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AN OBJECTIVE METHOD OF ASSESSING NOISE ANNOYANCE FROM DISCOTHEQUES

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INTRODUCTION

Discotheque noise nuisance is a common, widespread and well known problem. The usual complaint is of a low frequency 'thumping noise'.[1]

The octave band spectra inside discotheques is relatively flat from 63Hz to 2 kHz centre band frequencies. The upper curve in figure 1 show a typical long term avaraged spectrum inside a discotheque. The lower curve shows the spectrum outside the discotheque and it is dominated by low frequency.

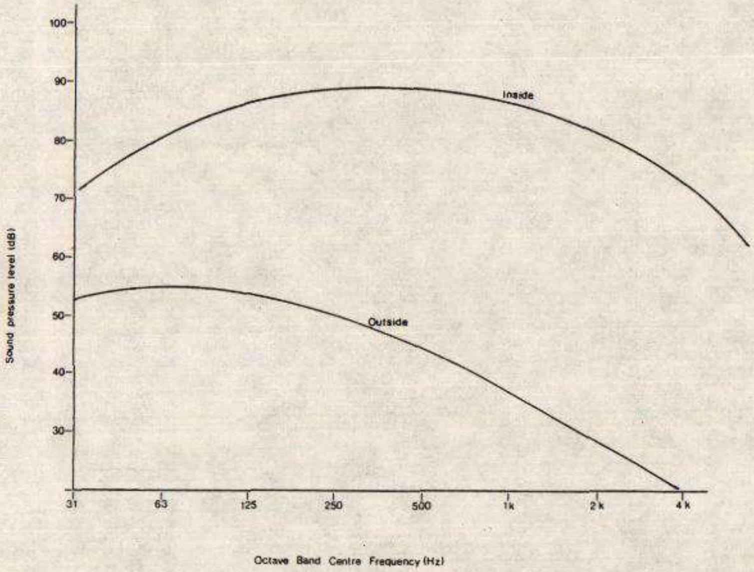
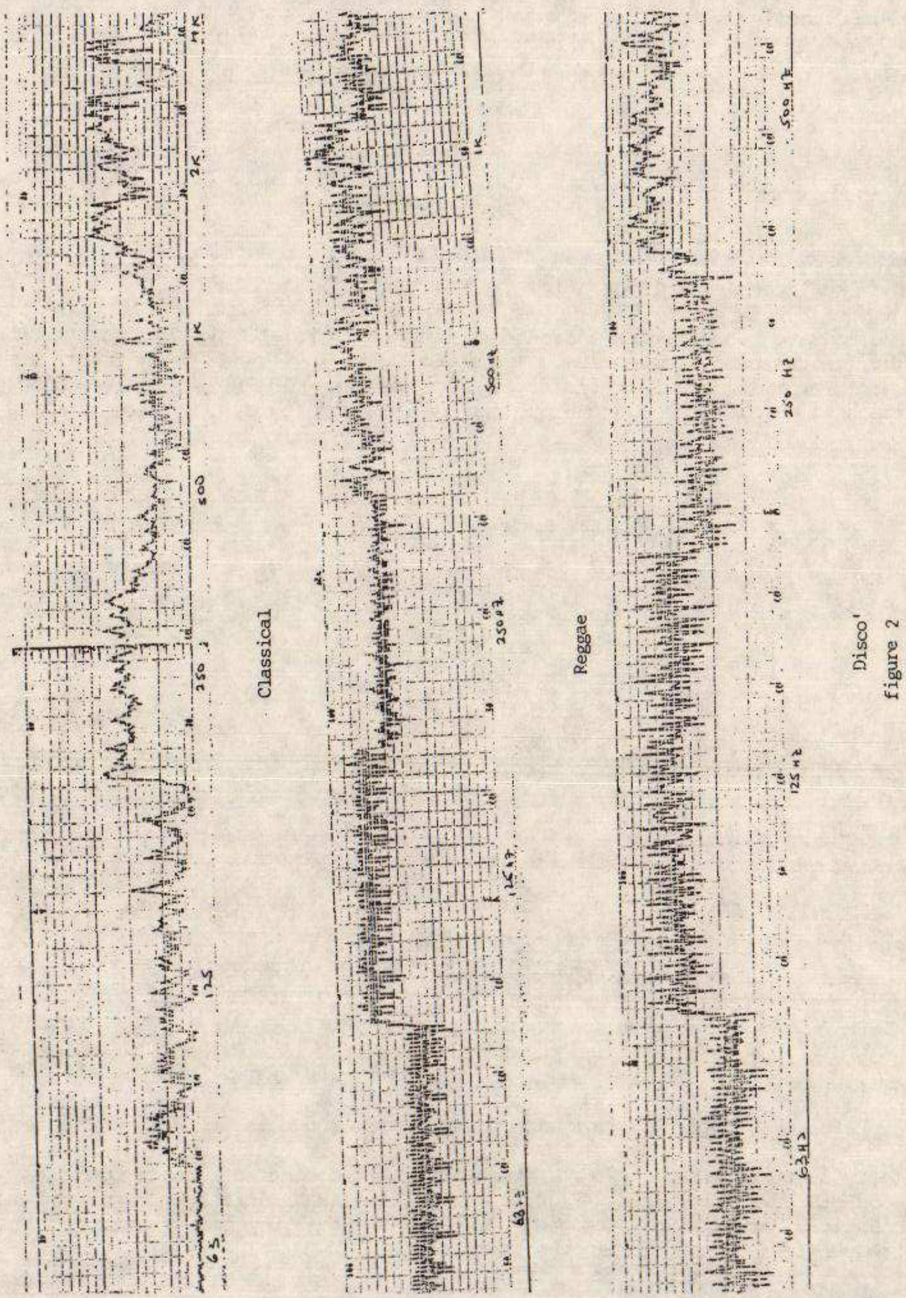


Figure 1. Typical averaged spectra inside and outside of discotheques

Most discotheque music, has a strong rhythmic content at low frequencies which adds to the annoyance. Figure 2 compares three different types of music; classical, disco and reggae, and shows the rhythmic pattern, at low frequencies, on the latter two examples.



Classical

Reggae

Disco'

figure 2

WEIGHTING

Being predominately low frequencies and rhythmic at low frequency it is of little use trying to assess the annoyance using 'A' weighting which attenuates this frequency by 16 to 40 dB. The other commonly used weightings 'B', 'C', and 'D' are also wrong. An ideal weighting for assessing discotheque noise annoyance is shown in Figure 3.[2]. This is compared to the 'A' weighting and shows a dramatic difference. As the ideal is not readily available it is best to use linear response.

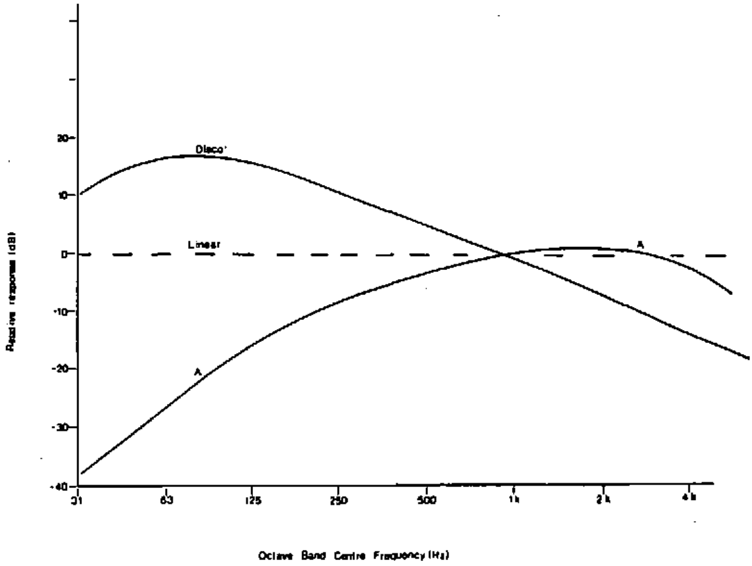


Figure 3. An ideal frequency weighting for disco' annoyance assessment and the familiar 'A' weighting.

OTHER FACTORS

Factors affecting the likelyhood of noise annoyance from discotheques include:-

i) The reverberent sound pressure level inside the discotheque Linear L_i.

ii) The ambient linear background level (L_{90}) at the resident premises when the discotheque is not operating. (At the various times of the day when complaint is likely).

iii) The transmission loss of the discotheque building (R).

iv) The area of radiating partition the side of the residence (S).

v) The distance between the discotheque and the residence premises (r).

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The factors can be related using the formula:-

$$L_i = L_{90} + R + 10 \log 4 - 10 \log S + 10 \log 2 \pi r^2 \ [3]$$

which can be reduced to:-

$$L_i = L_{90} + R - 10 \log S + 20 \log r + 14 \qquad (1)$$

(Where L_{90} is linear and fast weightings, S is in square metres and r is in metres)

(The 10 log 4 is included as the sound energy incident on the partition is diffuse but it is not on the transmitted side. The relationship between the acoustic pressure and the acoustic intensity is different by a factor of 4.) [4]

Formula 1 makes quite a few assumptions which can affect the accuracy of the predictions. It does, however, allow an objective estimate of the level inside the discotheque to be calculated for distances greater than about one wall width from the partition.

The factors such as the linear L_{90}: the partition area and the distances between discotheque and the residence can be easily measured. The transmission loss (R) may be more difficult to measure on site. Typical values for R are shown in Figure 4 and TABLE 1.

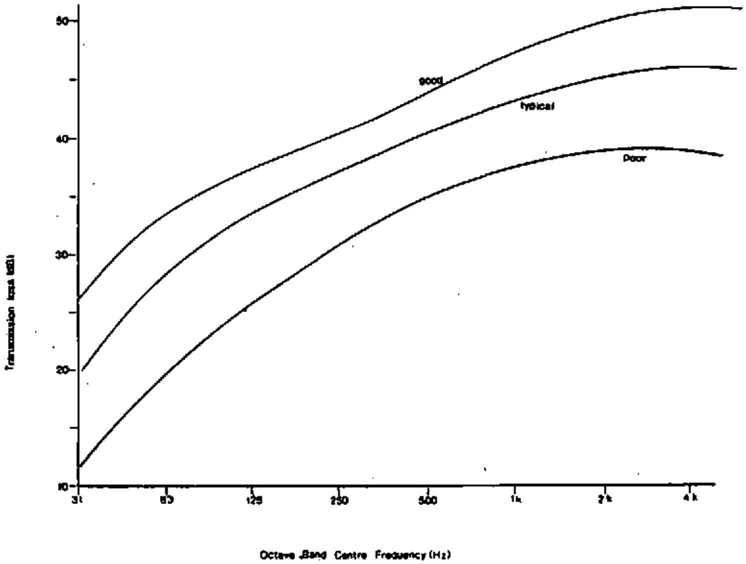

Figure 4. Transmission loss of typical discotheque buildings.

The value of R will depend on factors such as the construction materials used (e.g. wood, plasterboard and roof tiles are poor. Brick, concrete and thick glass (25 mm) are good) (5). Weak points such as open windows, ventilation systems, doors and thin glass panes will also greatly reduce the value of R.

For a general guide the following values of R can be used in TABLE 1 and are based only on the frequency of interest (i.e. 63Hz and 125Hz centre frequency octave bands.)

Quality of Construction	Transmission Loss R (dB)
Poor	16
Average	20
Good	25
Excellent	32

TABLE 1

ILLUSTRATION

A discotheque has a brick wall size 10 m X 5 m with two well sealed windows with 6 mm thick panes, 30 metres from the nearest residence. The measured L_{90} when the discotheque is not operating is 45dB. The discotheque employs a CEL 206 noise level limiter with the microphone in th reverberent field. The level L_i should be set at:-

$$L_{90} + R - 10 \log 50 + 20 \log r + 14$$

$$= 45 + 20 - 17 + 29 + 14$$

$$= 91 \text{ dB}$$

A linear level of 91 dB inside the discotheque will mean that the background level at the residence will not be increased. However, it is unlikely that this level will be high enough to please the patrions of the discotheque. Some further action is required. The windows can be replaced with 25 mm panes which should give an additional 5 dB (thermal double glazing will give little improvement at low frequencies). Thus the level can be increased to 96 dB. If the windows are replaced with bricks an approximate 8 dB increase in transmission loss can be expected giving a linear level of 99 dB. This level should please all parties.

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CONCLUSION

Setting and controlling levels in discotheques needs some degree of compromise and diplomacy. Using the trail and error method of deciding on a level can be time consuming and result in loss of credability.

Using formula 1 will not give a technical perfect answer on all occasions and it does make several assumptions, however it does give a good estimated basis to start on.

REFERENCES

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3. Acoustics, Noise + Building - Parkin/Humphreys + Cowell, 1985

4. Acoustics + Noise Control - Smith/Peters/Owen, 1985

5. The Airborne Sound Insulation of Patrions - E N Bazley, 1978