information on the STC of different building assemblies at STCratings.com. Here are a couple rules of thumb:

* Assemblies with greater mass do better. As a result, masonry walls are better at stopping sound transmission than stud walls.
* Sound is like light - it will seize any opportunity to continue its travels. So, if you are building a wall to lessen the transmission of sound, don’t forget the major openings in the wall that will leak sound. At a minimum, doors and windows in sound partitions should be insulated and gasketed. In addition, any penetration through a sound wall, including ducts and conduits, needs to be thoroughly sealed.

Dissipation. In nature, sound dissipates very quickly because there are few reverberant surfaces. A simple logarithm explains the relationship of decibels to distance: Decibels of Change <=> 20 <x> log (distance1</>distance2). More simply, sound intensity decreases at a rate of approximately six dB for every doubling of distance.

Dissipation is not the most useful method for reducing noise within a room because distances around the space are usually small. However, within an entire facility, dissipation can be a useful tool. For example, assume the dogs are located 80 feet from the offices, and the noise in the kennels, 10 feet from the dogs, is 100 dB. By the time the sound reaches the offices, it will be 18 dB lower, regardless of other factors. This decrease may not be relevant by itself, but when paired with sound isolation walls and absorptive materials, it can complement the overall scheme to reduce noise in certain areas of the hospital.

HVAC Design. Ducts penetrating from one sound area to another can be a possible source of sound or noise leakage. A ceiling penetration with a diffuser or grille will also allow sound to migrate to another room. Eliminating ducts that penetrate between sound areas can control sound leakage. However, if ducts do penetrate, two things can be done. First, a sound attenuator can be installed in the duct directly at the point of penetration. Care should be taken to seal the joint between the wall and the sound attenuator. Second, a duct can be lined with an acoustical material to contain the sound within the duct system. With these two methods, noise within HVAC systems can be contained and managed from one sound area to another.

Masking. Masking cannot replace other noise control methods, but it may be helpful in addition to them. Because noise is not additive (meaning that adding two noises together does not necessarily increase the overall noise level), it is possible to play soft music or nature sounds to mask a background noise problem. But be careful with using noise all the time, especially for animals that stay overnight. Animals need quiet as much as we do.

More design suggestions:

* Both dog and cat wards must be surrounded by sound walls. While cats don’t make much noise, they are very sensitive to noises that occur in the hospital.
* A sound buffer between exam and treatment can prevent the transmission of sounds that may frighten animals. A buffer is defined as another space such as a lab or a pharmacy. If your hospital is not designed with a specific buffer zone, consider at minimum developing a way to have two doors between the exam rooms and the treatment area to cut down on sound leakage.
* Considering that animals hear noises we don’t hear, and hear them better, preventing mechanical noise and vibration is a critical goal for designing healing spaces for animals.
	+ Locate rooftop mechanical equipment over spaces other than animal wards.
	+ Provide mass isolation pads or spring isolators under rooftop mechanical equipment that is located over any medical spaces.
	+ Provide mechanical equipment with internal vibration isolation.
	+ If you have an existing building, replace any old fluorescent lighting with new fixtures with electronic ballasts. This will eliminate the buzzing noise that old fixtures emit.
	+ Locate other motors and mechanical equipment such as housekeeping vacuums, medical suction pumps, etc. in remote closets well away from animal and medical spaces.
* Incorporate a non-audible paging and alert systems throughout the hospital such as vibrating pagers, light systems, and digital boards.
* Provide the infrastructure required to allow for species-specific music (Through a Dog’s Ear or Through a Cat’s Ear) or audio books to be played in each room containing animals. If you are using a centralized speaker system, provide individual volume control for each room so that it can be adjusted to be best for the animals in each room.

Considering the elements that contribute to noise and doing what you can to mitigate what the animals hear will ensure that the environment within your hospital is as stress free and conducive to healing as possible.