



# Diminishing reliability of the application of Standards on Environmental Noise in the UK

Mike STIGWOOD

MAS Environmental, UK

## ABSTRACT

This paper is one of a series reviewing the development and application of guidance and standards on environmental noise in the UK. The first paper in this series, presented at Internoise 2016 looked at evolving problems with British Standard 4142 for industrial and commercial sound due to introduced ambiguity and a diverse range of problems. This paper reviews the practical application of standards.

Community noise is generally divided into sources of environmental (transport), neighbour and neighbourhood noise (arising from commercial sites) with different principles applicable to each many without any decibel guidance. Boundaries between the assessment and determination of these three types of noise sources and determination of their acceptability are increasingly blurred in the UK with practitioners arguing guidance for one as directly transferable to others. Confusion and ambiguity regarding the interpretation of standards is arguably beneficial to developers and noise producers who may emit excess noise and those wishing to develop land in noisy areas. An inherent inability to enforce noise controls arises as any interpretation of compliance with standards is duty bound to apply the least onerous interpretation as in the UK it is normally subject to a criminal standard of proof. One of the most commonly applied standards in the UK is BS4142: 2014. Its revisions have introduced widespread ambiguity, uncertainty and contradictory application which were reviewed at Internoise 2016. In this study I examine, at random, a wide range of noise impact assessments provided within the UK applying guidance. I compare how that guidance is interpreted, whether limitations are correctly applied and the application in general of decibel based guidelines outside its scope. The findings identify widespread misuse of standards, the lack of adequate review of assessments and significant inconsistency in guidance application.

Keywords: Standards, Noise Surveys, Perception, psycho-acoustical factors.

## 1. INTRODUCTION

There is arguably a perception of degradation in noise control standards over the last couple of decades in the UK despite increasing understanding of the adverse effects of noise. This perhaps arises due to the emphasis on the use of acoustic units, primarily the decibel. There appears a desire to apply engineering units to define unwanted sound which fit the mind of the engineer but arguably not the human psyche. Whether this is deliberate or by accident, analysis shows this largely benefits developers and the engineers who work for them at the expense of communities who experience greater noise. It is considered that public health specialists need to re-assert the importance of psycho-acoustic features in noise which impact on communities and which are not measured or accurately measured by the decibel level.

It may be considered that describing noise impact by the decibel level and factors such as tone and impulse content is potentially equivalent to trying to derive the beauty of a landscape's benefit based on the percentage of colours present. We recognise snow scenes which are mainly white can be beautiful. Similarly the tranquillity of an area cannot be described by the presence of tones and impulse sounds caused by bird.

There is evidence indicating misrepresentation of guidance whether deliberately or through erroneous understanding. A second study now in progress is collating the reports of authors who are found to apply different interpretations of guidance in different cases and also different source sound energy levels for the same source. There is a need for the UK Institute of Acoustics to address inconsistencies.

Traditionally in the UK the defence to misapplication of guidance was the local authority Environmental Health Officer but evidence indicates there are now few with the expertise to identify and address the issues as their role has changed. Influence is arguably dominated by those who rely on industry and development for a living, which may be viewed a risk of degrading community protection. This paper seeks to examine whether such perceptions are erroneous.

It is long recognised, for example by the WHO in guidelines to local authorities(1) that the decibel level accounts for perhaps only one third of noise annoyance and that non-acoustic factors such as the message imparted by the noise<sup>1</sup> are more important. For example the WHO recognise there is an expectation of greater freedom from noise at weekends and during the evenings(1).

Decibel guidelines are reasonably well developed in relation to environmental noise such as transport sources which are generally anonymous of any particular site or activity. In contrast only limited decibel guidelines are found in relation to neighbourhood noises which display attention grabbing characteristics. In the analysis within this paper of 45 reports, even well established transport noise guidelines were misapplied.

## **2. PART I - NOISE EXHIBITING NOTABLE ATTENTION GRABBING CHARACTER**

### **2.1 Introduction to character**

Research on the effects of combined character impact is limited and compounded by unquantifiable cumulative effects such as low frequency and modulating content or patterns and syncopation. Acoustics is arguably unable to quantify these different features in terms of their decibel equivalence and the continuing move to solely using decibel descriptors is questionable. Varying features of sound can be categorised by their attention grabbing quality leading to diverse responses, depending on the sensation level for the type of sound observed. Moderating factors include masking effects, cultural, community and learnt response mechanisms. Sounds that intrude by drawing attention and interrupting thoughts or rest and relaxation clearly do so when such sounds are sufficiently audible and not masked.

### **2.2 Disrupting sounds**

Research into the operation of our conscious and unconscious processes has revealed much about how we think and perceive sounds. Our unconscious listening appears to need obligatory access to memory however irrelevant the sound is and as a result it disrupts tasks, rest and relaxation regardless of its decibel level, unless inaudible or not discernible. Chronological arranging of sounds will affect seriation of other processes of the mind and therefore disrupt thinking, a process which is beyond our control unless applying high levels of memory such as with intense concentration. This may be okay when at work but not when at home relaxing. Thus irrelevant sound can disrupt more when we are not concentrating. Studies show acoustic change is identified as the main causal factor for disruption of thought processes, depending on pitch, timbre or tempo but not decibel level.

Researchers have recently established that different areas of the brain are involved in different aspects of the processing of sounds and we have different neurons which process different elements of sound. Some neurons process sound energy level, some sensation level, some the frequency content (tonotopy) and others *what* and *where* the sound is. Effects arise whether the sound occurs at the same time as visual effects. Habituation does not normally occur for many sounds but where it does, intervention by quiet appears to then lead to de-habituation again. This would not be the case with a continuous motorway. The adverse effects appear to arise from the automatic processing of auditory information that disrupts other memory processes and also due to subjective processing effects, especially the message imparted by the irrelevant sounds. For example stressor sounds clearly disrupt rest and relaxation more than tasks requiring high working memory such as proof reading. (2) (3).

---

<sup>1</sup> The message imparted by the noise can be complex such as the level of regard for those affected by the noise by noise producers, the necessity of the noise, whether it is expected in such a locality, the ease by which it could be avoided.

### 2.3 “What is it, where is it”

One of the better understood attention grabbing elements of noise which warrants particular attention is the “what is it and where is it” phenomenon that automatically disrupts attention or relaxation to ensure the inadvertent listener is alert to potential threats and the need for a “fight or flight” response. This also occurs at night(4). This phenomena and its importance in relation to noise with attention grabbing character for which decibel based standards are usually inadequate is the subject of a subsequent paper(5).

The human system of sound perception includes speech recognition but analyses of “what” and “where” a sound source is are quicker than speech recognition. For example, say you are waiting to meet a friend in a busy airport and they approach you from behind and call out “Hi John I am over here”, we almost instantly recognise “what” (our known friend calling which we decipher and separate from all the other sounds entering our ears, we do this almost in an instant) and “where” as those sounds arrive at our two ears at a slightly different level and time depending on the direction, allowing us to process direction and to some extent distance. Thus, we swing around even before we process the speech of what they said. In this case the speech content is unhelpful as it does not inform “where” they are.

It follows if we were meeting a stranger whose voice characteristics we had not learnt we would not instantly relate to their voice character but may turn around after processing the speech content which includes our name. It may depend how alert we were to anyone calling out.

Thus two of our most critical processing elements of the brain in relation to sound are “*what*” and “*where*”. It is recognised these relate to any danger the sound represents and where that danger may arise from. We may need to instantly respond, leading to flight or fight etc. A child does not have the same ability as an adult as it is still developing its “*what*” and “*where*” processing. It has a growing head size changing the differential between the ears and a vastly smaller source of learnt sound perceptions to compare.

Research shows (2)(3)(4) a trained pianist has rapid focus in close proximity to their location for musical sounds and the accuracy of tone and pitch. A conductor has more developed peripheral hearing ability to reflect the entire orchestra and any instrument with incorrect tuning or timing. Someone without musical ability has a less defined “*what*” and “*where*” system for the musical notes and instruments played. Musicians improve their sensitisation to error or change, in different ways. Two instruments can produce a note of exactly the same pitch and loudness but we can differentiate between the oboe and the flute or clarinet due to timbre (quality) of the sound. This ability arises as we have heard the instruments separately and have previously stored auditory information on each that differentiates them.

In the case of noise where its frequency content, pitch and timbre is constantly changing and which is sufficient to commonly trigger a subconscious response of “*what*” is it, we cannot habituate to it as the sound remains alien as it has not been heard before. Similar sounds will have less effect as we have something similar within our memory we can relate it to. In the case of alien sounds such as a newly built wind farm, people struggle to try to relate its sounds to something common within their environment but which is slightly different. Wind farm noise leads to a huge range of differing descriptors such as “shoes in the tumbler dryer”, “the aircraft never arriving” and a range of other, sometimes obscure and varying descriptors.

We experience the sensations of pitch, changing moment to moment with an infinite number of variables. When we increase our range of learnt sound memories, it increasingly dominates our repertoire of learnt sounds but also extends our thoughts / memories that relate these sounds to its disruption, ultimately leading to a wider recognition of adverse responses of what remains alien sounds that keeps drawing our attention. Thus we become aware these sounds relate to an immediate adverse response mechanism of “*what*” is it and “*where*” is it, which we cannot properly process and therefore it draws our attention. This is a circular situation where occurrence of the noise increases the negative responses.

Thus the human brain continues to struggle with “*what*” certain sounds are that commonly change. A classic example is modern music noise. Whilst subsequent to the instantaneous response, we consciously process the information recognising it is yet another manifestation of modern music and the instant reaction mechanism of “*what*” it continues to cause us to react. Our alert / alarm responses continue to be triggered and we have to suppress these. This is similar to the busy airport scenario where there are hundreds of voices and sounds that we filter and ignore while we are prepared for any sounds that we recognise as “*what*” they are. This is fine in an airport where we are alert and applying higher mental tasks but not when at home and trying to relax or focus on other matters.

Over time living with a sound source our “*what*” processing may become more sophisticated. Whilst the initial identification of “*what*” the sound source is may be quick, where the character is variable we will continue to assess the manifestation of the sound in the environment, based on our previous experience of the sound or similar sounds (e.g. in the case of a wind turbine, the plane that never arrives). Music noise from a nearby community centre will force us to try to anticipate what the sound represents, is it a dance lesson session lasting an hour or a late night party until 01:00 hours? We end up unconsciously making predictions based on our previous experience of the sound, but if or when these predictions or expectations are broken a new evaluation of the sound is made. Thus a rock band practising would introduce a variation in the disturbance identified.

“*Where*” a sound is can more easily be determined, when outside buildings, due to the fractional time difference of a sound arriving at the ears. It can be complicated where the source of noise varies or has low frequency content where directional filtering is reduced. This processing of “*where*” can also be briefly confused by changing spectrum and low frequency content, heightening our alert responses. Inside rooms the problem can be accentuated as reverberation within a room confuses the “*where*” effect.

This “*what*” and “*where*” leads to constant appraisal and re-appraisal of the sound and is why variable sounds are commonly more intrusive and grab attention. Simply put it is hard to ignore and may constantly distract once it emerges above its sensation level, the level when it attracts our attention.

In summary sounds that exhibit varying character is more often highly intrusive as once it is triggering sensation level neurons, i.e. we are processing the information it presents, our protective alert responses are triggered and working to establish “*what*” it is and “*where*” it is coming from as an immediate process, necessary to enable us to respond appropriately to a possible source of danger. It is commonly recognised this adverse response process is triggered more with sounds that are entirely alien or incongruous. As our experience of the range of different but new noises produced increases they would become more and more associated with any adverse response identified with the source where it has intruded and we cannot avoid it grabbing our attention. Such sounds arguably cannot be evaluated by absolute decibel levels. (4).

### 3. DISCUSSION

It is evident from the analysis of reports set out below that many acousticians consider or at least argue noise of whatever type of character cannot cause problems below a certain absolute external or internal level. There is no objective evidence to support this in the case of noise exhibiting special characteristics that increase or attract attention. In any event impact outside buildings which is widely used for assessment purposes does not necessarily correlate with the impact arising inside a dwelling. There are many reasons for this not least the common false assumption of there being a more or less fixed relationship between the source noise and the level of masking noise outside, which is believed to be the same inside and also the reduction from outside to inside which is viewed simplistically as between 10-15dBA for a partially open window. This is often argued on the basis of statements within the WHO Community Noise Guidelines 1999 (6) but a simple review of the WHO Community Noise Stockholm 1995 (7) on which the 1999 guidelines are based reveals this as an erroneous interpretation of those guidelines.

It is long recognised that sounds of different spectral content will reduce to different amounts from outside to inside as will sources from different directions. Another false assumption commonly stated in UK reports is that inside dwellings background noise levels are typically in the region of

20-30dBA. In many cases measured by MAS they are well below 10-15dBA<sup>2</sup> even with windows open and in urban areas. These are common errors identified within reports reviewed.

The consequence of human reaction to noise with attention grabbing character is that impact relates more to its emergence above its sensation level and in turn this depends not just on the content of the intruding noise but also on the level and content of masking noise present in an environment. It is well recognised in a noisy party or gathering that we can instantly pick out someone saying our name or speech from a voice we recognise, even when quiet and well away from us because of the “what” and “where” mechanisms which is commonly known as the “cocktail effect” (4). It follows a valid assessment of impact inside a dwelling requires observations and measurements inside that dwelling, not just of the sound energy but audio content as well, using instruments that do not mask the noise by generating electrical energy within their circuitry at levels within 10dBA of the source being assessed.

Thus whilst we understand some sounds disrupt not due to their decibel level or tonal content etc. but because of the message they impart to an inadvertent listener, evaluating the introduction of such noise sources into a community or locating dwellings near such sources of noise arguably requires consideration of the audibility, discern-ability, incongruity and dominance of such sources of noise along with an analysis of what effects they are liable to have on people in their homes. This type of pragmatic observation style analysis appears uninformed by the decibel levels other than in relation to the level of masking provided but is well recognised by the UK courts (8).

## **4. PART II - ANALYSIS OF THE APPLICATION OF GUIDANCE AND CONSIDERATION OF THE CHARACTER OF NOISE.**

### **4.1 Introduction**

In order to consider how UK acousticians consider the effect of character in noise a random review of 45 UK noise impact assessments was undertaken to determine the extent to which noise with attention grabbing character are assessed by acousticians or whether, primarily, reliance is placed on decibel levels and use of guidelines for noise absent such characteristics such as more benign and anonymous sources of noise. Further research into their comparison is to follow in subsequent papers.

### **4.2 Diminishing moderating controls by enforcers.**

The Local Authority Environmental Health profession in the UK are generally public health specialists tasked with providing the main advice on regulatory control of noise producing developments. They originally approached noise problems through analysis of actual human response to noise. As guidance has developed, acousticians who are in the main engineers, have effectively taken a lead role in the assessment and control of noise. In turn there is a perception they focus on the more simplistic measurable quantity, the decibel. Conversely some UK development control guidance has in part moved away from reliance on the decibel and looks at noise in terms of its effects rather than decibel levels.

In recent years there has been a significant loss of regulatory expertise in relation to noise which it is considered has led to a lack of focus on decibel guidance and in turn, arguably has led to widespread misunderstanding of guideline levels.

Anecdotal evidence also suggests widespread misapplication of decibel based guidance to all types of noise simplifying assessment and reducing the constraints otherwise arising. This paper forms part of a wider review of this problem. Degradation of control is argued in the formulation of some standards or guidance where contradictory interpretations are now common.

The most common erroneous argument found in the UK as supported by this study is that noise with decibel levels below the WHO (1999) guideline values for transport sources of noise must be acceptable to amenity whatever the source of noise, the guideline levels apply to all community noise and relate to amenity effects, not just health effects. This analysis also reveals the adoption of WHO transport noise guideline values by many regulators and decision makers for all types of noise.

Virtually none of the reports reviewed provide caution or address the caveats to the application and use of the WHO (1999) and similar guideline levels. Conversely UK courts have dismissed such misuse of standards and guidelines (9).

---

<sup>2</sup> The most common reason identified in MAS research for this error is the use of sound level meters and microphones which exhibit a noise floor of the order of 18-23dBA and thereby mask the true sound environment.

In the vast majority of cases reviewed it was considered the decibel worked simply to ignore the relevance and important aspects of character and sensation level and focuses solely on intensity / energy level ignoring the true complex interrelationship of sound impact upon humans and eroding the importance of true noise effects.

A classic example of this is the absolute level of noise. ISO1996 long recognised the relevance of the emergence of noise above the background noise level and the need for a penalty to reflect noise character. The concept is a simple one that noise should be masked by other sounds and once they attain a certain level, regardless of masking, they should not exceed certain levels of emergence depending on the character contained within the noise. In other words there were limits to which people should be exposed and it should not go any higher. The reverse argument by some acousticians that noise, regardless of character, does not cause adverse impact below a certain decibel level is progressively being argued in the UK.

A classic example in the UK was with guidance ETSU-R-97 (10) on wind farms. This still remains the UK official guidance for the assessment of a proposed wind farm despite evidence such farms compliant with ETSU-R-97 cause more community complaints as a proportion of their number than any other category of noise identified in the UK. ETSU-R-97 used the WHO guideline value for traffic noise that led to the onset of critical health effects to evolve its minimum levels of acceptable noise and argued wind farm noise is not different unless tonal and will not cause adverse impact below an equivalent level. Furthermore it argued wind farm noise levels could rise well above the WHO guideline provided there is a degree of masking noise when assessed externally. It disregarded the total noise dose and applied a known flawed argument that wind farm noise was no more intrusive than transport noise. It also applied a known flawed argument that the introduction of attention grabbing character, i.e. tonality, merely required a penalty adjustment regardless of how dominant that character remained in the sound environment. There is no basis for this within the WHO guidelines or research. Despite much emerging evidence that this approach was not just logically flawed but empirically and evidentially flawed it has taken more than 20 years for there to be wider recognition that wind farm noise is more intrusive than traffic noise with differences up to 16 decibels for road traffic now reported (11) There remains evidence many acousticians who primarily work for the industry continue to deny noise effects. The complaints are strongly supported by widespread community complaints in particular in quiet areas. The result is distrust in acousticians and acoustic standards and in the case of wind farms, potentially long term damage to the reputation of this necessary renewable energy.

On its face the evidence within this analysis indicates many acousticians do not acknowledge or recognise the importance of the nature and character of noise and how it influences human reaction. The research presented in this paper reveals a need for a fundamental change in the approach to noise assessment, investigation and the integrity and reliability of impact assessments in the UK. There is extensive evidence of the failings of the current system and it is proposed to provide a series of papers to follow this demonstrating these problems and referencing the reports analysed.

### **4.3 Action of enforcers**

Another consideration for a future study already underway is the effectiveness of enforcers and their understanding and application of statutory controls.

## **5. PART III - APPROACH TO STUDY OF NOISE IMPACT ASSESSMENTS AND FINDINGS**

45 randomly selected reports provided by consultants were analysed in detail from a number of sources including and primarily relating to UK planning applications for new development. The approach adopted was to analyse the purpose of the report, review whether it references and applies relevant guidance and standards commonly recognised as applicable to the matter being analysed, whether limitations within the standards and guidance are referenced in the report and whether they are applied contrary to the context identified within the guidance. Focus was applied to many cases involving a mix of intruding sources of noise including those with particular attention grabbing character. They include sources for which specific guidance was available and others cases for which no decibel level guidance existed in the UK or in international standards.

The primary areas considered include:

- New residential development affected by transport sources

- New residential development affected by commercial noise sources and / or mixed sources
- New industrial / commercial sources affecting dwellings
- Existing sources of commercial noise that intended to intensify or change.

Below a number of potential non-acoustic factors are identified, none of which were considered as modifying factors except in a small minority of reviewed cases in relation solely to an arbitrary shift of decibel limits potentially lowering the sound energy slightly. No other forms of control were considered in the reports reviewed:

- Any special characteristics which attract attention or prevent habituation.
- Duration and intermittency of the noise and especially at particularly sensitive times.
- Times of occurrence compared to what is normal at that time and expectation.
- What activity is disrupted (social factors) and whether it involves low or high memory / concentration.
- The message imparted by the noise and how it is perceived by those impacted.
- Audibility, relative loudness or dominance of the noise in context to other sounds.
- Variation and fluctuation in the noise over time.
- Incongruity with the sound environment and alien content.
- Timbre / quality and pitch of the noise as well as how these features change.
- Rhythm and syncopation within the noise.
- Regularity including the regularity of specific features in the noise.
- Respite from the noise and the length / duration of respite.
- What types of noise are expected or typically experienced (norm) in such a locality.
- How easily the noise intrusion is avoided by those causing it.
- How easily recipients can escape the noise.
- Modifications to lifestyle caused by the noise.
- Cumulative effects whether from other types of noise or other sensor triggers such as smell, light and vision / seeing activities causing the noise.
- Necessity of the noise and its direct relationship to the needs of society.
- Want or like of activities the noise represents.
- Whether the noise is identifiable or anonymous and non-descript.
- Whether expected or unexpected and predictability of occurrence at specific times.
- Impact upon periods of expected freedom from or reduced noise such as at weekends.
- Social relationship with those causing the noise.
- Ability to plan for and modify living to address any intrusion.

Taking two arguably non-acoustic points, respite from the noise and modifications to lifestyle caused, none of the reports involving the introduction of new sources of noise discussed, reviewed or analysed what respite was afforded from noise and whether this coincided with times of expected greater freedom from noise. In the case of new residential development, many were assessed on the basis that to achieve an acceptable internal sound environment, windows would need to be kept closed. None of the reports reviewed considered the problem of the need for summertime cooling and the need to open windows at times to address high humidity and excess heat gain, concluding windows could remain closed with trickle ventilation provided. In one case a site check was undertaken during a warm summertime period which revealed a high number of dwelling occupiers in the assessed residential development chose to leave their windows wide open at night, presumably placing the need to purge ventilate and cool internally above the intruding noise that resulted. This is a further part of the study to be reported.

The importance of noise character is commonly referenced in guidelines and was also referenced in some of the reports. It is similarly highlighted within the syllabus of acoustic qualifications. This detailed analysis of 45 reports in the UK reveals it is has been consistently ignored or its contribution / importance diminished to a minimal penalty that does not serve to address the audible effects of its character.

The reports were selected using a range of search criteria that included key words relating primarily to proposed development requiring governmental permission. This analysis has deliberately avoided wind farm developments where a particular narrow set of guidelines apply in the UK. The reports

date from 2009 to 2017.

Common features of some of the assessments that are questioned as potentially inappropriate include:

- a. Using noise guideline values that are restricted to assessing impact from transport sources of noise as if directly applicable to all forms of community noise regardless of their different character and effects.
- b. Disregarding specific guidance relating to sources of noise with character and in cases arguing it is inapplicable citing reasons that are inconsistent with the guidance itself. The most commonly ignored guidance documents include WHO 2009 Night Noise Guidelines (12), guidance on music noise and that for industrial and commercial noise.
- c. Disregard of dominance of noise with intrusive character. In some cases a 5dBA penalty was applied but this did not change the source of noise such it was no longer dominant.
- d. Assessing internal levels of noise with windows closed meaning they will need to remain closed to provide an acceptable internal environment.
- e. Creating criteria for noise with character from guidance relating to other sources of noise that also has character but disregarding the differences and restrictions on that guidance. For example guidance on impulse shooting noise is often applied to other forms of impulse noise but this disregards cumulative effects of other character present and the shooting noise guidelines relate to daytime levels only.
- f. Focus on the increase in total sound energy provided either daily or annually rather than the effect of introducing alien sounds or character not commonly experienced. Use of long term averaging
- g. Ignoring and failing to report caveats in guidance about their use and thus using them outside of their scope. The most common cases of this related to BS8233 (13) and the WHO 1999 Community Noise Guidelines (6).
- h. Adopting arbitrary criteria for noise with attention grabbing character with minimal explanation or reasoning and which was generally formulated on more benign sources of noise.
- i. In a very small minority of cases reports provided explanation of criteria adopted. In only one case it was considered the criteria adopted reflected the increased intrusiveness of a particular character of the noise (impulse character of balls striking a fence) but it nevertheless applied absolute criteria to internal impact and thus was not context related. People noise was also ignored.
- j. Non-acoustic effects and criteria were ignored in all assessments, for example the need for respite from the noise.
- k. In many cases sources of noise with character was ignored during the assessments. In a small minority of cases they were discussed but no adjustment was made to reflect their added intrusiveness.
- l. There was a general failure to consider cumulative effects, whether in relation to cumulative sound energy, different effects of different sources of noise or total effects of impact upon multiple senses, sound, light and smell.
- m. In many cases selective reporting of limitations on the use of guidance was applied resulting in different interpretations to those presented in the guidance or standard. The common outcome of this was the exclusion of guidance inappropriately.
- n. In most cases assessments of sound energy levels were performed during one weekday night often at locations away from residential property and with no reporting of wind direction. Requirements of BS7445 and ISO1996 for short term surveys were generally ignored despite claims to the contrary in some cases.



**Noise source types reviewed:**

- |   |                                 |  |                                       |
|---|---------------------------------|--|---------------------------------------|
| a. Mainly commercial plant                                  | d. Music related                | h. Mix of various commercial and transport | k. Other community noise i.e. kennels |
| b. Road traffic noise                                       | e. Various industrial sources   | i. Sea transport and dock noise            |                                       |
| c. Sport related impulse and voices / shouts / power sports | f. Construction noise           | j. Railway noise                           |                                       |
|   | g. Air traffic and ground noise |  |                                       |

Table 1 – Summary of analysis of 45 reports on environmental noise produced in the UK in support of development and what they consider.

Reference No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Source types of noise in Report.	a	b	a	e	e	a	a	g	b	a	b	h	e	c	a	e	e	e	c	h	k	h	h	b	b	e	C	k	p	h	c	h	c	h	h	h	e	c	c	k	bh	b	h	h	
Involves non-transport sources with attention grabbing character	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	
Acceptability and assessment criteria based solely on decibel levels.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Considers effect of all non-transport characteristics affecting impact	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	-	N	N	
Considers some of non-transport characteristics affecting impact	Y	-	Y	Y	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	-	Y	N	N	N	N	N	N	-	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Uses Guideline values or Standards outside of their scope	Y	Y	Y	Y	-	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Identifies the use of Guidelines and Standards outside of their scope	N	N	N	Y	-	N	-	-	N	Y	N	Y	N	Y	N	N	-	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y
Uses transport noise related guidelines to determine non-transport sources with attention grabbing character	N	-	Y	Y	-	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	



## 6. CONCLUSIONS

There was widespread misapplication of guidance and commonly this was supported by misquoting the guidance itself or applying its guidance out of the context to which it was considered. In most cases the guidance was simply stated as directly applicable to the type of noise under review.

In none of the cases were non-acoustic modifiers applied to the analysis of noise impact, for example including periods of freedom from intruding noise. None of the reports considered the suitability of hours or days of operation of intruding noise sources other than when recognising their occurrence at night.

- In only 2 cases out of 43 (5%) did the authors consider all intruding elements of the noise.
- In 15 out of 40 cases (38%) report authors completely ignored the presence of attention grabbing character and assessed the noise as equivalent to a more benign transport type source.
- In 41 out of 44 cases (93%) guidance was used outside of its scope and in only 9 of those (20%) did the authors identify they had done this.
- In 30 out of 43 cases (70%) transport noise guidelines were used to determine acceptability of non-transport noise sources that had recognised attention grabbing character.
- In 33 out of 44 cases (75%) specific guidelines addressing a source or element of noise were either totally or partially ignored. In some cases this was argued through selective quoting of parts of the guidelines in isolation and relevant parts ignored.
- In 34 out of 38 cases it was concluded less stringent controls were applied than would be derived either through applying the specific guidance relative to the noise type and in some cases ignored the conventional controls applied.
- In 10 out of 43 cases an arbitrary adjustment to guideline values was applied in order to argue their relevance to the type of noise under consideration and in none of those cases was the adjustment perceived as adequate, due to continued dominance of the noise characteristic.
- In 33 out of 45 cases (73%) it was considered the resulting noise was likely to include some significant low frequency elements but only in one of these was it reviewed. This was due to the insistence of regulators. It is concluded that in no case was low frequency noise effects adequately quantified or evaluated with recognised methods ignored.
- In 5 out of 45 cases (11%) acceptability for development was considered under a separate legislative regime that is not relevant to Town and Country Planning laws in the UK. In part this occurred as defences in law that are not applicable to the assessment of development were argued.
- It was concluded that in 34 out of 37 cases the interpretation of guidance adopted permitted higher noise than when applying guidance as written. In all cases this made arguments in support of development stronger.
- In only one case (2%) was there a perception enough information was provided to adequately inform on the acceptability of development. Inadequate information was varied but commonly included inadequate determination or misrepresentation of monitoring conditions, especially meteorological conditions and wind direction, monitoring locations and whether representative of noise typically experienced.
- In only 3 cases out of 42 (7%) where noise with special character likely to grab attention existed did report authors consider whether an intruding noise would be masked or remain dominant and continue to grab attention.
- In no cases did authors consider cumulative noise effects of all sources near and far. In many cases sources were considered against total noise guideline values in isolation of the existence of other noise. In no cases did report authors consider cumulative effects upon other senses such as light and smell issues associated with some of the sources.
- In some cases report authors identified guideline values were restricted, for example to “steady” and “continuous” source but even then continued to apply the guidelines without change. No authors considered the differences between “critical health effects” to which WHO guidelines were generally caveated and differences in terms of effects upon amenity.
- No reports made reference to guidance by the WHO either generally or specifically that the decibel level accounts for only a third of noise annoyance and that non-acoustic factors were effectively

considered more important.

- Few reports covering or including industrial and commercial noise made reference to BS4142: 2014 (14) or its predecessor BS4142: 1997, arguably the main standard in the UK for these categories of noise and where they did many misquoted its guidance to argue its exclusion or in cases effectively argued guidance in BS8233 (13) overrides its findings. This occurred despite BS8233 advising BS4142 should be used where its advice is applicable.

It is concluded common application of guidance outside of its scope, the exclusion of guidance that applies stricter criteria usually on erroneous grounds and ignoring the effect of attention grabbing character within noise sources altogether, is of serious concern warranting review by regulators. However, the regulators, who are locally based and lack significant central guidance or support on technical issues, lack quality and consistency requiring better organization, training and supervision.

The application of absolute thresholds based on daily transport noise in noisy areas to sources of noise which intrude when dominant or unmasked due to attention grabbing character, in quiet areas, along with disregard for incongruent and alien features within certain forms of noise, leads to poor planning, avoidable community conflicts and distrust.

There is the need for more detailed and systematic review of reports ensuring potential factors including low frequency noise and cumulative effects are not ignored. Complaining is recognized as a minority coping strategy and not a measure of noise acceptability but the high level of complaints over community sources of noise remains an indicator of substantial unacceptable noise impact within British society. The lack of appropriate and accurate assessment is indicated as one important contributor.

## REFERENCES

1. World Health Organisation (WHO) (2000) *Noise and Health* Copenhagen: WHO
2. Jones DM, Hughes RW, Macken WJ. Auditory distraction and serial memory: The avoidable and the ineluctable. *Noise Health* 2010;12:201-9
3. Banbury, S.P et al (2001). Auditory distraction and short term memory: phenomena and practical implications. *Human Factors The Journal of the Human Factors and Ergonomics Society* 43(1):12-29
4. Bars, B.J. & Gage, N.M (2010). *Cognition, Brain, and Consciousness*. 2nd ed. Academic Press.
5. www.masenv.co.uk – To be announced
6. Berglund B., Lindvall T., & Schwela D.H., (eds) World Health Organisation (WHO) (1999) *Guidelines for Community Noise*. Geneva: WHO
7. WHO (1995). Berglund B., & Lindvall, T. (Eds). *Community Noise*. Stockholm: WHO
8. *Godfrey v Conwy CBC* 2000 [2000] All ER (D) 1809
9. *Coventry v Lawrence* 2014 UK Supreme Court aka *Lawrence and Another v Fen Tigers Ltd and Others* [2011] EWHC 360 (QB), [2011] 4 All ER 1314
10. Great Britain. Department of Trade and Industry (DTI) (1996) *The Assessment and Rating of Noise from Wind Farms*. ETSU-R-97.
11. Michaud, D.S. et al (2016). Personal and situational variables associated with wind turbine noise annoyance. *J. Acoust. Soc. Am.* 139(3), 1455–1466
12. World Health Organisation (2009) *Night noise guidelines for Europe*. Geneva: WHO
13. British Standards Institution (2014) *BS8223:2014: Guidance on sound insulation and noise reduction for buildings*. London: BSI.
14. British Standards Institution (2014) *BS4142:2014: Methods for rating and assessing industrial and commercial sound*. London: BSI