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RECENT STUDIES ON COMMUNITY NOISE IN BAHIA BLANCA CITY (ARGENTINA)

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Based on the public demand through noise complaints expressed by the neighbors to the local newspaper, radios and TV, a research project on community noise is being performed by the authors trying to find a practical methodology for the acoustic characterization of medium size cities (50,000 - 500,000 inhabitants). One of the research steps was to hold an environmental noise survey (more than 400 questionnaires were filled) in order to know the subjective opinion of the people about their neighborhood, main noise sources, level of annoyance, etc. Simultaneously, measurements were taken to objectively evaluate in-situ the actual noise levels. The present paper briefly shows preliminary results on the correlation between the subjective opinions and objective measurements.

INTRODUCTION

As a result of the human activities of almost all nature (work, transport, entertainment, leisure, etc.) carried out in medium and large cities and the massive access to technology, noise has become one of the main sources of environmental pollution and a major cause of troubles for city councils authorities.
Scientific articles [1-3], books [4-5] and regulations all over the world [6] trying to give response to the public demand expressed by people through mass media, attest to the fact that noise is a serious environmental health problem. Even yet, and as it was stated in Reference 7 "some standards and regulations continue to list noise and vibration with 'other' environmental aspects while the overwhelming considerations are with air and water pollution. As far as having long term cumulative effects on our world is concerned, air and water pollution do differ from noise and vibration".
Within this conceptual frame, a research project on community noise is being performed by the authors from 1995 trying to find a practical methodology for the acoustic characterization of medium size cities (50,000 - 500,000 inhabitants). The noise sources include transportation noise, industrial and commercial noise and neighborhood noise. First, a general set of

measurements was taken along the main streets of Bahia Blanca (a city of 237,000 inhabitants), totaling 47 stations. This study showed that some points had equivalent levels (Leq) well upon 70 dB(A), suggested as an upper limit by the European OECD [4]. This first set of systematic measurements during periods of the morning, afternoon and night allowed for the verification that the neighbors' complaints were right in the majority of the cases. Following these results, a second step of the research was to perform an environmental noise survey (more than 400 questionnaires were filled) in order to know the subjective opinion of the people about their neighborhood, main noise sources, level of annoyance, etc. Simultaneously, measurements were taken to objectively evaluate in-situ the actual noise levels. The present paper shows preliminary results on the correlation between the subjective opinions and objective measurements.

Following the excellent paper [1] "a thorough understanding of the effects of noise on people is essential if community noise exposure is to be brought under control in a consistent and effective manner. It is also necessary to identify the effects that are well founded and significant, to express these effects in quantitative terms, and to develop criteria that can be used to define the quality of noise environments".

The authors hope the kind of study presented here will yield to a better comprehension of the phenomenon and to political and technological solutions for the community noise problem.

METHODOLOGY

The main goal of this research is to find a method for the acoustic characterization of communities. To do this, a subjective study was performed by means of a survey in order to know the opinions of the neighbors with respect to the noise character of their neighborhood. Simultaneously, a series of measurements were performed to objectively know the character of the actual noise level. Finally, the objective and subjective results were related one another in order to obtain a general criterion for the acoustic characterization.

The size of the survey and the quantity and quality of the measurements were restricted by the scarce availability of: a) human resources; the authors were helped by three university students while performing the survey, and b) appropriate equipment; an integrating sound level meter (SLM) Quest 2800 and a non-integrating SLM Extech 407735 were used together with a temperature/humidity sensor Extech 4465CF (-20/60 °C) and an anemometer Field Master (0.4-30 m/sec).

The first methodological step was to determine which areas of the city would be included in the study. A data base carried out by the Environment Direction was relevant for taking into consideration possible existing noise pollution sources and registered neighbor complaints. This way, 27 convenient sites were chosen for study, distributed as follows: 14 within the downtown zone, 11 populous suburbs, and 2 residential park suburbs (See Figure 1).

The second phase was to design the questionnaire and the sampling criterion. Reference 8 helped to draw a five items survey including the following aspects: 1. Area description (very noisy/ noisy/ quiet); 2. Annoyance (none/ a little/ something/ enough/ much); 3. Main Sources (neighbors/ aircraft/ entertainment/ trains/ road traffic/ industry/ schools/ motor cycles/ other - specify); 4. Main Annoyance Day Period (0-6 a.m./ 6-12 a.m./ 12 a.m. - 6 p.m./ 6-12 p.m.); Residence Condition (live/ work). The survey was performed by visiting homes and works during labor hours.

Five sets of measurements were taken in each site, including: equivalent sound pressure level (Leq) with the integrating instrument (T = 15 min. periods), and acquisition of discrete

readings from the non-integrating instrument. This procedure enables the comparison of results between the two methods of measurement by computing Leq following Reference 9, and to obtain very important parameters such as the level that is exceeded x % of the time (Lx) by means of simple statistical computations with the available equipment.

RESULTS AND CONCLUSIONS

Figure 2 shows the typical presentation of results for every one of the 27 sites. Figure 2.a. shows the results of the survey in site 20, where 82 % of people is resident. One can see that 76 % of the sample (14 homes, 3 commerce) describe their area as noisy, 12 % as very noisy and 12 % as quiet. By the other way, only 6 % consider the annoyance as much, against 47 % as a little and 35 % as none. The main source of noise is road traffic (71 %), followed by motor cycles (18 %). Almost a half say that the period of higher annoyance is in the morning (6-12 a.m., 45 %) followed by 29 % during the night (0-6 p.m.).
Figure 2.b. shows the results of the 5 sets of measurements. One can see max. peaks under 90 dB(A) and min. peaks near 50 dB(A), with a corresponding average Leq = 71 dB(A). Following [4] where a suggested upper limit of Leq = 70 dB(A) is established, one can characterize this site as "noisy" with a good agreement between the objective parameter and the neighbors' opinion. An excellent agreement is also noted between the integrated and computed Leq.
This way, 439 interviews were held in total with inhabitants of Bahia Blanca city (51 % residents, 49 % workers; 57 % female, 43 % male), and more than 5000 discrete noise level values were obtained. As a general result, 7 areas (sites 6, 7, 9, 10, 17, 19 and 21) were found to be very noisy [Leq > 75 dB(A)], 13 (sites 1 to 5, 8, 11 to 16, 18 and 20) noisy [70 dB(A) ≤ Leq ≤ 75 dB(A)], and 7 (sites 22 to 27) quiet [Leq < 70 dB(A)].
No good agreement was found in general between the subjective parameters area description and annoyance: while over the total sample 92 % considered their area as noisy (58 %) or very noisy (34 %), only 28 % are enough (15 %) or much (13 %) annoyed, but 51 % say the annoyance is none (22 %) or a little (29 %); the remaining 21 % say they are something bothered.
Traffic road (53 %) and motor cycles (28 %) resulted far and away the general main annoyance sources (also appear industries, 6%; neighbors, trains and entertainment, 2% each; and others, 7%).
As a first practical result of this research, actions to control noise emitted by all categories of automobiles, trucks and motor cycles are being proposed by the authors to the local authorities.
Further investigations should include measurement of a wider kind of parameters, in order to be able to establish comparisons with the open international literature [1-3].

REFERENCES

1. Shaw, E.A.G., 1996. Noise environments outdoors and the effects of community noise exposure. Noise Control Engineering Journal 44(3), 109-119.
2. Chakrabarty, D., et all, 1997. Status of road traffic noise in Calcuta Metropolis, India. Journal of the Acoustical society of America 101(2), 943-949.
3.- Santiago, J.S., et all, 1987. Urban noise in Madrid, Proceedings of INTERNOISE, Japan, 875-878.

4. Organization for Economic Co-operation and Development (OECD), 1991. Fighting noise in the 1990's, Paris.
5. Berglund, B., and Lindvall, T., 1996. Community noise, World Health Organization (WHO), Copenhagen.
6. Noise Regulation Report, 1996, 23(18), 137-142.
7. Lawrence, A., 1996. Is noise part of the environment?. Noise/News International (4)1, 6.
8. Miller, J., 1992. Environmental Noise Survey. Report from the Manchester Area Pollution Advisory Council (MAPAC), U.K
9. International Standardization Organization (ISO), 1982. Acoustic description and measurement of environmental noise. 1996-1/2/3.

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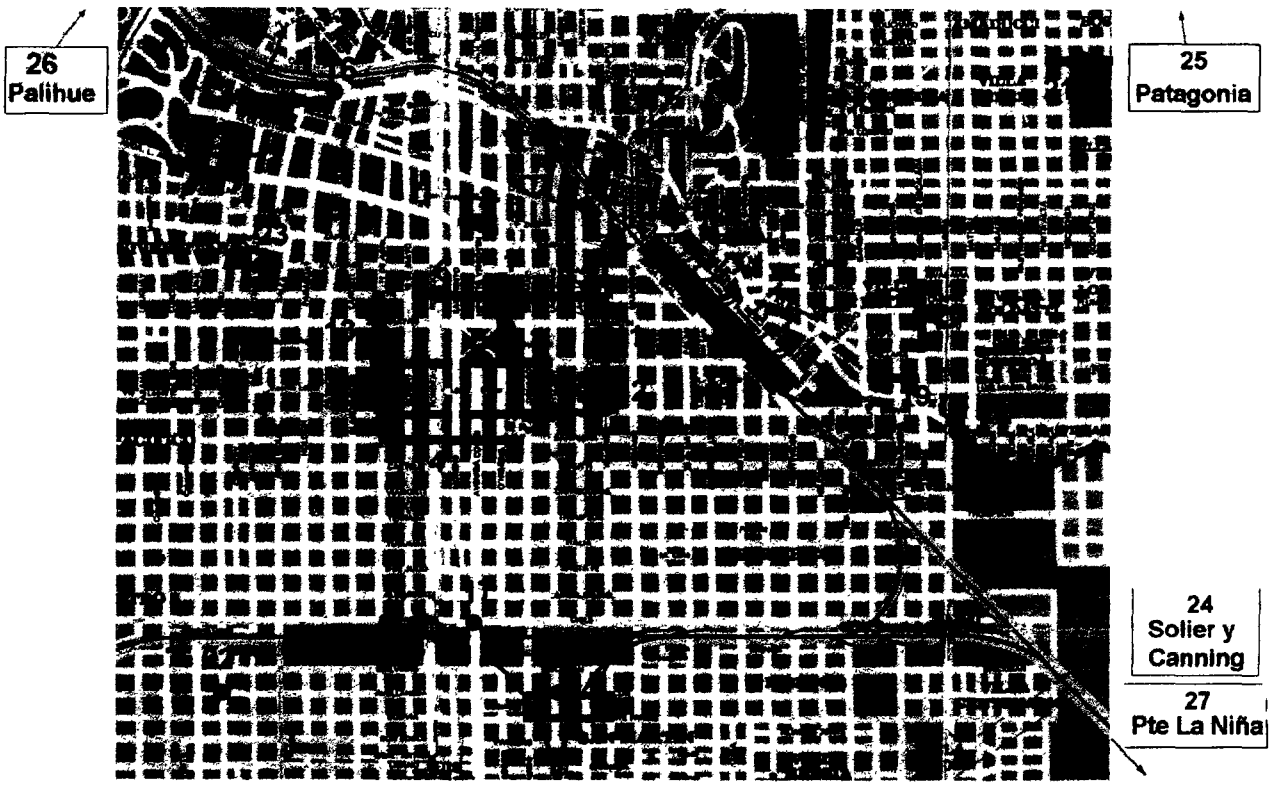
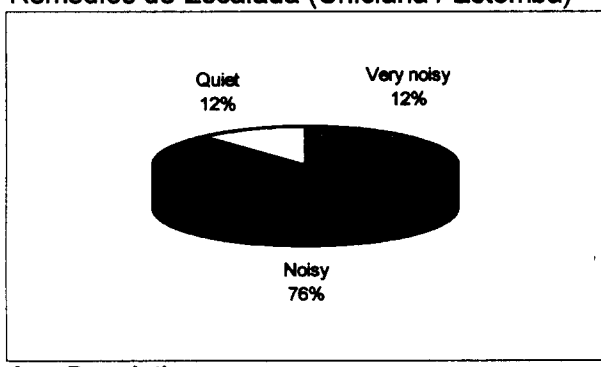


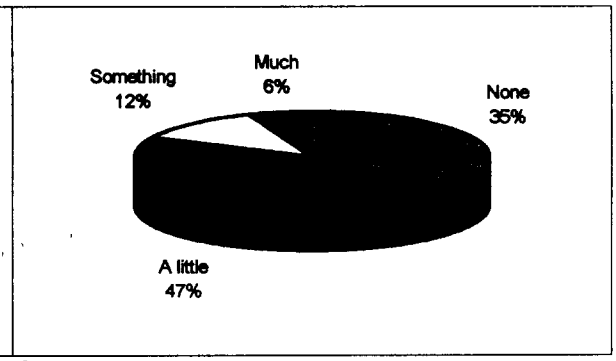
Figure 1. Detail of the 27 areas under study

Site 20

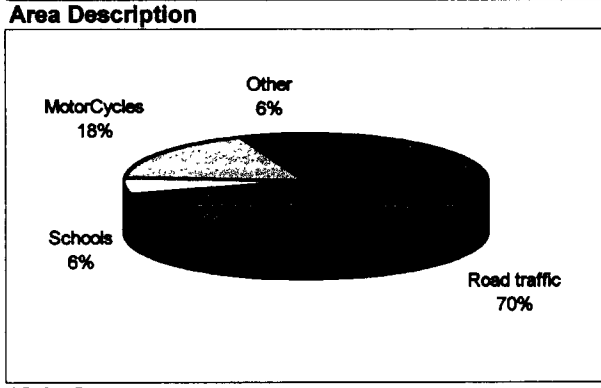
Remedios de Escalada (Chiclana / Estomba)



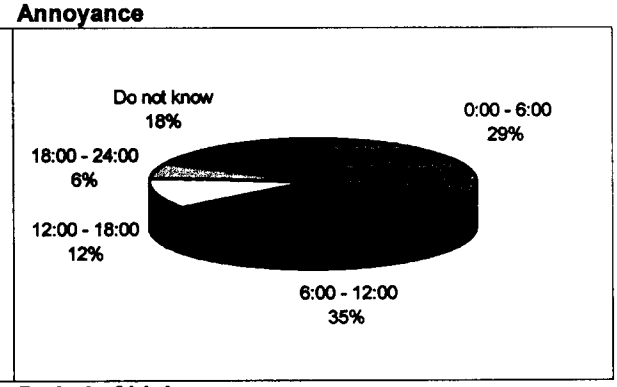
Area Description



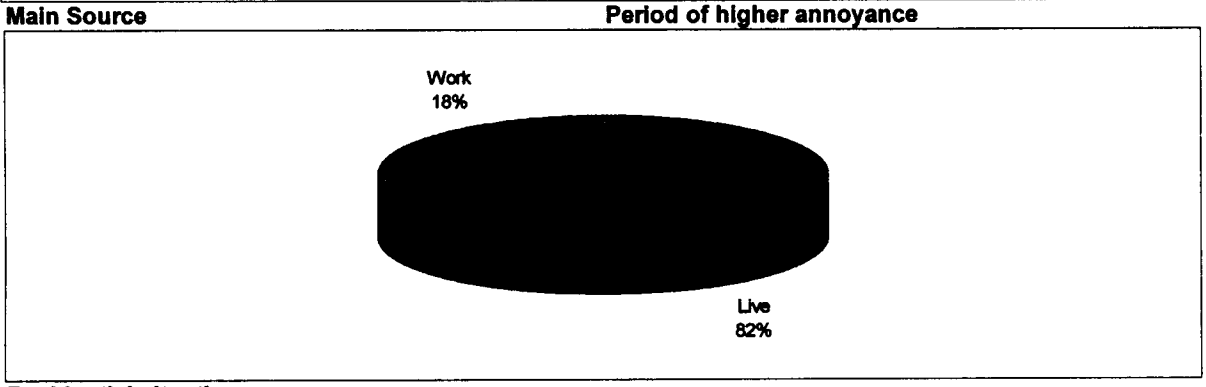
Annoyance



Main Source

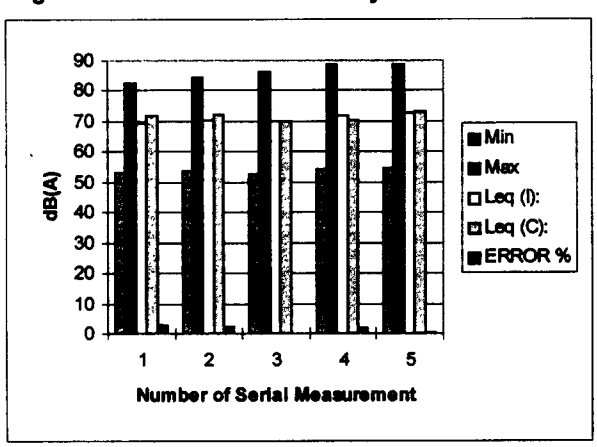


Period of higher annoyance



Residential situation

Figure 2.a. Results of the survey



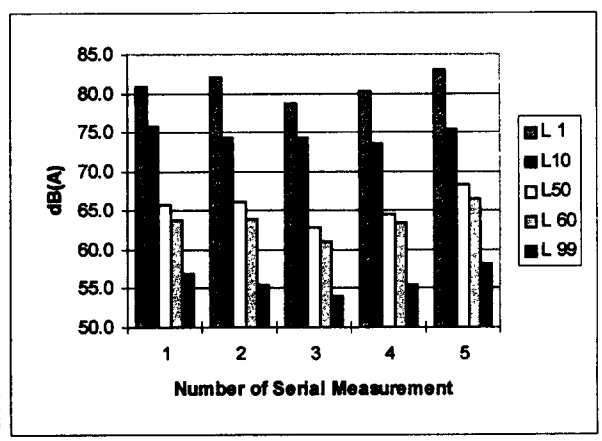


Figure 2.b. Measurement Results

Figure 2. General results in Site 20