

# *Sound Advice*

Helpful Information from *Stewart Acoustical Consultants*

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## **Advice for Homeowners, Home Buyers, and Apartment Seekers**

by Noral D. Stewart

Many acoustical problems can affect satisfaction with a residence. Anyone searching for a new home should start with thoughts about the environmental or community sound, then consider factors related to the structure. If a multifamily building is considered, isolation and noise problems unique to these must be considered.

### Sound in the Community

How important is noise to you? Do you want a quiet community, or would one with a little more sound suit you better? It may seem strange that some people could be happier in communities with a little more noise, but that is the case. Some people are not sensitive to noise or they may be at a period in their life where noise is less important to them than other factors. They happily trade a little noise for convenience and a location near work, school, shopping, or recreational activities. Some people have hobbies that involve producing sound that could be annoying to neighbors. Such people will be happier in a community that is a little noisy already. That noise will help mask the sound they produce. Such communities also are more likely to be inhabited by people who are more tolerant of sound. If multifamily housing is considered, a noisier community helps mask sound leaking between units that could be more of a problem. The greatest conflicts occur when people who are looking for peace and quiet and those looking for a place to practice noisy activities wind up at the same place. This often occurs in rural areas. Some people go to rural areas expecting quiet since neighbors are fewer and far between. Others go there expecting to be able to practice their noisy hobbies for the same reasons.

Once you have an idea what you are looking for, you need to examine the sound present in possible home locations, and the sound that could potentially be there in the future. A brief visit does not do the job. Some sound sources are present only part of the time. Some may only be present in certain seasons. Atmospheric factors can strongly influence sounds from distances beyond a few hundred feet. If you are concerned about noise, spend at least a couple of evenings on the site with winds from different directions, as well as some time during the day. However, this is just the start. Next you have to research the potential problems that might not show up in brief visits. First check transportation noise sources:

Truck routes – Check within 500 feet in more populated areas or within 1000 feet in rural areas, possibly farther if you are particularly sensitive. Check with local road authorities about plans to build new roads or widen roads. Look for truck terminals.

Rail routes - within 1500 feet in populated areas or 3000 feet in rural areas, possibly farther if you are particularly sensitive. Look especially for grade crossings where horns are sounded. Horns are designed to be heard and can be heard over long distances at night and during certain atmospheric conditions. Even people who are relatively tolerant of noise will likely find horns within about 700 feet to be a problem.

Airports within at least five miles. Look at the flight paths. Noise is strongest off the ends of the runways and usually less at the sides. Recognize that the direction of takeoff and landing varies with wind direction. Landing noise is usually strongest directly under an extended centerline of the runways. Takeoff noise covers a wider area, and planes often turn on takeoff. For major commercial airports it may be necessary to follow flight tracks several miles from the airport as there is a trend to concentrate planes in specific tracks further from the airports. Find out if flight lessons are given at the airport. This can result in endless loops around the airport on weekends bringing noise even to areas beside the runways. Carefully check for any plans to add runways, extend runways, or add service to the airport.

Mass Transit Stations in urban areas. These can concentrate noise nearby.

Fire Stations and Hospitals. These can mean a lot of siren noise. Firemen often respond to medical emergencies as well as fires.

Military Flight Training Routes and Medical Helicopter Ambulance Routes. The base may be far away, but you might be on the flight path. Military craft and medical helicopters often fly at low altitude.

Realize that Federal legislation allows transportation agencies to strongly increase noise in quiet areas before they have to do anything about it. The Federal policy is designed to allow noise anywhere to rise to a relatively loud level typical of communities with a population density of 20,000 people per square mile.

Next, start looking for nearby sources or potential sources.

Commercial and Institutional buildings including Churches, and large multifamily buildings. These often have noisy air-conditioning equipment that can be a problem. Watch out especially for rotary screw chillers that produce a distinctive siren-like sound. A chiller is essentially the large commercial version of the home air-conditioning condenser with compressors and condensing coils with fans on top. While all are noisy, the versions with the “screw” type of compressor are particularly noticeable and irritating.

Industrial and Utility Plants including power generation and water treatment. These often have noisy equipment or equipment with distinctive sounds that can be particularly irritating and heard over very long distances, possibly miles in quiet areas.

Entertainment and Recreational Facilities. Nightclubs might be heard for a few thousand feet in quiet areas. A nightclub anywhere in a multifamily structure might be heard throughout the building. Automobile race tracks and music amphitheaters can be heard for miles.

If these sources are not present, look for possibilities. Is nearby land zoned to allow such facilities? Are any being planned? Is there an intersection of a major gas pipeline and electrical transmission line nearby? That is a likely site of a future power plant. Is it a windy area where commercial or even private wind turbines might be built?

Find out if the area has a noise ordinance and if so become familiar with it. Realize that even good ordinances are not totally protective. An ordinance written so stringent that it satisfies someone very sensitive to noise would likely put most homeowners in violation. However, a well-written ordinance can help prevent the worst problems and give you a first line of defense. Most noise ordinances set limits on industrial and commercial neighbors based on your residential use. However, a few ordinances set higher limits for sound coming from industrial and commercial properties regardless of the presence of a residential neighbor or set limits so high as to offer no significant benefit. Unfortunately, most ordinance writers fail to realize there is a big difference between the acceptability of a sound that lasts for only a few seconds and one at the same level

steady for 24 hours a day. They will write the ordinance with a single limit. That limit will either be too low for a sound that lasts only a few seconds, or too high for a steady continuous sound. These ordinances with very high limits can be a serious problem as they allow sounds so loud that they would be objectionable to almost anyone if continuous for long periods. Be aware ordinances often contain exceptions allowing certain sounds to exceed the stated limits. Sometimes there are even exceptions written into separate laws preventing the application of a local ordinance to a particular source. For instance, in some places state law exempts all agricultural operations from any noise regulation. Unfortunately, most ordinances are written without good professional guidance and are seriously flawed in some way.

If you intend to produce loud sounds including live music or amplified music in a residential area, choose your site carefully. Do not consider multifamily housing. Such buildings are not designed to contain live or extremely loud music. Find a single family home in an area that is already somewhat noisy. This applies also to those with noisy outdoor hobbies. Look for communities with lenient noise ordinances.

#### Home Design to Block Outdoor Sound

If you choose a home in an area that is noisy, you may want to make sure the home does a good job of keeping noise out. If you are in a quiet area and plan to produce loud sound inside, you need to consider some of the same ideas to contain the sound.

Windows are usually the weakest link for sound leakage. Beware that typical thermal windows are not very good at blocking low-frequency sound. Special acoustical windows are available but rarely seen in this area. The best protection for most sounds is provided by a large air space of at least 2 inches between layers of glass. Consider storm windows, either interior or exterior. Interior storm windows are an option many do not think about. Use a layer of laminated safety glass in the storm window if possible. Use heavy solid-core exterior doors, or add storm doors.

A masonry or brick home will do a better job of blocking sound than a frame construction. If a house is to be built with frame construction in a noisy area, consider getting expert advice. Pay attention to attic and crawl space ventilation. If openings to these areas exceed minimum requirements, extra silencing may be desirable. Avoid window air conditioners.

#### Typical Problems within Homes and on the Property

Often the ventilation systems for homes are noisy. The most common problem is a very short distance between the return air intake and fan. Check the location of the air returns. They should be in corridors or less sensitive locations. Several feet of lined duct or flexduct should extend from the grille to the fan. Avoid fans in closets with returns through doors within living or dining areas. Sometimes water-source heat pumps with compressors inside the residence are used in multifamily buildings. These compressors can be a severe noise source.

Single family homes are not typically designed to provide very much privacy within the home. If you have a need or desire for good privacy between spaces within the home, professional advice during design is advisable.

Very large rooms, especially with very high ceilings, are often very reverberant. Rooms with ceilings more than 9-10 feet high often need more absorption than provided by furniture. Special acoustical treatments may be required especially if the room is not carpeted.

Poorly planned plumbing can create problems. Good plumbing design is always desirable, but essential if pipes must run in undesirable locations. For instance, drain pipes routed through the wall

of a room where guests are entertained could create embarrassing sounds. Use cast-iron drain pipe to below the lowest occupied level. Make sure pipes in walls adjacent to sensitive spaces are isolated from the structure. Examine the noise of the plumbing in existing homes.

The outdoor condensing units of air conditioners and heat pumps can create problems for the homeowner or neighbors. Make sure the location is selected to minimize problems for both. Where local noise ordinances exist with limits on sound levels at boundaries, these systems are often in violation of night time limits.

#### Appliances, Garage Door Openers, Home Entertainment

The noise produced by various types of household appliances varies widely. Some are very quiet and some are very loud. It pays to shop. For garbage disposals, look for models with “induction” motors and extra noise insulation. For dishwashers, look for models with separate supply and drain pumps. For new front-load clothes washers be especially careful if they are to be located on an upper floor or over a basement or crawl space. These washers can introduce strong vibration into supported floors. If not on a slab on grade, try to locate them near an exterior wall or other location with vertical support below immediately adjacent. Look for models that have special balancing and isolation features to reduce the vibration introduced into the floor. If a garage is located under a bedroom or other sensitive space, look for a belt-drive model with extra sound control features. If especially sensitive, look for aftermarket isolation devices to isolate the motor and support rails from the structure above.

If planning a major home entertainment system, consider the location relative to spaces where you may not want it to interfere. Provide buffer spaces when possible. Provide doors so the sound has to go through at least two doors between the entertainment room and a sensitive space. Do not build speakers into walls and ceilings adjacent to sensitive spaces. If you cannot avoid sensitive spaces immediately adjacent to the entertainment room, get professional advice on the isolation.

#### Multifamily Housing Concerns

Multifamily housing brings additional concerns, the chief among them being isolation from the sounds produced by neighbors. With even the best designed and constructed buildings, you will sometimes hear your neighbors. Do not expect total isolation. However, some buildings provide very little isolation. Be very careful. If you are very sensitive, consider a top-floor unit, but be careful about mechanical equipment on the roof.

A first caution involves footstep sounds. Footsteps impact the floor, and the floor-ceiling becomes the sound source, rather than something to block the sound. Footstep sound comes in two kinds: a low-frequency thump and higher-pitched tapping sounds. The low-frequency thump will always be heard in buildings with wood-frame structures or with steel joists supporting floors. The degree of this sound can be reduced with shorter spans, which means smaller rooms or columns. The ONLY way to fully eliminate this thumping sound is to build with thick self-supporting concrete floors. The higher-pitched tapping sound is easily controlled with carpet and pad. In areas with hard floor surfaces, a special resilient material must be used below the floor finish. This resilient material also can limit the transmission of tapping sounds laterally to adjacent units. A resilient support of the ceiling below and sound absorptive batts in a cavity between floor and ceiling are also required in frame structures for both airborne and impact isolation. Even with heavy concrete construction a separate ceiling below the floor slab helps with isolation from both above and the side. In the case of condominiums with carpeted floors, make sure that the condominium rules prohibit the replacement of carpet with a hard floor surface without taking steps to limit the tapping sound.

Make sure the walls between units are not constructed with a single set of studs with gypsum directly attached on each side. As a minimum, the gypsum on one side should be isolated from the studs in some way. Ideally, there should be two sets of studs not tied together. Look for two layers of gypsum on each side of the wall with no gypsum or plywood inside between the studs. Unfortunately, in some circumstances, code requires gypsum or plywood inside the wall. In those cases, make sure it is on only one set of studs inside the wall. Though extra gypsum inside seems like it would help, it can strongly weaken the wall with regard to blockage of low-frequency sound. The wall must have sound absorptive material such as fiberglass batts in the cavities.

Be especially careful if considering an older industrial or warehouse building converted into housing. These buildings often have wood floors that are left exposed above and below. These wood floors not only produce footstep sounds, but cannot provide the needed sound blockage of airborne sound. You will hear more than footsteps from your neighbors upstairs and downstairs. The problem is often made worse by large cracks between the floor and exterior walls. Any crack is a problem. While good walls can be built between units, sealing these walls to the exterior walls, floor, and ceiling can be very difficult. Thus, privacy problems between units on the same level are common. Often, old pipes and other elements are left in place penetrating walls. These provide an additional problem in sound isolation. If you are considering one of these conversions, make sure you have someone you trust talk and walk in all adjacent units beside, below, and above. If possible play some music on entertainment systems in adjacent units while listening in the unit you are considering. Talk to existing residents about their experiences.

Plumbing noise can be a problem. First consider the sounds generated in the unit you are considering. Turn on the fan on high speed and consider the sound carefully. Flush the toilet and listen. However, make sure the ventilation and plumbing systems of other units will not create a problem. Listen while toilets are flushed in adjacent units. Listen for noise of mechanical systems serving other units.

Be especially careful if condensing units or large mechanical systems are mounted on a rooftop and you are on the top floor. Some high rise buildings use large fans on the roof to ventilate baths and clothes dryers. These can create noise problems for people on the top floor.

Examine the floor plan. Ideally, all the adjacent rooms above, below, and beside your bedrooms in other units should be other bedrooms. Be especially concerned about kitchens, bathrooms, or any room with hard floors above the bedroom, or a room with a major entertainment system adjacent to the bedroom.

Look for the locations of elevators, garbage chutes, major mechanical equipment, and transformers. Listen to make sure these will not be a problem.

Find out what the management or residents' association positions are regarding any existing or potential noise problems. Have they had complaints? What have they done? Do the rules prohibit live music or loud amplified music? Are all the needed policies in place to resolve problems?