Noise pollution.

Industrial noise pollution is an ever growing problem and its management is centred around many pieces of legislation, standards, guidance documents, etc. many of which frequently contradict each other. There are two main viewpoints, the more obvious of which is the quantification and control of a noise nuisance, usually in response to a complaint. Secondly, we have planning considerations where a potential nuisance or loss of amenity is anticipated and planning refusal or control conditions are imposed.

Noise-sensitive areas, i.e. the likely recipients of environmental noise, can be very varied: I have worked on environmental noise problems in offices, hover craft passenger decks, bird roosting sites, and shark aquariums. The vast majority of environmental noise problems, however, are associated with housing, particularly night time hours when peoples sleep may be disturbed. Sources of environmental noise are numerous but most can be covered by four main headings - Industrial Noise, Construction Noise, Leisure Noise, and Traffic Noise.

How Annoying is a Noise?

We can begin with the level of the noise - the louder it is the greater the risk of disturbance. The nature of the noise is also important e.g. a tonal sound (a hum, whine or whistle) will be more disturbing than a broad spread of frequencies (few would be disturbed by waves on the beach, even though it can be quite noisy). Intermittent noise can also attract attention beyond its true noise level, such as a thermostatically controlled chiller.

How disturbing a noise is will often be dependent on the amount of masking noise or background noise there is. One industrial noise standard, for instance, rates industrial noise by how much it exceeds background noise.

Numerous psychological effects should also be considered, not only in how we judge the noise, but in the choice of measurement and assessment methods. For a given noise level a lawn mower is likely to be less disturbing than a hi-fi played loudly with the windows open, simply because one will be regarded as reasonable while the other is less so. Other types of noise are inherently disturbing such as grinding, gun shots, dog barks, and the 90’s problem of the repetitive thump of modern dance music.

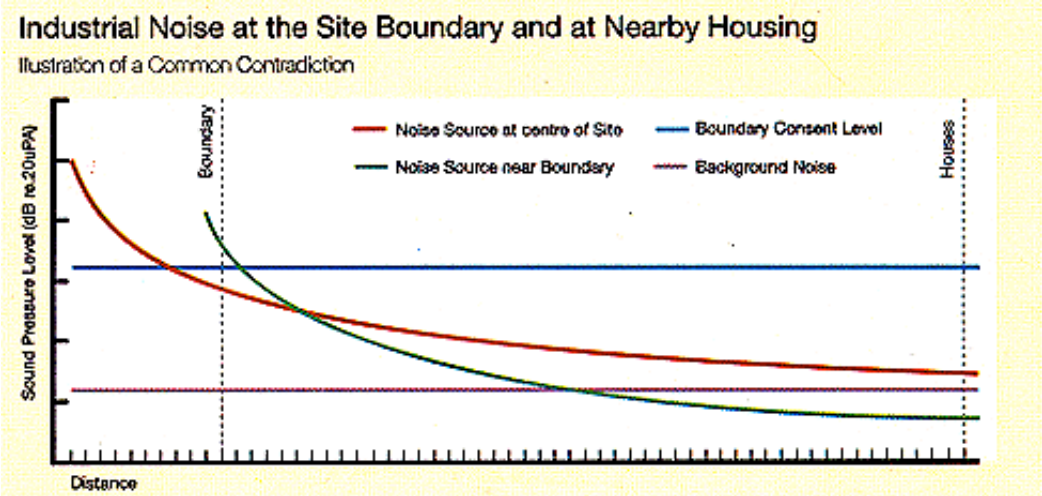
All this leaves us with very few clear, generic targets for the control of noise and much scope for arguments and debates, frequently in a courtroom. The good acoustic consultant, however, should be experienced enough and should have the appropriate range of analytical skills and tools to be guided by the various standards, etc. but also to disagree, modify, or interpret the standards if he or she feels that the situation is sufficiently unique to merit it.

Industrial Noise

BS 4142: 1990 "Rating Industrial Noise Affecting Mixed Residential and Industrial Areas" is the most important guidance document here and is the one most frequently used by environmental health officers to determine the degree of nuisance from a factory.

Basically, the alleged source of nuisance is measured (or predicted) and adjusted for disturbing features such as tones and intermittancy. This adjusted level is then compared with the background noise and a sliding scale from positively justified complaints to positively no justified complaints can then be applied.

BS 4142 will usually be the main tool used in planning assessments where industrial noise is the main issue - be it a new factory near to housing or new housing near industrial areas. In addition, however, planners (usually under advice from environmental health officers) may impose boundary noise limits or planning consent levels. Such conditions are often rigidly imposed but are necessarily vague in relevance and ought to be subordinate to a proper nuisance assessment, as illustrated in the graph below.



A source of noise can be relatively noisy but, due to its distance from the boundary, it could be below the consent level but, as the houses are not much further away, the noise level does not decay quickly enough and the noise at the houses is above background noise. In fact, noise decays by 6 dB for every doubling of distance, i.e. an ever diminishing benefit with distance. Also illustrated in the graph is a source which is relatively quiet but, being near to the boundary, it exceeds the consent level. As the houses are relatively much further away, the noise is well below background noise and not a problem.

Now, planning consent levels have to be relevant and must demonstrably serve a positive purpose. There may, therefore, be grounds for appealing against it if a source of noise is quiet enough not to disturb neighbours but so close to the boundary that it exceeds a consent level. Conversely, many industrial clients believe that complying with consent levels will immunise them from nuisance action, this is not the case.

Industrial Case Study

A large factory had been in receipt of vigorous complaints and early assessments revealed that boundary consent levels were being substantially exceeded and a severe nuisance was being created at nearby houses. Some 105 significant sources of noise were analysed and were built into a large computer model of the noise climate which simulated the noise at the nearby houses. Some sources, however, were utterly insignificant at the houses but, as they were only a metre or two from the boundary, they were responsible for fairly significant exceedances of the consent levels.

Extensive negotiations with the local authority resulted in their agreeing to suspend action associated with the boundary noise and to accept suitable time scales for a major noise control programe for the sources affecting the houses. The consent levels ,however, would be kept "in reserve" as an extra stick with which to beat the company if suitable noise control progress was not made.

Noise control solutions were designed for all significant sources utilising additional expertise from structural engineers and air movement engineers. Solutions were costed-up and a detailed programme of phased implementation and commissioning was arranged.

Noise has so far been reduced by about 15 dB(A), from a severe nuisance to a marginal problem. The final phase will achieve a further 8 dB(A) reduction and it is due to begin shortly, completely solving the problem.

One vital final point to end this case study is that the key to the success of this project has been the forging of good relationships between the client, acoustic consultant and local authority. The standpoint was one of a common problem to which we all seek a sensible solution.

Large stainless steel silencers on a cooling tower which was just one of the 105 sources on this site.

Leisure Noise

This can cover all manner of activities such as motor sport, shooting, open air events, etc. but by far the biggest concern is music. Most people now have access to high-quality, high power, inexpensive sound systems in their homes and in their cars. Higher quality sound means less distortion and a greater tendency to turn-up the level. The same quality and level expectations are being found in nightclubs and, coupled with the modern dance music trend of very heavy bass thumping and pressure for cheap, lightweight building materials, the problem is quite serious.

Standards for leisure noise are not at all clear and, in many cases have codes of practice set-up by the industry body and, hence, have debatable objectivity. Music noise standards vary dramatically between local authorities from a simple application of the principles of BS4142, or simple absolute noise limits, to the "inaudibility" standards required by an increasing number of authorities. Inaudibility is a perfectly respectable standard in the appropriate circumstances but, if it is not too much of a contradiction, inaudibility needs a technical definition. Anyone can claim to hear something when others cannot. Ask 10 acoustic consultants to define inaudibility, however, and you will get 10 answers but most would agree that, one way or another, the music peaks should be below the background troughs. Many believe that this should apply at all frequencies.

This leads us to a major difficulty in the design of nightclubs, especially for the major operators who genuinely wish to promote an environmentally friendly image. The bass thump of modern dance music is centred around 63 Hz - just the frequency at which most building materials are acoustically weakest. It is also a frequency at which the risk or room and envelope resonances can occur and decisive predictions can be very difficult.

Nightclub Noise Case Study

The acoustic design of a nightclub is full of conflicting requirements. Clearly, the shell must be acoustically strong enough to contain the music noise levels, which must be established in advance, along with background noise levels in the community and an agreed acceptable music noise level in the community. Operators will be under pressure to increase noise levels, while other parts of the facility (such as restaurants, offices, etc.) will require quiet. European noise-at-work regulations need to be considered for employees while maximising on-dance-floor noise levels. Finally, the contractors who will build the nightclub, often on a fixed price agreement, will want to minimise costs.

By careful acoustic design of the nightclub shell, an operator had achieved target noise levels in the community with adequate on-dance-floor music levels. Unfortunately music was poorly distributed and poor internal acoustics meant that employees were seriously over-exposed to occupational noise. Detailed modelling of the acoustic climate of all parts of the club was carried out and the sound system specification "installed" in the model. By careful redesign of the acoustics and the sound system, all parts of the nightclub were covered with

clear, high-quality music at a lower level, while high on-dance-floor levels were maintained. Employees benefited from acceptable occupational noise exposure, bar communication was improved, and music was intelligible in all areas resulting in more widespread dancing and general enjoyment, and less crowding.

Other Types of Noise Pollution

Traffic noise is a big issue be it road, rail or air traffic. High profile cases such as Manchester Airport bring the problem closer to our attention and most of us are increasingly aware of increases in road traffic noise. It should be borne in mind, however, that for a given noise level, traffic noise is generally less disturbing than industrial or leisure noise as it is usually traffic which defines the background noise for assessing these issues.

It is also true that predicted increases in traffic volumes will not necessarily directly correlate to increases in noise. In a typical day a busy road will be at its quietest during the middle of the day and noise will increase as the rush hour approaches. A point will come, however, when the road is so busy that traffic begins to slow-down, even stop and noise levels will often go down. Predicted increases in traffic volumes, therefore, may not necessarily lead to the noise problems many predict.

Construction noise and quarrying could be regarded as a form of industrial noise but standards will often be somewhat more lenient. It is clear enough that such situations are temporary and, therefore, may be less of a problem.

It is unlikely that noise pollution problems will be disappearing in the near future, although the British and other European governments do seem to be attempting to align and co-ordinate their policies. I am not convinced that they will get worse (perhaps with the exception of domestic music noise) but they are likely to change in nature, as will peoples attitudes towards them.

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