NOISE MONITORING IN A HIGH TRAFFIC AREA OF BACAU, ROMANIA

NEDEFF VALENTIN, TOMOZEI CLAUDIA*, PANAINTE MIRELA, MĂCĂRESCU BOGDAN, MOSNEGUTU EMILIAN, LAZĂR GABRIEL

"Vasile Alecsandri" University of Bacau, Calea Marasesti 156, Bacau, 600115, Romania

Abstract: The paper presents the results obtained for the noise level measurements in the city of Bacau, Romania. The measurement point was chosen close to the main road of the city, in an inhabited area. During all day the values of the maximum time-weighted sound level shows a significant exceeding of the permissible limits, indicating a serious noise pollution in the area. The IMMI software was used to obtain the representation of noise dispersion in the studied area. The map shows that the neighborhood inhabited areas are affected by street noise, although some of the noise pollution is absorbed by the trees' barrier on the roadside. In order to reduce the noise pollution impact, some solutions are proposed.

Keywords: noise; noise map; traffic and environment.

1. INTRODUCTION

Noise pollution is now the third in the hierarchy of the most dangerous types of environmental pollution, preceded by air pollution (greenhouse gas) and water pollution [1, 2].

Although we are constantly surrounded by noise, both at work and in any other place, in most cases we operate ignoring "ambient noise". However, with increasing noise, it becomes an unwanted permanently pollutant of the ambiance of living and working, which negatively influences the level of professional performance, being very often the cause of fatigue, nervousness or decrease of the quantity and / or quality of the activity [2-7].

Noise, especially traffic noise, is one of the biggest polluters of the urban environment. Depending on the duration and intensity, noise exposure leads to permanent damage of the body, neurological and autonomic system effects, decreased power of concentration and working capacity [2, 8-11].

Studies and researches have shown that approximately 120 million people in the European Union, more than 30% of the total population, are exposed to levels of road traffic noise over 55 dB, while more than 50 million people are exposed to noise levels above 65 dB. Such high noise levels are often described as acoustic "black" zones [5, 12].

Computer modeling of traffic noise is useful in a variety of applications to predict noise levels at locations of interest, as those adjacent to streets and highways, to identify problems related to noise, to assess the effectiveness of noise reduction strategies and for experimental research on the dispersion of traffic noise [8, 13].

* Corresponding author, email: claudia.tomozei@ub.ro

The paper aims to examine how the noise caused by various noise sources (traffic emissions on a principal thoroughfare in Bacau) determines concentrations of noise in imission, and to achieve the noise map for the studied area.

2. EXPERIMENTAL SETUP

The European Parliament and Council adopted in June 25, 2002 the Directive 2002/49/EC which was transposed into Romanian legislation by the Decision of government H.G. nr. 321/2005 on the assessment and management of environmental noise [14-16].

Under this directive, all urban agglomerations with more than 250,000 inhabitants and major roads had to realize until 2007, noise maps to reflect the situation of urban noise. Based on these, action plans are prepared to control and reduce urban noise, seeking to minimize its impact on the population. The main task of the Directive is to create a common basis for managing urban environmental noise, for monitoring environmental problems and to achieve strategic noise maps [3, 16].

These maps will be used to assess the number of people affected by noise in the EU and to realize action plans to manage noise and its effects [3, 14].

Making noise maps is an important factor in defining development strategies of cities, to improve the habitat area, to ensure environmental conditions at European level, mandatory requirements of the National Action Plan for reducing noise levels [3, 14].

The measurements were made in the city of Bacau, a town with less than 250,000 inhabitants and, according to Decision of government H.G. nr. 321/2005, without a noise map.

Fig. 1. Position of the measurement point:
1. Measurement point; 2. European 85 road; 3. Bacau Municipal Stadium; 4. Bacau Emergency Hospital; 5. Railway; 6. Airport runway.

To measure the noise level was chosen an area (Figure 1) in Bacau, where have been identified various sources of noise:
- car traffic;
- rail traffic;
- air traffic;
- urban agglomeration.

The point where the device was set to measure the noise is located as follows:
- near the busiest car thoroughfare (Route Marasesti - E85) - 4 m from the road edge;
- near Bacau Municipal Stadium - approximate 300 m distance;
- near Bacau Emergency Hospital - approximate 200 m distance;
- near railway - approximate 500 m distance; Bacau is the main railway hub linking the North and the South of Moldova Romania;
- near flight corridor in the vicinity of civilian and military airport - approximate 1000 m distance.

Noise monitoring system was positioned inside of the Air Quality monitoring stations located within the "Vasile Alecsandri" University of Bacau (Figure 2).

Fig. 2. Location of the noise monitoring system.

Measurements were made with the noise monitoring station - Sinus NoiseLOG_mobile, which is a continuous urban and industrial noise monitoring equipment, included in accuracy class 1 according to standards IEC / EN 60 561 Type1, IEC 61672-1. The calibration was made according to the calibration certificate DIN 50049-2.3, TYPE 974.304.0 [17].

For measurements was used an external microphone, positioned at an approximate height of 4 m from ground level and approximately 4 m from the main road (Route Marasesti - E85) [15].

For the outdoor urban area, the maximum allowable limits, under which the legislation considers the sound environment legally, are given in STAS 10009-88 who provide the terms of location of residential buildings. According to this standard, the noise outside the building, measured at 2 m from its facade, does not exceed the maximum 50 dB (A) and if the examined target is located in an industrial zone, the maximum permissible sound pressure level in the enclosure limit is 65 dB (A) [15]. In our case, the populated area is located about 50 m of the measurement area.

To process data and to realize the noise map IMMI software (Noise Mapping and Air-Pollution Mapping Software) was used, software that provides a set of functions necessary for predicting noise projects in urban areas. The software is fully functional, in order to achieve noise maps of atmospheric pollution for small projects with import and export data in DXF file extension type, according to Directive 2002/49/EC.

Measurements were made between 7.30 - 17.30 hours, a period with intense traffic in the area.

3. RESULTS AND DISCUSSION

Measurements aimed to determine the levels of the maximum time-weighted sound level measured with A frequency and fast time weighting, during the measurement period L_{Afmax} (Figure 3) and of the minimum time-weighted sound level measured with A frequency and fast time weighting, during the measurement period L_{Afmin} (Figure 4) recorded at the measuring point. The values of the maximum time-weighted sound level and the majority values of the minimum time-weighted sound level exceeds the permissible limit of 50 dB during the day in urban areas. During all day the values of the maximum time-weighted sound level shows a significant exceeding of the permissible limits, indicating a serious noise pollution in the area.

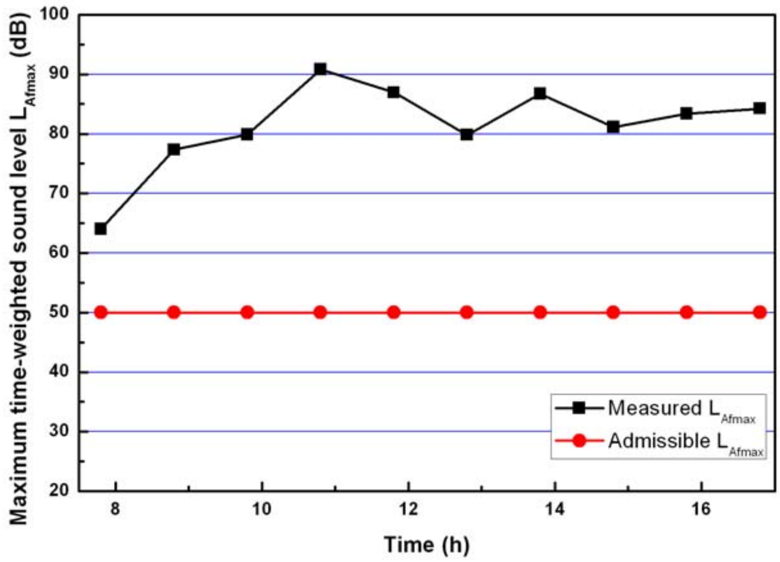

Fig. 3. Variation of the maximum time-weighted sound level measured with A frequency and fast time weighting, during the measurement period (L_{Afmax}) recorded at the measuring point.

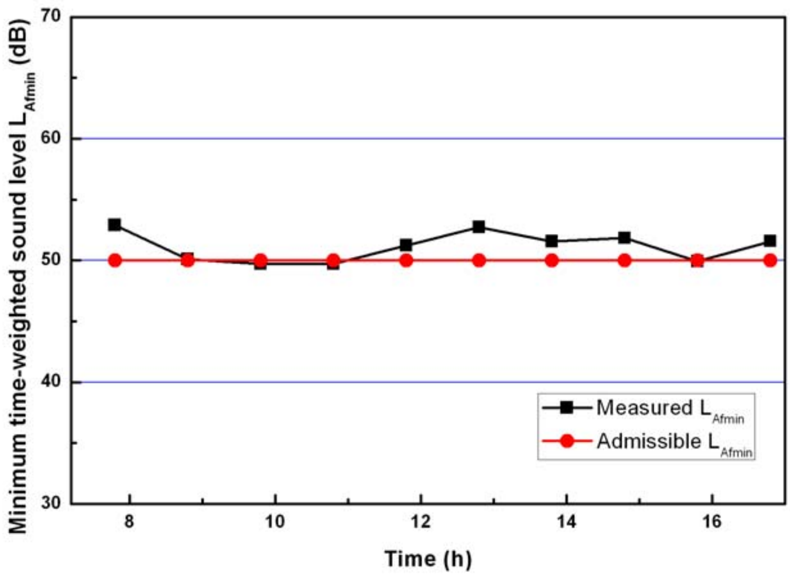

Fig. 4. Variation of the minimum time-weighted sound level measured with A frequency and fast time weighting, during the measurement period (L_{Afmin}) recorded at the measuring point.

In Figure 5 is presented the variation of the A-weighted equivalent continuous noise level L_{Aeq} recorded in measuring point for the analyzed area. The values of mean equivalent continuous noise level, recorded by the monitoring station, is around L_{Aeq} = 67.8 dB (A), a value that exceeds the permissible limit 50 dB (A), confirming the results already presented. The maxima of the equivalent continuous noise level were registered at the crossing motorcycles (81.79 dB values) and ambulances (80.34 dB values).

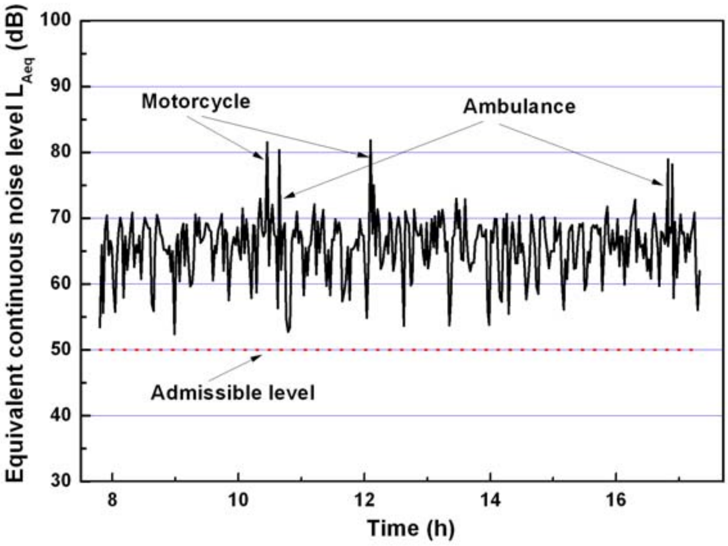

Fig. 5. Variations of the A-weighted equivalent continuous noise level L_{Aeq} recorded at the measuring point.

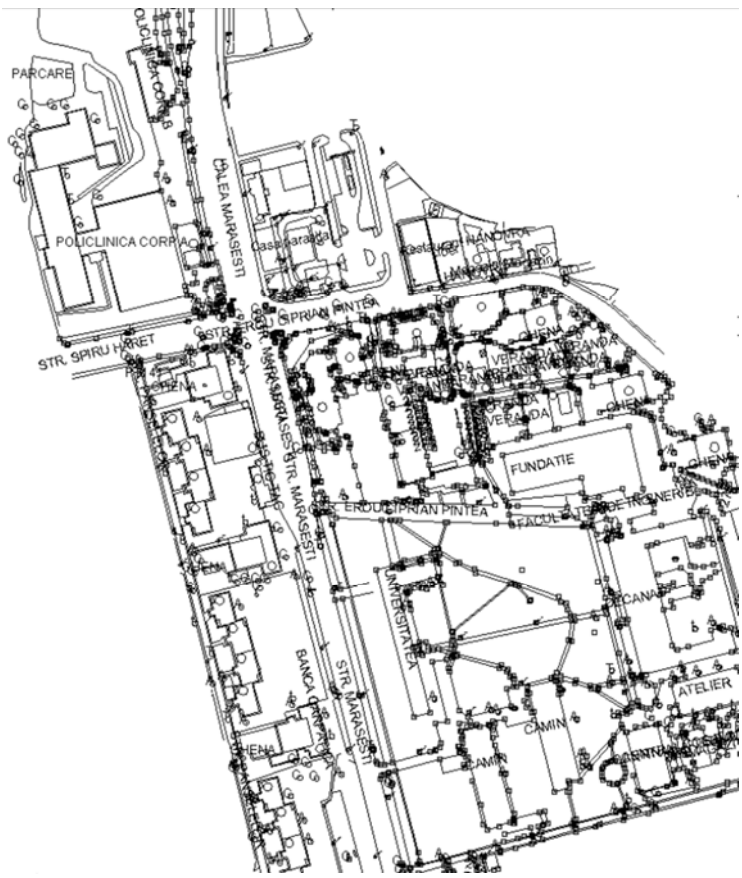

Fig. 6. Representation of topographical map of the studied area.

An important noise source can be considered the buses and the old cars in circulation. There are not important contributions from rail traffic because of the buildings separating the railway and the measurement point. The measurements present an ordinary day, without military flights, which greatly increase the noise level in the area. It should also be noted that the acoustic pressure level does not vary on different time scales but kept the same parameters throughout all day, indicating the high traffic in the vicinity of the measurement point.

To achieve the noise map using IMMI software (The Noise Mapping and Air-Pollution Mapping Software), previously has been made the topographic map of the area (Figure 6), with DXF file extension type, then converted and saved in IPR file type.

The point where measurements were made was marked on the topographic map and LAeq equivalent acoustic pressure levels recorded during the measurements analyzed were introduced. The generation of the noise map was made automatically by the IMMI software, obtaining so the representation of noise dispersion in the studied area (Figure 7). Neighborhood inhabited areas are affected by street noise, although some of the noise pollution is absorbed by the tree's barrier on the roadside. To reduce the noise impact on inhabited areas it is recommended to detour traffic on less populated areas and the initiation by local authorities of projects for buildings acoustic/phonic isolation.

Fig. 7. Acoustic map of the studied area.

An important motif for this situation, with a high level of noise pollution, is the city itself, projected for a much lower traffic than the current one, without detour belts and in the close vicinity of the airport.

4. CONCLUSIONS

The paper presents the results obtained for the noise level measurements in the city of Bacau, Romania. The measurement point was chosen close to the main road of the city, in an inhabited area.

During all day the values of the maximum time-weighted sound level showed a significant exceeding of the permissible limits, indicating a serious noise pollution in the area.

The IMMI software was used to obtain the representation of noise dispersion in the studied area. The map shows that the neighborhood inhabited areas are affected by street noise, although some of the noise pollution is absorbed by the trees' barrier on the roadside.

The local authorities have a very important mission to find practical solutions for eliminate the noise problem in Bacau area.

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