

Community Noise:

DEALING WITH A GROWING PROBLEM

by James P. Cowan

In 1982, the Environmental Protection Agency reported that 87% of America's urban population was being exposed to noise levels exceeding those recommended for safety and health concerns. Since that time, noise levels have, if anything, increased as urban borders continue to expand.

Noise is becoming even more of an issue with the reawakening of environmental consciousness and the construction of industrial plants, highways, airports, and rail lines in close proximity to residential developments. Other common noise sources of concern in residential communities include pets (especially barking dogs), private parties, public clubs, kennels, and outdoor concerts.

Most municipalities deal with noise only after a problem surfaces. Even when these problems are confronted, however, the technical nature of acoustics and noise control can create misunderstandings and legal battles that often do not effectively solve the problem at hand.

Most potential noise sources can be identified and controlled through an effective community planning process and through enforcement of noise control ordinances. Unfortunately, many communities today still fail to consider noise issues in the planning process (or when reviewing projects) and/or have ineffective noise control regulations.

Acoustic terminology can often be confusing to the average person having no background in the field. Since a noise ordinance must be enforced by zoning administrators or police officers who probably

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have no technical background in acoustics, all technical terms used in the ordinance should be defined so that the average person can understand them. The terminology used in noise ordinances should also be related to concrete, objective (numerical) criteria that are based on accepted scientific principles.

Many noise ordinances set restrictions against creating "unnecessary noise," a "noise disturbance," or a "nuisance." This sort of vague and undefined terminology leaves an ordinance open to subjective interpretation. One person may claim that

a noise source is highly disturbing while most others cannot even hear it. On the other hand, a noise may be disturbing to many people but because of the vague wording of the ordinance, a court may refuse to enforce it. *Noise & the Courts*

But having objective criteria in the ordinance is not enough. The ordinance must also avoid using confusing or obsolete measurement parameters. The more values an enforcement officer has to record, the greater the chance that errors or misinterpretation will occur, thus again rendering the ordinance very difficult to enforce. Monitoring instruments needed to enforce complex noise criteria can also be prohibitively expensive to most municipalities. In many cases where complex noise criteria exist, municipalities don't even have the proper instruments available to enforce their own ordinances. To be most effective, ordinances should require objective criteria in terms of a single number that can be read from a basic sound level meter.

NOISE CRITERIA

There are two types of criteria that can be used to objectively assess a noise disturbance or nuisance. These are absolute and relative criteria. Absolute criteria set a noise level limit that cannot be exceeded. Relative criteria set a limit on the amount of increase in the sound level that can be caused by the noise source.

Table 1. Noise Levels of Common Sources

Sound Source	Sound Pressure Level (dBA)
Threshold of Hearing	0
Audiometric (Hearing Testing) Booth	10
Isolated Broadcast Studio	20
Typical Rural Area at Night	30
Quiet Suburban Area at Night	40
Typical Suburban Area Background	50

Typical Urban Area Background/Busy Office	60
On Sidewalk by Passing Automobiles with Mufflers	70
On Sidewalk by Typical Highway	80
On Sidewalk by Passing Heavy Truck or Bus	90

Note: The decibel scale is logarithmic in nature, similar to the Richter scale used in rating earthquakes. A change in 3 dBA is a just noticeable change in sound pressure level while a change in 10 dBA is perceived as a doubling or halving in sound pressure level.



Noise & the Courts

There has been a constant parade of litigation involving municipal noise ordinances. Most have involved citizens who, after being charged with violating the ordinance, challenge it as violating their constitutional due process rights because it uses "vague" terms. While there has been considerable variation from state to state in how such claims have fared, the trend has been for courts to more critically examine noise ordinances.

Typical of this is *Nichols v. City of Gulfport*, 589 So.2d 1280 (1991) in which the Mississippi Supreme Court found Gulfport's noise ordinance unconstitutionally vague. In that case, the owners of a lounge featuring live entertainment on an outdoor patio had been cited for violating the ordinance. The ordinance provided that: "Unnecessary or unusual noises shall not be made or caused to be made ... which either annoys, injures or endangers the comfort, repose or safety of others" This is language similar to that found in countless ordinances across the country.

The state Supreme Court agreed with the lounge owners that the words were inherently vague. As the Court observed: "If beauty is in the eye of the beholder, whether a noise is 'unnecessary,' 'unusual' or 'annoying' certainly depends upon the ear of the listener. A statute is unconstitutionally vague when the standard of conduct it specifies is dependent upon the individualized sensitivity of each complainant."

The Court concluded its opinion with the following comments: "We are by no means condoning interference with the tranquility and inviolability of one's home by loud noise. We are simply persuaded that Section 1 [of the ordinance] can be more clearly worded

and more narrowly drawn. Given the fact ... the ordinance is nearly half a century old, and in view of the technological age in which we now find ourselves, another look at the city's anti-noise ordinance would seem wise."



A Noise Glossary

Ambient noise level is the total noise level in an area, including all sound sources.


Background noise level is the total noise level in an area, including all sound sources except a particular source of interest.

Decibel (denoted dB) is the unit usually used to assess noise. It is based on a logarithmic ratio. Noise levels are typically measured using sound pressure levels (SPL), defined in terms of a logarithmic ratio of pressures associated with the sound energy. SPLs only have meaning when they are identified in terms of their locations with reference to a sound source.

A-Weighted Decibel (denoted dBA) is the SPL adjusted to account for human sensitivity to different pitches or frequencies of sound. dBA adjusts for the fact that low frequencies (bass sounds) sound quieter to us than higher frequencies having the same decibel level rating.

Octave Bands are standardized frequency segments used to characterize the pitch of a sound source.

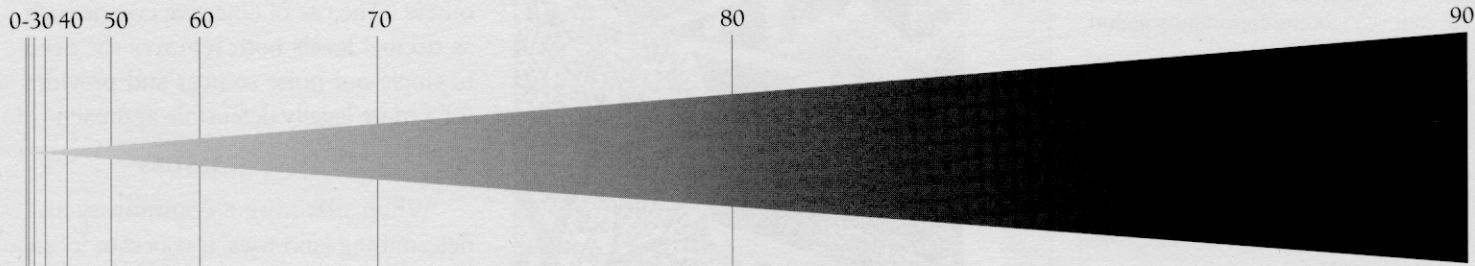
Although most noise ordinances contain absolute, not relative, criteria, it is usually a significant relative increase in ambient noise level that disturbs people. This is often the case even though the noise level falls within the ordinance's absolute criteria. For example, a typical daytime absolute noise level limit used in municipal noise ordinances for suburban areas is 65 dBA (A-weighted decibels).

 **A Noise Glossary.** In other words, the ordinance is violated when the noise level exceeds 65 dBA. Thus, a noise source generating 64 dBA at the specified property line would not violate the ordinance. However, if the background noise level (the noise level in the area without the offensive sound) were in the 45 to 50 dBA range — typical for many suburban residential or rural areas — most people would find the 64 dBA noise source highly annoying. Why is that? Simply because the noise is some 14 to 19 dBA above the background level — a substantial relative difference. Tables 1 and 2 should give you a clearer sense of the absolute and relative nature of the decibel scale.

A-WEIGHTED SOUND PRESSURE LEVELS

Noise ordinances should simply use A-weighted sound pressure levels (dBA). Unfortunately, many ordinances still set requirements using octave band

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Noise & Silence

by Pico Iyer

It often seems that the world is getting noisier these days: in Japan, which may be a model of our future, cars and buses have voices, doors and elevators speak. The answering machine talks to us, and for us, somewhere above the din of the TV; the Walkman preserves a public silence but ensures that we need never — in the bathtub, on a mountaintop, even at our desks — be without the clangor of the world. White noise becomes the aural equivalent of the clash of images, the nonstop blast of fragments that increasingly agitates our minds. As Ben Okri, the young Nigerian novelist, puts it, “When chaos is the god of an era, clamorous music is the deity’s chief instrument.”

There is, of course, a place for noise, as there is for daily lives. There is a place for roaring, for the shouting exultation of a baseball game, for hymns and spoken prayers, for orchestras and cries of pleasure. Silence, like all the best things, is best appreciated in its absence: if noise is the signature tune of the world, silence is the music of the other world, the closest thing we know to the harmony of the spheres. But the greatest charm of noise is when it ceases. In silence, suddenly, it seems as if all the windows of the world are thrown open and everything is as clear as on a morning after rain.

Excerpted from “The Eloquent Sounds of Silence,” Time Magazine (Jan. 25, 1993). Copyright 1993 Time Inc. Reprinted by permission.

Table 2. Community Response to Increases in Noise Levels

Change (dBA)	Community Reaction
0	No observed reaction
5	Sporadic complaints
10	Widespread complaints
15	Threats of community action
20	Vigorous community action

Source: Environmental Protection Agency. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Report No. 550/9-74-004, Washington, DC: EPA Office of Noise Abatement and Control, 1974.

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terminology, setting different limits for different frequency ranges. In addition to the complexity added to the monitoring process by using these requirements, the limits are often stated in antiquated terms. Moreover, it is hard to even find instruments that can record data based on such requirements.

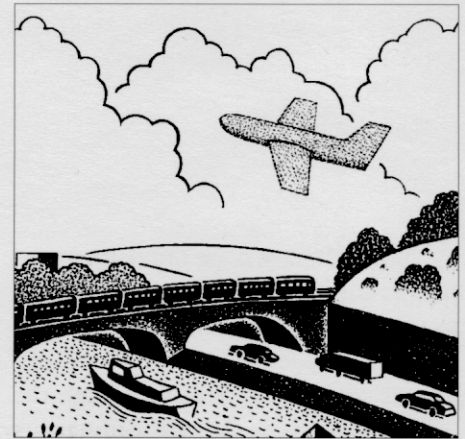
SOUND LEVEL METERS

Twenty years ago it was difficult to find a sound level meter that was inexpensive and easy to use. Perhaps this justified the use of subjective language in noise control ordinances. Today sound level meters are available at reasonable prices. Many have digital displays and just a few buttons (contrary to popular belief, the best instruments usually have the fewest buttons to push) and are small enough to fit in a pocket.

In addition to using instrumentation instead of personal judgment, noise readings recorded by one person must be capable of being easily replicated by a different person. Without specific, repeatable, objective measurements, the question of whether a noise ordinance is being violated becomes dependent on the personal interpretation of whoever happens to be enforcing the ordinance.

ORDINANCE STANDARDS

Noise ordinances should include a maximum absolute dBA limit that cannot be exceeded except for emergency and other specifically defined situations, and a relative increase limit for dBA values below the maximum absolute limit. For



example, in a residential area, a community might set an absolute limit of 70 dBA, but also limit noise to a maximum of 6 dBA above the background level. Such limits would be appropriate for both constant noise sources (e.g., air conditioning units or any machinery that runs for extended periods of time) and intermittent noise sources (e.g., power tools, loudspeakers, or barking dogs). It also makes sense to have different limits for daytime versus nighttime hours, because of the difference in typical background levels and the greater sensitivity people have to noise during their sleeping hours.

It is impossible for me to provide you with specific recommended dBA limits. Each community should determine this for itself, based on a variety of factors including existing noise levels, the pattern of land uses, and residents’ reactions to noise. An absolute limit of 75 dBA with a relative limit of 10 dBA might be appropriate for one community, while an absolute limit of 65 dBA with a relative limit of 6 dBA might work best for another.

Many ordinances, unfortunately, still single out specific objectionable sources, such as barking dogs and portable sound systems, while using subjective terms like: “the noise shall not be disturbing to others.” The use of objective criteria such as decibel levels both removes the need to single out noise sources and provides for a more legally defensible approach.

PLANNING ISSUES

When planning a community and determining land uses, it is best to locate major noise generating sources as far as possible from residential areas. Ordi-

nances or design standards can encourage buildings that are oriented so they do not reflect noise into a community.

Depending on the terrain and atmospheric conditions between a noise source and listener, sound levels generally drop off at a rate of 3 to 6 decibels per doubling of distance from the source. Establishing ample buffering distances between major noise generators and other uses should be done when possible. The alternative (other than enclosing the noise source) is usually to erect some sort of sound barrier.

A barrier can be anything from a wall to an earth berm, but it must completely block any sight of the noise source at the listener's location. Trees or fences are usually ineffective noise control measures unless they are very dense and completely shield the listener from seeing the



source. Because of the physical property of diffraction, even well designed outdoor barriers, as are found along some highways, cannot reduce noise levels more than 10 to 15 dBA. As a result, most people in communities built close to highways will still clearly hear the traffic noise even though noise barriers have been erected.

In terms of traffic flow adjustments, vehicle speed restrictions will not contribute to significant noise reductions unless speeds are cut at least in half. But limiting vehicle types by, for example, prohibiting heavy vehicles on roadways near noise-sensitive areas, can significantly decrease the most annoying maximum levels.

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Consider Italy

Noise is not a uniquely American, or even a uniquely modern, problem. Historian Jerome Carcopino tells us that Julius Caesar, in order to reduce daytime traffic congestion on Rome's streets, decreed that most carts and chariots could only use the streets at night (exceptions were allowed for chariots necessary for triumphal processions, or used on either days of solemn ceremony or official celebration, and, reasonably enough, for chariots needed by contractors engaged in wrecking or constructing buildings).

One unfortunate by-product of this decree, however, was excessive noise at night: "According to Juvenal [a Roman poet and satirist living at the time] the incessant night traffic and the hum of noise condemned Rome to everlasting insomnia. 'What sleep is possible in a lodging?' he asks. 'The crossing of wagons in the narrow, winding streets, the swearing of drovers brought to a standstill would snatch sleep from a sea-calf or the emperor Claudius himself.'" *From Carcopino's Daily Life in Ancient Rome (Yale University Press, 1940).*

But to be fair to Italy, consider Venice, "... one of the few renowned cities left in the world where you can still hear everyday sounds — sounds that otherwise go unnoticed or have disappeared entirely from venues where the car, and not the sea, is king." As writer Louis Inturrisi goes on to explain: "When a city's traffic is entirely on water, its sounds are gentler to the ear, less insistent, and its streets fill up with human rather than mechanical noise Any city dweller who has visited Venice for even a short time knows the initial feeling of disori-

entation the absence of vehicular traffic can cause. For some it remains a discomfort, but for others it passes into a celebration of that wealth of ordinary sounds that makes Venice not only a feast for the eye and a thrill for the mind, but an auditory adventure as well. ... From the laughter of children in the campos to the burst of pigeons scattering skyward in the piazza to the avalanche of languages from all over the world, acoustic Venice — the home of Vivaldi and Stravinsky — is its own symphony." *From "The Serene Sounds of Venice," The New York Times (Dec. 20, 1992).*



Resources:

If you are trying to find an acoustical consultant for assistance in drafting a noise ordinance, the Institute of Noise Control Engineers offers a national directory of board-certified noise control engineers. For information, contact them at: P.O. Box 3206, Arlington Branch, Poughkeepsie, NY 12603; (914) 462-4006.

The Handbook of Environmental Acoustics by James Cowan is a practical guidebook explaining noise issues, regulations, and terminology. For availability call the publisher, Van Nostrand Reinhold; (800) 544-0550. Documents published by the Environmental Protection Agency between 1972 and 1982 are also of value for explaining basic principles. Of most relevance are *Noise Effects Handbook: A Desk Reference to Health and Welfare Effects of Noise* (EPA document number 550/9-82-106) and *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare...* (550/9-74-004). Both are available through the National Technical Information Service; (800) 553-6847.



Noise Planning in California

by Frank Gomez, Dr. P.H.

The State of California is perhaps unique in requiring that cities and counties prepare a noise element as part of their general plans.

Each community's noise element follows guidelines established by the State Office of Noise Control. These guidelines call for each planning jurisdiction to determine current and projected noise levels for all highways and freeways, primary arterials and major streets, railroad and surface rapid transit systems, airports, heliports, and local stationary noise sources which significantly contribute to the community noise environment.

Noise contours, stated in terms of day-night average noise level, must be developed for the major noise sources identified in the noise element. The noise contours are used to assist planners in establishing a pattern of land use that minimizes residents' exposure to excessive noise.

The noise element also contains implementation policies that address existing and foreseeable noise problems and is used to guide local compliance with the state's noise insulation standards for the construction of residential units (California is the only state which has developed such standards).

The noise element has provided planning commissions with a framework for effectively considering community noise control in their land use decisions. Developers have strongly supported most noise control efforts, well aware that quiet communities and subdivisions have higher land values and are more desirable to potential buyers — quiet not only enhances the community environment, it "sells."

Frank Gomez is Environmental Health Training Coordinator for Los Angeles County. He is past president of the National Association of Noise Control Officials, and has served as an advisor on noise issues to the National League of Cities. Mr. Gomez would be glad to provide interested readers with copies of the California noise guidelines or building noise insulation standards; he can be reached at: (213) 881-4118.



It's Driving Me Up the Wall!


While some researchers have linked excessive noise with a variety of health problems ranging from hearing loss to heart disease (an overview of this research can be found in the Fall 1991 issue of the *Nutrition Health Review*), perhaps the biggest reported problem is *annoyance*. As one researcher has put it: "[Noise has the] capability for affecting people in a wide variety of ways. Some of these are purely attitudinal, as when someone says that 'the traffic noise here drives me up the wall.' Others are more closely related to various activities interfered with, such as reading, talking or watching television ... Further along the line of noise nuisance are the 'indirect' effects. Thus in warm weather, external noise will result in windows being closed, with consequent overheating, poor ventilation and general discomfort." From "Noise Annoyance," in *The Noise Handbook* (Academic Press, 1985).

Donald Appleyard's detailed survey of San Francisco neighborhoods found noise to be a pervasive problem: "Noise is the primary disturber of indoor activities: 38 percent of our sample had their sleep and TV watching disturbed by noise, nearly one-third found their conversations interrupted, and 20 percent found working and eating suffered interference." In Appleyard's survey, sensitivity to noise was (not surprisingly) correlated with the amount of street traffic on the respondent's street. From *Livable Streets* (University of California Press, 1981). Other studies, also summarized in Appleyard's book, yielded similar results.

Several researchers have found that excessive noise can adversely affect school children's ability to learn — especially when schools are located near airports, highways or rail lines. See "Noise Is Hazardous to Child's Health and Well-Being," in *The Brown University Child Behavior and Development Letter* (October 1989).

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On a large scale, New York City seriously considers noise issues when reviewing major projects. As a result, effective noise control measures are typically incorporated into project design and siting. California has also taken a strong role in ensuring that noise concerns are addressed as part of the planning and review process.  Noise Planning in California.

SUMMING UP:

Noise is an environmental stressor that can lead to a deterioration in the quality of our lives. The best way for a municipality to control noise is through a noise ordinance. Such an ordinance should make use of objective criteria that can be readily enforced. While the field of acoustics and noise control may seem quite complicated, it need not be when dealing with local noise problems. With some basic knowledge, and proper guidance when needed, a community can provide a sound environment for its inhabitants. ♦



James P. Cowan is a certified noise control engineer and manager of acoustical analysis for McCormick, Taylor & Associates, an engineering and environmental consulting firm in Philadelphia, Pennsylvania. He is also the author of *Handbook of Environmental Acoustics*, a reference book on community noise issues just published by Van Nostrand Reinhold. Jim, who holds a masters degree in acoustics, has consulted on more than 100 acoustical projects nationwide, teaches acoustics courses at Drexel University, and has lectured and been published extensively in his field. Jim is shown in the photograph holding a sound level meter