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THE BRITISH STANDARD BS 4142 : 1990 - CASE STUDIES AND A CONSULTANT'S VIEW.

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1. INTRODUCTION

Part III of the Environmental Protection Act (1990) [1] recognises that noise (and vibration) can be the cause of statutory nuisance and hence there is a duty on Local Authorities to investigate complaints. The rise in complaints from noise originating from industrial and commercial premises has grown from just over 200 complaints per million persons in 1971 to over 700 in 1987/88. This is illustrated in figure 1 using the figures given in the Department of the Environment in the Noise Review Working Party Report 1990 [2].

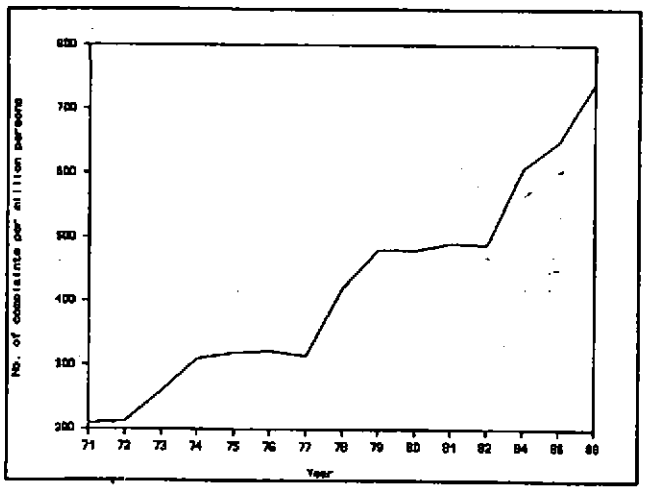

Figure 1. Complaints of noise from industrial and commercial premises received by environmental health officers. Original source: Environmental Health Reports. Institution of Environmental Health Officers.

2. SUMMARY OF THE NEW STANDARD

To meet the growth in environmental awareness the British Standard BS 4142, "Method for rating industrial noise affecting mixed residential and industrial areas", [3] has been updated. The new standard describes a method for assessing whether noise levels from factories and industrial premises are likely to give rise to complaints from people residing in neighbouring buildings. In general, noise is likely to provoke complaints whenever its level exceeds the background by a certain margin.

In summary, the new standard is intended to be used for assessing the measured noise from existing premises or the calculated noise from proposed new or modified premises. This is known as the specific noise level and, when corrected to take account of its character, it is compared with the background level to determine the likelihood of complaints.

2. ASSESSMENT PROCEDURE FOR THE NOISE FROM EXISTING PREMISES

The procedure for assessing the noise from existing premises can be divided into four parts:

i) Measure the specific noise level
This requires a measurement of the equivalent continuous sound pressure level (L_{Aeq}) at a position 1 m from the facade of the affected building. The measurements should be made at a position 1.2 m to 1.5 m above the ground and at least 3.5 m from any reflecting structures (other than the ground or the facade in question). Use a reference time interval (see glossary) of 1 hour during the day and 5 minutes during the night.

ii) Measure the background noise level
This is the L_{A90} measured in the absence of the specific noise taken for a period of time sufficient to obtain a representative value. Measurements should be taken at the same position as the specific noise. Where this is not possible (i.e. specific noise cannot be switched off) measurements should be taken at a position selected as being representative of the background noise in the absence of the specific noise.

iii) Determine the rating level
This is the specific noise plus an addition of 5 dB(A) if the character of the noise is irregular enough to attract attention or unpleasant (i.e. contains a whine, hiss, screech, hum, or bangs, clicks, clatters or thumps).

iv) Assess the noise
Calculate the difference between the rating level and the background level and use table 1 to determine the likelihood of complaints.

TABLE 1 - ASSESSING THE LIKELIHOOD OF NOISE COMPLAINTS

Difference between rating level and background (dB)	Assessment
- 10 or less	Positive indication that complaints are unlikely
+ 5	Marginal significance
+ 10 or greater	Complaints likely

In general, the lower the value of this difference the less likelihood of complaints.

3. COMMENTS AND INTERPRETATION

3.1. Limitations

The standard is limited in scope for example:

(i) Limited applications

The standard covers noise from:-

factories,
industrial premises
fixed installations
sources of an industrial nature in commercial premises

This presumably covers equipment such as office ventilation fans but not noise from leisure industries such as motorcar or motorcycle racing, clay pigeon shooting noise, rock concerts etc.

(ii) Limited assessments

The standard is not intended to cover (statuary) nuisance or general community annoyance. Only the assessment of whether the noise in question is likely to give rise to complaint is covered by the standard.

(iii) Limited background noise

The standard cannot be used for assessing the noise measured inside buildings or for assessing noise situations where the background is very low i.e. below 30 dB(A). This is an important limitation which could easily be overlooked. No guidance is given on what action is taken in such situations. For example, is an assumed background

(iv) Limited frequencies

The exclusive use of the 'A' weighting frequency filter makes the standard unsuitable for the assessment of predominately low frequency (i.e. below 250 Hz) noise, particularly if the noise is low level and was an unpleasant, variable character such as noise from some fans, compressors, bass drum type noises (see for example Scannell (1989) [4]).

3.2 Creeping Background

The standard does not address the age old problem of creeping background noise from industrial estates. For example, a factory which has an existing (and acceptable) noise installs a new machine which increases the noise by 5 dB(A). According to the standard this would be judged as of 'marginal significance'. Sometime later a second machine is adding giving a further rise of 5 dB(A). Another time, another machine and a further 5 dB(A) rise in noise level. All three rises are of marginal significance. However, over the full time period a highly significant 15 dB(A) increases has been allowed. It was to stop this creeping background rise in noise levels that the 'Noise Abatement Zone' system was developed. Unfortunately this system has not been generally implemented due to the large resources (both financial and in terms of personnel) required to make it work (see for example Hinton 1987).

3.3 Tonal Noise

No clear definition is given in the standard for tonal noise. This could lead to confusion and conflict in deciding whether to add the 5 dB(A) correction factor. See for example case study number 6.3 -'Broad tonal noise'.

4. CONCLUSIONS

For all of its limitations the standard is of use in practice to:

(i) ascertain whether noise complains are reasonable

(ii) establish noise control targets.

These two uses make the standard a worthwhile aid in the fight against environmental noise pollution.

5. REFERENCES

[1] The Environmental Protection Act (1990) HMSO Books, London.

[2] Report of the Noise Review Working Party (1990) HMSO Books, London.

[3] British Standard BS 4142 (1990) 'Method for Rating industrial noise affecting mixed residential and industrial areas' British Standards Institute, London.

[4] Scannell, K. (1989) 'Human Response to a Low Frequency Repetitive, Impulsive Noise' Journal of Low Frequency Noise and Vibration, Volume 8, Number 4, pp. 122 - 129.

[5] Hinton, J. (1987) 'Noise Abatement Zones - The Way Forward', Proc. IOA Vol. 9 Part 7 pp. 51 - 57.

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6. CASE STUDIES

6.1 BROAD BAND NOISE

Problem

A Large pharmaceutical factory with noisy plant on the Northern boundary. The noise is from fans and compressors and is continuous 24 hours per day 365 days per year. The noise is broadband and not of an impulsive temporal structure. The noise cannot be switched off.

Results and Assessment

			Relevant clause
Night time			
$L_{Aeq,Tm}$ = 52 dB T_m = T_r = 5 min			5.5.2
Specific noise level	$L_{Aeq,(5\ min)}$ =	52 dB	
Character correction		0 dB	
Rating level		52 dB	7
Background level	$L_{A90,(10\ min)}$ =	40 dB	6.4
Assessment level	52 - 40	12 dB	8.2

Conclusion: complaints likely.

Action

(i) - Options

A noise barrier was considered, however acoustic fences and walls are expensive and require constant maintenance. A traditional earth bund could not be used due to the large base area required. A barrier consisting of willow slats woven between two sets of willow post and filled with soil seemed an good solution. However, the cost was £100 per square metre and calculations predicted that a barrier 3 m high and 150 m long would be required, at a cost of £45000.

(ii) - Solution chosen

The Industrial Noise and Vibration Centre were consulted and noise control at source methods were recommend on the numerous noise sources. For less than 10% of the barrier cost, a noise reduction of 8 dB(A) at the nearest dwelling was achieved, giving a rating level (L_{Aeq}) of 44 dB and an assessment level of 4 dB (i.e. 44 - 40 dB). No further complaints have been received.

6.2. IMPULSE AND INTERMITTENT NOISE

Problem

A dairy depot which loads milk floats from 02:00 hours. The noise is generated by loading milk crates on to milk floats, diesel and electric powered float engines and from speech. The noise fluctuates at random and impulsive. The loading area is screened with a plastic curtain and is situated approximately 15 m from the window of the nearest dwelling.

Results and Assessment

				Relevant clause
Night time				
$L_{Aeq,Tm}$ = 39 dB T_m = T_r = 5 min				5.5.5
Specific noise level	$L_{Aeq,(5\ min)}$ =	39 dB		
Character correction		5 dB	(impulsive)	7.2
Rating level		44 dB		7
Background level	$L_{A90,(10\ min)}$ =	31 dB		6.3
Assessment level	44 - 31	13 dB		8.2

Conclusion: complaints likely.

Action

(i) Options

The Local Authority recommended that the dairy contact the Industrial Noise and Vibration Centre. The Centre determined that the best practical solution was to reduced the entrance opening as far as possible and replace the plastic curtains with an automatic closing acoustic door. This gave a sound reduction of 35 dB(A). When fitted it reduced the specific noise level (L_{Aeq}) to 34 dB giving an assessment level of 3 dB (i.e. 34 - 31 dB) and the impulsive noise was inaudible.

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6.3. BROAD TONAL NOISE

Problem

A two storey engineering workshop which only operates during the day time. It is situated in the middle of an urban residential road. The noise is generated by capstan lathes turning small screws and other small components. The noise is quite tonal in the 2500 to 4000 Hz range and escapes from the many large windows in the factory.

Results and Assessment

				Relevant clause
Day time				
$L_{Aeq,Tm}$ = 71 dB (windows open)				
$L_{Aeq,Tm}$ = 60 dB (windows closed)				
$T_m = T_r$ = 5 min				5.5.5
Specific noise level	$L_{Aeq,(5\ min)}$ =	71 dB	60 dB	7.2
Character correction		5 dB	5 dB	7
Rating level		76 dB	65 dB	
Background level	$L_{A90,(10\ min)}$ =	43 dB		6.3
Assessment level (windows open)	76 - 43	33 dB		8.2
Assessment level (windows closed)	65 - 43	22 dB		

Conclusion: complaints very likely.

Action

(i) Notice and Local Authority recommendation.
A notice to reduce the noise was served on the company and replacement windows costing in the order of £20000 and mechanical ventilation costing £3500 was recommended by the Local Authority.

(ii) INVC contacted by the Company.
The company contacted the Industrial Noise and Vibration Centre who designed a low cost secondary glazing system which cost £2500 and recommended minor machine modifications. The noise level was reduced from 60 dB(A) to 45 dB(A) with the tonal content removed. Assessment level was reduced to 2 dB (i.e. 45 - 43 dB) and further complaints have not been recieved to date.

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6.4. NARROW BAND TONAL NOISE

Problem

An agricultural company, situated approximately 300 m from the local village, installed a grain dryer. The noise from the fan of the dryer produced a noise level of 63 dB(A) at 30 m and it is required to operate for 24 hours per day. The noise is also tonal with a blade passing frequency at 144 Hz and the 1 st Harmonic at 288 Hz. The noise level from the fan at the closest dwelling in the village was 43 dB(A).

Results and Assessment

			Relevant clause
Night time			
$L_{Aeq,Tm}$ = 43 dB $T_m = T_r$ = 5 min			5.5.5
Specific noise level	$L_{Aeq,T(5\ min)}$ =	43 dB	
Character correction		5 dB	7.2
Rating level		48 dB	7
Background level	$L_{A90,(10\ min)}$ =	32 dB	6.3
Assessment level	48 - 32	16 dB	8.2

Conclusion: complaints likely.

Action

(i) Local Authority refused night time use.
Conventional fan silencers could not be used for hygienic reasons and the Local Authority refused night time used of the dryer.

(ii) INVC consulted.
The Industrial Noise and Vibration Centre were consulted and noise control at source involving internal modifications to the fans and ducts were recommended. This resulted in a 20 dB reduction at the frequency of complaint and an overall reduction of 11 dB(A). The tone was also completely inaudible eliminating the need for the 5 dB(A) tonal addition. This, together with the 11 dB(A) reduction gave a new rating level of 32 dB(A) (i.e. 48 - 5 - 11 dB(A) and an assessment level of 0 dB (i.e. 32 - 32 dB). The night time restriction was lifted and the residents remained undisturbed.