

ANALYSIS OF NOISE BOTHER BY SURVEY METHOD

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ABSTRACT

Noise degrades the quality of our environment and is known to produce many adverse effects both on humans and structures. In this project, embarked upon to identify the significant sources of noise in our environment (among other aims), it is found that - by using measurement, survey and tape-replay techniques - traffic noise is found to be the most significant source of noise. It is also found that it is the one that bothers people most, and that the degree of bother appears to be related to the energy content of the noise.

KEY WORDS : Noise, Environment, Survey, Tape-replay techniques

INTRODUCTION

Noise is now recognised as an aberration in our environment. It has escalated to the point where it is now a major threat to the quality of our life. This increase in noise can be attributed to the ever increasing population of the world and the rising levels of economic affluence.

Unfortunately noise will not vanish by a technical break-through. This is because there is no such thing as a really noise-less machine which is the major source of noise, because we insist on getting more powerful machines and because we show unconcern and apparent lack of awareness of the consequences of noise pollution.

It is now an established fact that excessive noise can cause hearing impairment, that certain levels and types of noise can cause heart attack, that body tissue resonances can be adversely affected by noise and that noise generally causes discomfort and annoyance to people exposed to it (EEC 1978). What are not so clear, in Nigeria, are the various types of noise that bother people, the impressions and elements that compose the complex 'noise-bother' reaction of people exposed to noise, and whether the degree of bother depends on the level of noise or not.

In this paper, the results of some studies carried out on peoples' reaction to noise are presented.

METHODOLOGY

This project was undertaken in three parts. The first part involved physical measurements of noise levels in specially selected areas of the various cities studied. These areas were around people's homes, and the aim was to enable checks to be made between people's responses of bother (as indicated by the bothered population) and the levels of noise. The second part involved survey as a series of interviews of different sectors of the population of Nigeria - North and South. The idea was to have an insight into what types of sources people identify as noise and how they are bothered by these.

The third part involved recording noise on tapes, replayable at predetermined levels and presenting

these to a selected section of the interviewed population. Their response was matched against levels of noise as an attempt to correlate degree of bother with level of noise.

(i) Noise Level Measurements

Various areas around homes and offices in the various cities were visited for noise level measurements. These were areas that inhabited sources that generated or appeared likely to generate noise.

Instrumentation:

The Bruel and Kjaer precision sound level meter type 2203 with 1/2 inch condenser microphone was used for all the measurements. The meter was first calibrated using the Bruel & Kjaer pistonphone type 4220.

Noise levels were measured according to the British Standard. The levels measured identified the areas that needed study. The criterion adopted was that

TABLE 1: LAGOS SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 94 | 84 |
| LORRIES | 88 | 80 |
| CHILDREN | 79 | 63 |
| BUILDING SITE | 75 | 41 |
| TRAINS | 63 | 37 |
| FACTORY | 60 | 41 |
| MOTOR CYCLE | 75 | 57 |
| AIRCRAFT | 79 | 56 |
| OTHER PEOPLE | 82 | 56 |
| NIGHT CLUB | 68 | 41 |
| ANIMALS | 59 | 12 |
| OTHER SOURCES | 63 | 21 |

TABLE 2: IBADAN SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 96 | 78 |
| LORRIES | 90 | 76 |
| CHILDREN | 81 | 63 |
| BUILDING SITE | 68 | 42 |
| TRAINS | 75 | 30 |
| FACTORY | 62 | 40 |
| MOTOR CYCLE | 72 | 32 |
| AIRCRAFT | 60 | 11 |
| OTHER PEOPLE | 91 | 62 |
| NIGHT CLUB | 69 | 37 |
| ANIMALS | 60 | 15 |
| OTHER SOURCES | 70 | 30 |

TABLE 3: PORT HARCOURT SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 92 | 81 |
| LORRIES | 90 | 65 |
| CHILDREN | 72 | 48 |
| BUILDING SITE | 54 | 20 |
| TRAINS | 80 | 42 |
| FACTORY | 78 | 51 |
| MOTOR CYCLE | 60 | 15 |
| AIRCRAFT | 72 | 20 |
| OTHER PEOPLE | 48 | 41 |
| NIGHT CLUB | 30 | 20 |
| ANIMALS | 62 | 37 |
| OTHER SOURCES | 42 | 30 |

any area in which the level of noise was up to 75 dB (10 dB safety margin) qualified as an interview area. By this method, 3500 interviews came to be undertaken.

(ii) **The Survey Method**

A questionnaire was developed as part of an interview survey while the interview itself was arranged in two parts. The first part addressed the impact of noise on the environment. Some major towns in the country were chosen as interview centres. The idea was to obtain the general sources of this impact first before undertaking a detailed study of any particular source. The topics of some questions in the questionnaire were on possible hearing acuity, on the neighbourhood people reside in, and on the types of noise they hear, as well as on topics that relate to the effects of noise exposure on different section of everyday life.

The interview samples on the whole, involved 3500 people. These were stratified to reflect the heavy noise areas of the cities selected; the areas being earlier identified by noise level measurements in them. On the whole, the survey covered 6 cities, Lagos, Ibadan, Port Harcourt, Enugu, Kaduna and Calabar. In Lagos 700 people were interviewed, 600 in Ibadan, 500 in Enugu, 300 in Calabar. The results are shown in tables 1 to 6. Figures 1 to 6 show the plots of the noise interviews of the exposed-population.

(iii) **Response To Noise Instrumentation**

Bruel & Kjaer frequency-modulated tape recorder type 7005 was employed in this section of the project. Noise was recorded from various sources at different levels using the combination of the sound level meter and the tape recorder. The meter was used to control the level of the noise for the duration of the tape required.

Experimentation

The various levels of the noise were presented to people in turns and their responses were noted. On the whole 300 interviewees were used, 50 from each of the cities. Their average responses are presented in table 7 with the corresponding plot in figure 7.

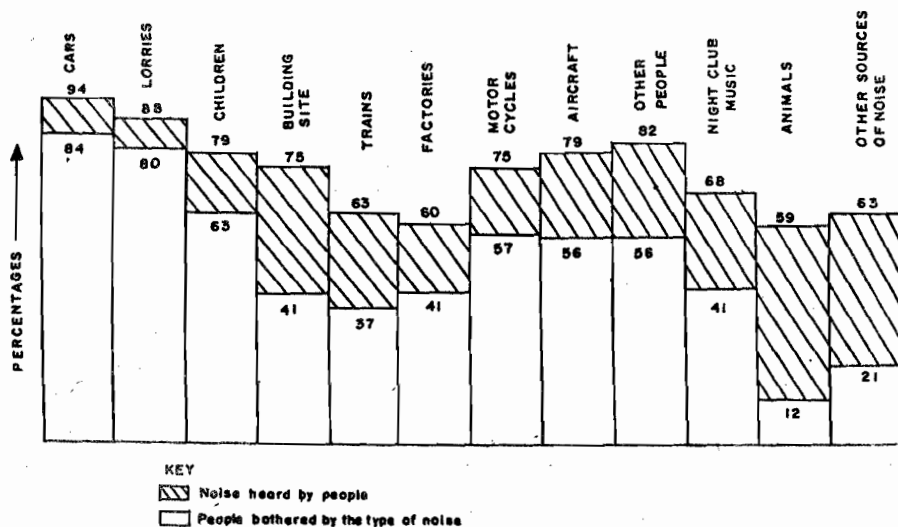


FIG. 1: LAGOS SURVEY

TABLE 4: ENUGU SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 96 | 83 |
| LORRIES | 94 | 91 |
| CHILDREN | 97 | 70 |
| BUILDING SITE | 80 | 38 |
| TRAINS | 83 | 56 |
| FACTORY | 84 | 50 |
| MOTOR CYCLE | 94 | 71 |
| AIRCRAFT | 88 | 43 |
| OTHER PEOPLE | 94 | 64 |
| NIGHT CLUB | 87 | 60 |
| ANIMALS | 88 | 31 |
| OTHER SOURCES | 78 | 30 |

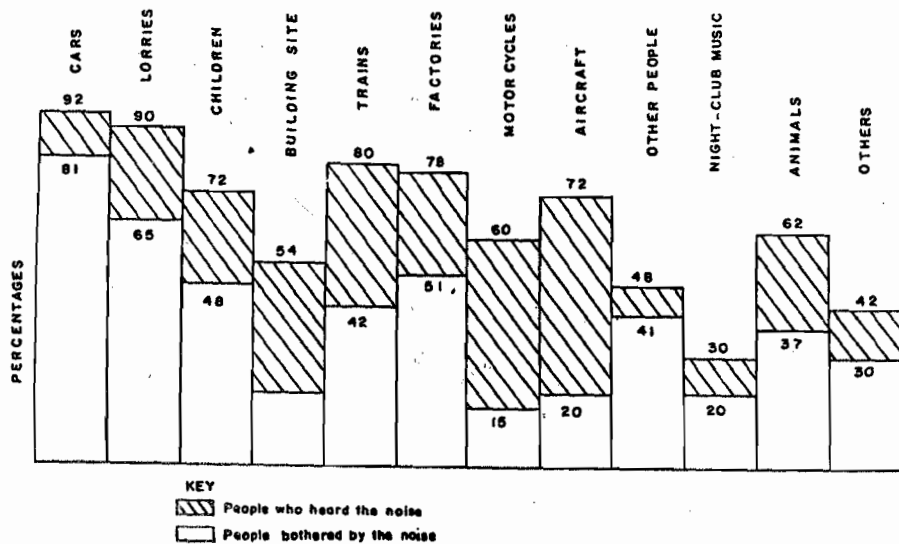
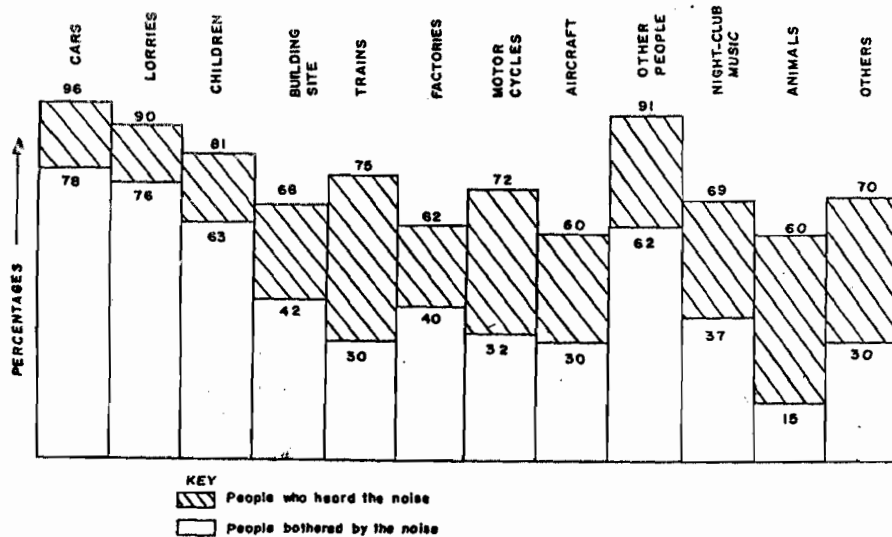
ANALYSIS OF RESULTS

1. **The Survey**

Lagos (Fig. 1)

The Lagos interview shows that 94% of those interviewed were exposed to car noise while 84% were bothered by it. The corresponding percentages for lorry noise were 88% and 80%. Noise of other people, either in conversation or merry-making or quarrels or funeral gatherings or hawking attracted the attention of 82% while 56% of those so attracted were actually bothered by it.

Motor cycle noise was heard by 75% of those interviewed while 57% of those were bothered by it. What emerged from this motor cycle case was largely 'clouded' by some sort



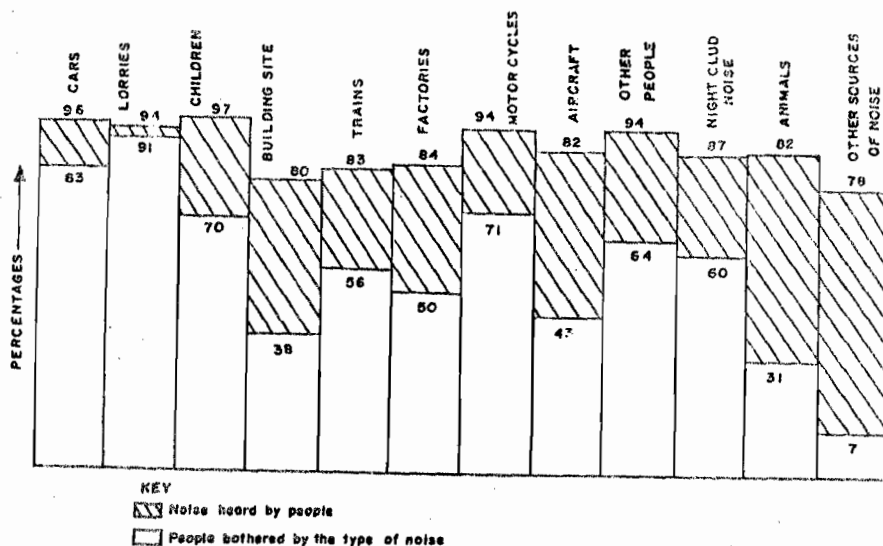


FIG. 4 : ENUGU SURVEY

TABLE 5: KADUNA SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 98 | 92 |
| LORRIES | 95 | 90 |
| CHILDREN | 59 | 11 |
| BUILDING SITE | 40 | 10 |
| TRAINS | 32 | 67 |
| FACTORY | 63 | 23 |
| MOTOR CYCLE | 49 | 18 |
| AIRCRAFT | 57 | 26 |
| OTHER PEOPLE | 62 | 42 |
| NIGHT CLUB | 57 | 40 |
| ANIMALS | 39 | 15 |
| OTHER SOURCES | 62 | 41 |

TABLE 6: CALABAR SURVEY

| NOISE | % HEARD | % BOTHERED |
|---------------|---------|------------|
| CARS | 90 | 81 |
| LORRIES | 74 | 71 |
| CHILDREN | 76 | 48 |
| BUILDING SITE | 45 | 38 |
| TRAINS | 24 | 19 |
| FACTORY | 58 | 28 |
| MOTOR CYCLE | 81 | 67 |
| AIRCRAFT | 69 | 52 |
| OTHER PEOPLE | 71 | 50 |
| NIGHT CLUB | 50 | 45 |
| ANIMALS | 48 | 24 |
| OTHER SOURCES | 38 | 17 |

of resentment - especially by the population that own cars. Some of these resentments were for motor cyclists "beating the Lagos traffic".

Other sources of noises heard in Lagos included church gatherings, moslem calls to prayers and street hawking. 79% of the population interviewed was exposed to aircraft noise while 56% was bothered by it. Night-Club noise had 68% exposed to it but only 41% found it a bother. As much as 75% was exposed to building site noise but only 41% was bothered by it.

One is tempted to conclude from this survey that the population exposed to noise in lagos appears to have 'adapted' to the situations. This can be dangerous (Naomi *et al* 1972).

Ibadan (Fig. 2)

The Ibadan survey results show rather similar patterns to those of Lagos except for a few exceptions. Car noise has the corresponding percentages of 96 and 78 for being heard and being bothered by it. A lot of complaints here include the incessant pressing of horns as aspects of car noise. Lorry noise is heard by 90% of the interviewed population while 76% of those exposed to it were bothered.

Whereas 75% of the population interviewed was exposed to train noise, only 30% was bothered by it. In Lagos, about half of the 63% exposed to train noise was bothered by it.

Noise of other people bothered 62% of the 91%

TABLE 7: AVERAGE RESPONSE TO NOISE

| NOISE LEVEL (dBA) | HEARD % | BOTHERED % | SERIOUSLY BOTHERED % |
|-------------------|---------|------------|----------------------|
| 50 | | | |
| 55 | | | |
| 60 | 80 | 30 | 2 |
| 65 | 88 | 68 | 30 |
| 70 | 85 | 62 | 45 |
| 75 | 84 | 75 | 50 |
| 80 | 91 | 70 | 23 |
| 85 | 90 | 80 | 11 |
| 90 | 89 | 82 | 15 |
| 95 | 92 | 88 | 8 |
| 100 | 90 | 75 | 10 |
| 110 | 90 | 74 | 11 |

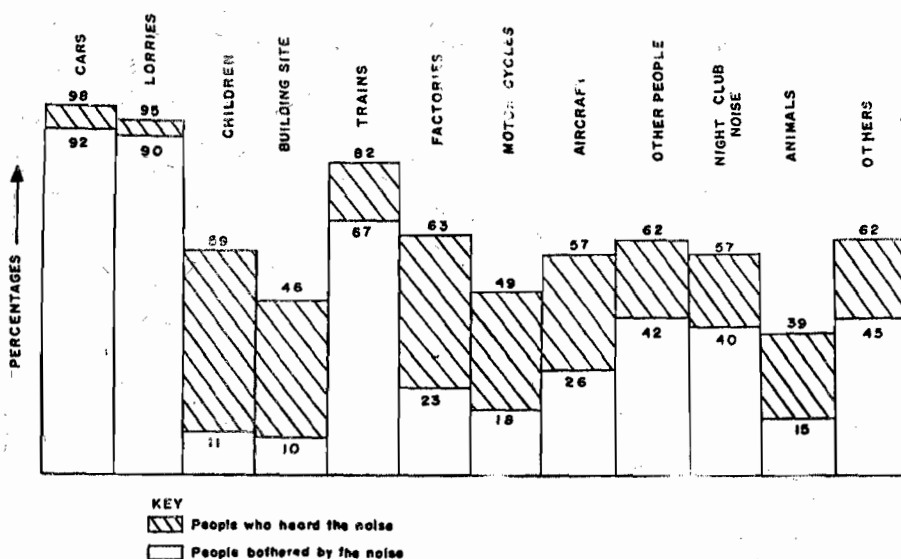


FIG. 5 : KADUNA SURVEY

exposed to it. Ibadan is a "sprawling" city with really large population. This result is not unexpected. Hawking formed the major 'other source'. The other sources of noise were dominated by mosque and christian processions. The bother here appeared to be closely linked with religious inclination. A moslem tolerated the noise from mosque while a christian accepted the noise from the christian processions.

Night club noise bothered about half the percentage of the population exposed to it. The bother by the noise of animals to 15% of the exposed population appeared to be more of visual interference. Some people even complained of noise from the moving cattle!

Port Harcourt (Fig. 3)

Cars top the list of the sources of noise that people are exposed to also in the Port Harcourt survey, averaging 92% with 81% bothered by it. Lorries come next with corresponding 90% and 65% while trains

have 90% exposed to their noise with 42% bothered by it.

Port Harcourt has a fairly large number of motor cycles, but surprisingly only 15% are bothered by their noise. Either they do not give out much noise or people have become used to them. Factory noise has 78% exposed to it while as much as 51% were bothered by it. Like the case in Lagos, 62% of those interviewed are exposed to animal noise while about half are bothered by it. Aircraft noise bothers only about 20% of those exposed to it. This may be because the (new) airport is now sited a fair distance from the main town of Port Harcourt.

Enugu Survey (Fig. 4)

The Enugu survey showed a difference in the trend. 97% of the interviewed population was exposed to noise of children (mainly in schools) and as much as 70% was bothered. This was closely followed by noise from cars which had 96% exposed to it with 83%

bothered by it. Lorries, motor cycles and other people had 94% of the interviewed population exposed to their noises with corresponding bother percentages of 91, 71 and 64. Building site has 38% of the 80% exposed to its noise bothered. In contrast, only 7% of the 78% exposed to other sources of noise was bothered by them. Other sources here included loudspeaker advertisements, street hawking and singing at church gatherings. Of the 87% exposed to noise from the night-clubs, 60% was bothered. 88% of the interviewed population was exposed to aircraft noise while 43% of these were bothered by it. So in this interview, although the noise of children tops the list of the sources of noise that people are exposed to, traffic noise once again appears to be the major source of bother to the exposed population.

Kaduna (Fig. 5)

Nearly the same percentage of car noise was exposed to noise from lorries (98% and 95% respectively) with corresponding bother percentages of 92 and 90. Train noise bothers 67% of the exposed 82%.

Only 57% was exposed to aircraft noise, and 26% of this is bothered by it. 62% are exposed to noise from other people while 42% are bothered by it. The major sources here were radio and television sets.

One seemingly surprising feature of the interview response in this survey appeared in the other sources. The most identified of sources was the call to prayers from mosques. Of the 62% who were exposed to other sources of noise, 41% were bothered by them.

Traffic noise again bothers people the most in this survey.

Calabar (Fig. 6)

In Calabar, 90% of those interviewed were exposed to car noise and 81% were bothered by it. Lorry noise had 74% exposed to it and 71% bothered by it. The corresponding percentages for motor cycles were 81% and 67%. One odd feature of this interview result appears in 'trains'. Calabar has no trains and yet returns were obtained for train noise. These might have come from people frequenting Aba, the nearest town to Calabar with facilities for trains.

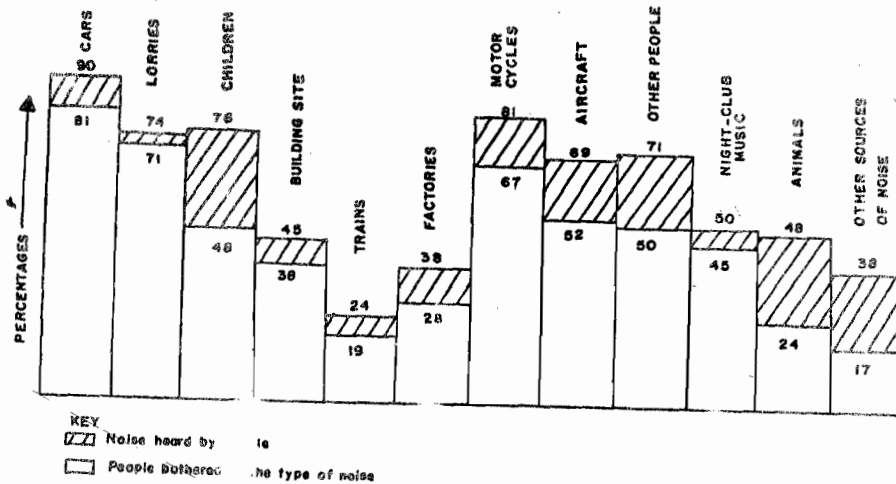


FIG. 6 : CALABAR SURVEY

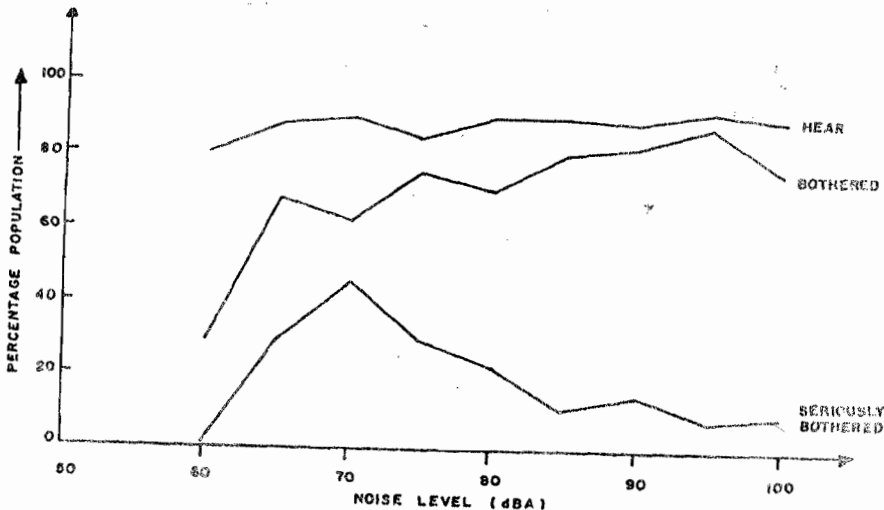


FIG. 7: AVERAGE RESPONSE TO NOISE.

GENERAL COMMENT

In all the surveys analysed above, one common feature stands out unmistakably. The major source of noise that bothers people most is the traffic. Of all the noises people are exposed to, traffic noise is the one that they are bothered by most.

B. The Response

Figure 7 shows the average response to noise of the total population exposed to noise. It has been hypothesized that the response of a population to noise is dependent on the behaviour of the three sub-populations: the noise-sensitive, the noise-insensitive and the remainder (Longdon *et al* 1982). Some indications of such groups are evident in figure 7.

Even at the low level of 60 dB, the percentage of the exposed population seriously bothered was about 2%. Those may well represent the ultra-sensitive (to noise) section of the population who do not want any form of noise.

At the other end of the noise scale, there are

indications that about 25% of the population exposed to noise are not bothered by the noise level of 100 dB! 90% hear, 75% are bothered and 10% are seriously bothered. This must be the noise-insensitive group.

The graph of figure 7 shows that response to noise of the population exposed to it is not a linear one. However, this graph provides basis for examining the possible relationship that exists between levels of noise and the degree of bother.

C. The Relation between Bother and Noise Level

A number of questions need to be addressed to establish a relationship between bother (or annoyance) and level of noise. Does the content of bother increase with exposure of noise? For example, does an increase of 5 dB from 60 dB to 65 dB produce the same reactions as the same increase from 70 dB to 75 dB? If 10% of the noise-exposed population are bothered by a noise level of 80 dB, are (10 + X)% bothered by 85%? Are (10 + 2X)% bothered by 90 dB?

This survey has revealed that there is no linear relationship between noise level and degree of bother (or annoyance). But rather there seems to exist a linear relationship between degree of bother (or annoyance) and dBA Leq

where T = total measured time

$P_A(t)$ = the dBA measured pressure

$P_o = 20\mu P_a$ reference pressure

Since Leq is a measure of energy content of the noise, it may be hypothesized that the degree of bother depends on the energy contents of the type of noise.

CONCLUSIONS

This project was undertaken to investigate the significant sources of noise that Nigerians are exposed to, and to find out which ones bother them. It also set out to find out if there is any correlation between levels

of noise and degree of bother as well as to determine what elements of experience and impressions make up the noise-bother reaction of people exposed to noise.

Results reveal that

- (1) there are many sources of noise that Nigerians are exposed to;
- (2) traffic noise is by far the source of most bother to Nigerians;
- (3) there is no well-defined relationship between levels of noise and degree of bother;
- (4) the degree of bother increases as Leq increases. This suggests that bother increases as energy content of noise increases;
- (5) the elements of experience and impressions include emotional attachment to the source of noise, impressions - such as visual - which the exposed has of the source and some prejudices directed towards the source or origin of the source.

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