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The Rating of Impulsive Noise

John Seller
Tottenham Acoustical Group
All Saints, White Hart Lane, London

1. Introduction

There are many occasions when impulsive noise can be determined using L_{Aeq}, . The use of L_{Aeq} will give satisfactory results. However there are occasions when such techniques fail because of the impulsive noise being embedded in environmental noise.

2. Discussion

I have spent many hours this year listening to Clay Pigeon Shooting and Piling. It is my opinion that I cannot attest that a noise is a nuisance if I cannot hear it because of the high background noise. I am also of the opinion that the greater the specific noise is in excess of the contemporaneous background level the more likely that the noise will be adjudged a nuisance.

At the sites that I have been monitoring the background levels vary from the low thirties to the high fifties. A specific noise level of 55 dB(A) is very noticeable over a background of 32 dB(A) (and gave rise to complaints) but that level was barely noticeable over a background of 49 dB(A). Very high levels for these sites (over 72 dB(A)) normally invoked complaints.

It is my opinion that for impulsive noise the following factors are important:-

- the impulsive noise level
- the background level
- the rate of discernable impulses heard
- the duration, time of day, the number of days per week

Another problem that I have encountered is in determining a fair value for the impulsive noise.

In defining the term **Typical Maximum Level** I have attempted to take account of the atypical result due to the occasional rogue cartridge or the build up of blanks in a power press or the unusual propagational properties.

I wanted a simple way to make allowance for the above and thus decided not to go for the absolute maximum value. I have done a number of statistical analysis of the level of impulses and the figure 4 is a typical distribution.

I am only interested in rating those impulses that I can hear, because the impulses that are inaudible cause no problem. The **Discernable rate of impulses** takes this into account.

The greatest problem that I have met is in assessing what is a reasonable number of occasions that an individual be subjected to impulsive noise. Clearly the complainant will want it to tend toward zero whilst the manufacturer will want no restraint. I have used a correction of ten times the logarithm of the number of days that discernable

formula based on there being up to about half the days per month when there was impulsive noise - how justified it would be in extrapolating it to every day per month is speculative but the maximum correction is 7 dB)

Digital meters are superb instruments but care has to be exercised in their use - read the instruction book and know what they are displaying.

Definitions

Background Noise Level is the Level in the absence of the Specific noise (in this case the impulsive noise) and shall be determined in terms of $L_{A90,T}$ using the F time-weighting.

Impulsive Background Noise Level is the background level whilst impulsive noise is in progress and shall be determined in terms of $L_{A90,T}$ using the F time-weighting.

Specific Noise Level is the noise level of the source (in this case the impulsive noise) and shall be determined as the Representative Maximum Level.

Typical Maximum Level $L_{AMAX9000}$ is that level which is exceeded on at least fifteen occasions in a fifteen minute period and shall be determined using the F time-weighting.

Alternatively it may be determined by measuring the $L_{AMAX9000I}$ using the I time-weighting and subtracting 5 dB to obtain the estimation of the $L_{AMAX9000}$ using the F time-weighting.

Discernable Impulse is any impulsive noise whose level exceeds the impulsive background level by 6 dB when measured using the F time-weighting.

Note care should be exercised to endeavour to exclude all impulses from other sources.

Discernable Rate of Impulses per minute R shall be determined by obtaining the average rate of impulses of discernable impulses.

The average rate of impulses shall be determined over at least five one minute periods distributed through a fifteen minute period.

Rate correction value C_r is given by the formula

$$C_r = 10 \lg (R/10) + 10 \lg(n/6) \quad \text{dB}$$

where $1 < R < 40$,

$1 < n < 16$

and n is the number of days in the previous month when there were discernable shots at any of the measurement positions.

Corrected Maximum Level LAc is given by Typical Maximum Level plus the Rate correction value.

Impulsive noise with birdsong and vehicles.
Paper speed 1 mm/s. Pen set to fast time weighting

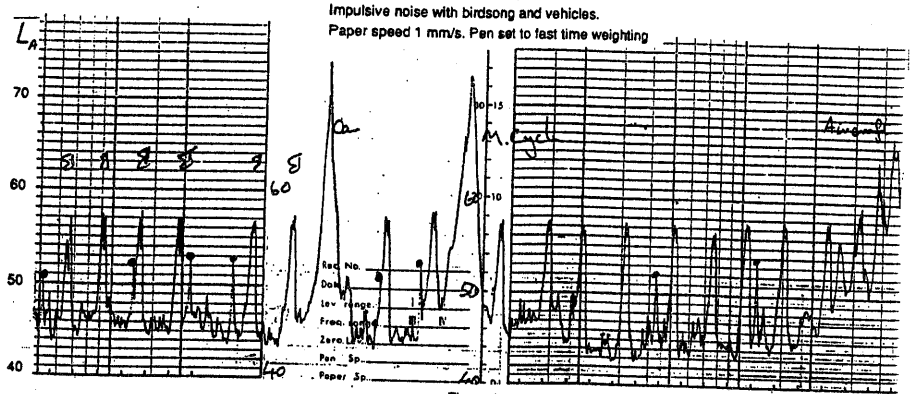

Figure 1

Impulsive noise with other impulses and birdsong.
Paper speed 1 mm/s. Pen set to fast time weighting

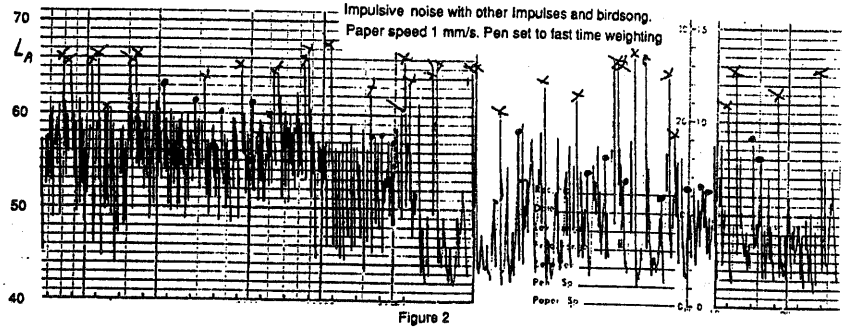

Figure 2

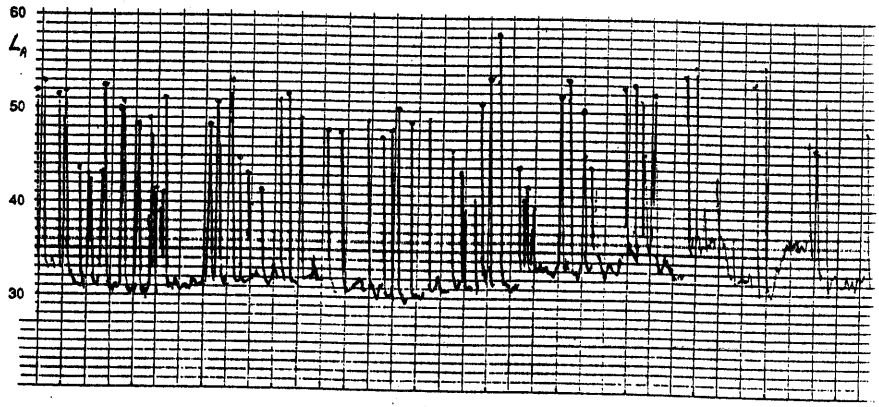

Figure 3

The Rating of Impulsive Noise

Rating Plot the Corrected Maximum Level against the Impulsive Background Level and determine the rating.

Day Rating the overall rating on any one day shall be equal to the highest rating determined on that day.

Level dB(A)	Distribution	Cumulative Distribution
66	2	2
65	1	3
64	1	4
63	1	5
62	3	8
61	7	15
60	8	23
59	14	37
58	27	64
57	28	92
56	24	116
55	29	145
54	23	168
53	15	183
52	14	197
51	3	200
50	3	203

Thus absolute maximum level	= 66 dB(A) fast time constant
Typical Maximum Level	= 61 dB(A) fast time constant
$L_{Aeq\ 15\ min}$	= 53.6 dB(A)
Background Level	= 45 dB(A) fast time constant

Figure 4

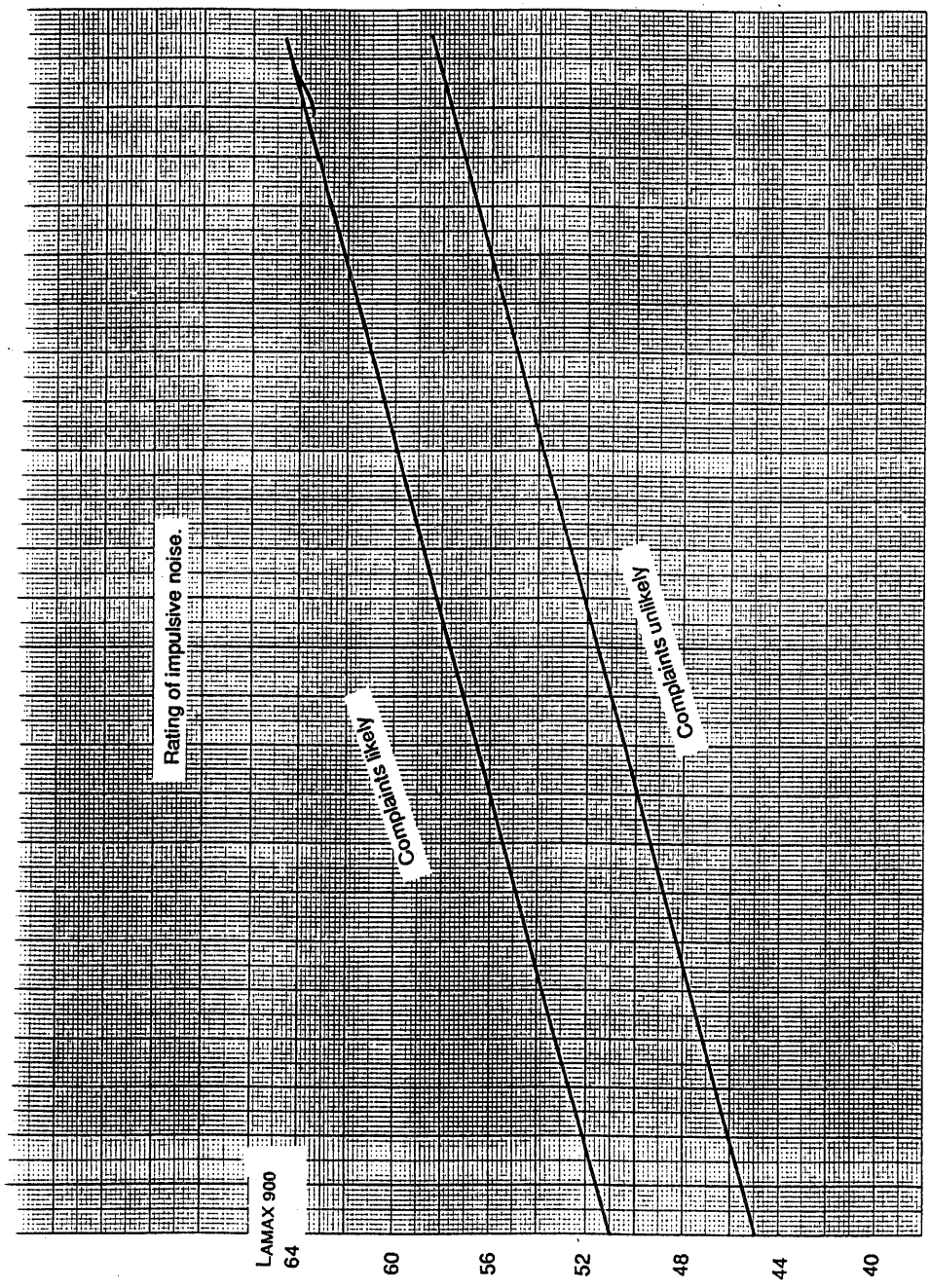
Rating of impulsive noise.
Complaints likely
Complaints unlikely
LAMAX 900
64
60
56
52
48
44
40
30
40
50
Impulsive Background Level dB(A)
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Figure 5