

METHODS AND MEASURING DEVICES OF RESEARCH OF SOUND POLLUTION DUE TO ROAD TRAFFIC IN SIBIU CITY

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Abstract. The present study aimed at an experiment related to environmental management in the city of Sibiu, by carrying out sound measurements at the most important points in the city. The field data collection took place from January 15 to February 15, 2020. We used three digital sound level meters (PeakTeach 5175, GLX-explorer, Voltcraft SL 50) provided by the environmental chemistry laboratory of our faculty. The results obtained from the measurements were aimed at identifying the maximum and minimum values as well as knowing the areas in the city which were most exposed to noise pollution.

Keywords: sound level, pollution, measuring, Sibiu City.

Rezumat. Metode și aparate de măsurare a poluării sonore datorate traficului rutier în orașul Sibiu. Prezentul studiu a avut ca scop un experiment legat de managementul mediului în orașul Sibiu, prin efectuarea de măsurători sonometrice în cele mai importante puncte din oraș. Colectarea datelor pe teren a avut loc în intervalul de timp cuprins între 15 ianuarie și 15 februarie 2020. Am folosit trei sonometre digitale (PeakTeach 5175, GLX-explorer, Voltcraft SL 50) din dotarea Laboratorului de chimie a mediului din facultatea noastră. Rezultatele obținute în urma măsurătorilor sonometrice au constat în identificarea valorilor maxime și minime, precum și cunoașterea celor mai expuse zone din oraș la poluarea fonică.

Cuvinte cheie: nivel de zgomot, poluare, măsurare, orașul Sibiu.

INTRODUCTION

Directive 2002/49/EC, imposed by the European Union, was transposed in the Romanian legislation for the first time by GD 321 of 14.04.2005 on the assessment, administration and control of environmental noise. It was subsequently amended by Law 121/2019 and is already in force and provides for the creation of noise maps (acoustic maps) every 5 years.

This Directive establishes the general framework in which noise maps are created. EU Member States may individually set allowable noise levels. Following the evaluation of the results of the acoustic mapping, the Directive 2002/49/EC requires that, where exceedances of the limit levels are discovered, the responsible authorities can take measures to reduce the emission:

- Determining the exposure to environmental noise, by drawing up noise maps;
- Providing the public with information on environmental noise and its effects;
- The adoption of action plans, based on the data from the noise maps, with the purpose of preventing and reducing the environmental noise, where appropriate, especially of the exposure levels, which can have harmful effects on human health.

Within Sibiu, the noise comes mainly from the various activities carried out by the inhabitants and especially from the means of personal or community transport that help them to move in or out of the city (DARABONȚ & COSTIN, 1982; FLOREA et al., 2000; MITRAN, 2012; DASCĂL & IVAN, 2014; AKCELIK, 2015).

According to the legislation, the Environmental Protection Agency in Sibiu analyses the noise level and makes maps in the city of Sibiu (<http://www.turnulsfatului.ro>) and performs the metric measurements of traffic: road, air, railway and due to industrial activities (<https://www.tribuna.ro>). After measurements are made at different time intervals, in the hours of heavy traffic for each study area, a noise map can be drawn up which is useful to the residents of the exposed areas for a long time at a noise level that exceeds the allowed limit.

MATERIALS AND METHODS

In order to monitor the noise sources at the intersections of the city of Sibiu, we used as a digital instrument the Sonometer (Fig. 1), the Peakteach Sonometer 5175 (Fig. 2) and the GLX-explore (Fig. 3) device to which the noise measurement sensor was attached. In order to have a complete picture of the sources and noise level in the city of Sibiu, we have taken samples from different locations and areas of the city, we have made measurements of the noise produced by road traffic. The measurements were made in 15 different intersections with heavy traffic in the city.

The devices used for the Sonometric measurements are found in the equipment of the Laboratory of Engineering and Environmental Protection in Agriculture and we have used them for the practical work in the discipline of Sources of environmental pollution.

Thus, for the realization of the present work we have made noise measurements in the years 2019-2020, at different time intervals, between the hours 7-9 in the morning, 12-14 at noon and 16-18 in the evening in 15 locations with heavy traffic in the city of Sibiu: Calea Dumbrăvii no. 133-135, Calea Dumbrăvii no. 16, Calea Cisnădiei no. 23, streets: Octavian Goga no.7, Maramureșului no.33, Constituției no. 26, Andrei Șaguna no. 10, Bălea no. 8, Șoseaua Alba Iulia no.73, Str Bastionului no.13, Henri Coandă no.8, Lungă no. 80, Regele Ferdinand (Train Sibiu), B-dul Mihai Viteazul (playground for children).



Figure 1. Digital sound level meter (orig.).



Figure 2. Peaktech Sonometer 5175 (orig.).



Figure 3. GLX-explorer device to which the noise measurement sensor (orig.).

RESULTS AND DISCUSSIONS

The field data collection took place from January 15 to February 15, 2020. We used three digital sound level meters (PeakTech 5175, GLX-explorer, Voltcraft SL 50) provided by the environmental chemistry laboratory of our faculty. For collecting the data from the field we made noise measurements at 15 points Calea Dumbrăvii no. 133-135, Calea Dumbrăvii no. 16, Calea Cisnădiei no. 23, streets: Octavian Goga no. 7, Maramureşului no. 33, Constituţiei no. 26, Andrei Şaguna no. 10, Bălea no. 8, Şoseaua Alba Iulia no.73, Str Bastionului no. 13, Henri Coandă no. 8, Lungă no. 80, Regele Ferdinand (Train Sibiu), B-dul Mihai Viteazul (playground for children) intensely circulated within the city of Sibiu (Fig. 4; Table 1).



Figure 4. Marking of the 15 locations in the city of Sibiu in which sound measurements were made (AutoCAD capture).

The time interval was between 7 and 9 (Fig. 5) a.m. when traffic is very intense, as the population of the city goes to work and takes children to school. In this interval the smallest value identified was 55.1 dB in the location of Lungă street no.80 and the highest value recorded was 89.9 dB in Bălea street no. 8.

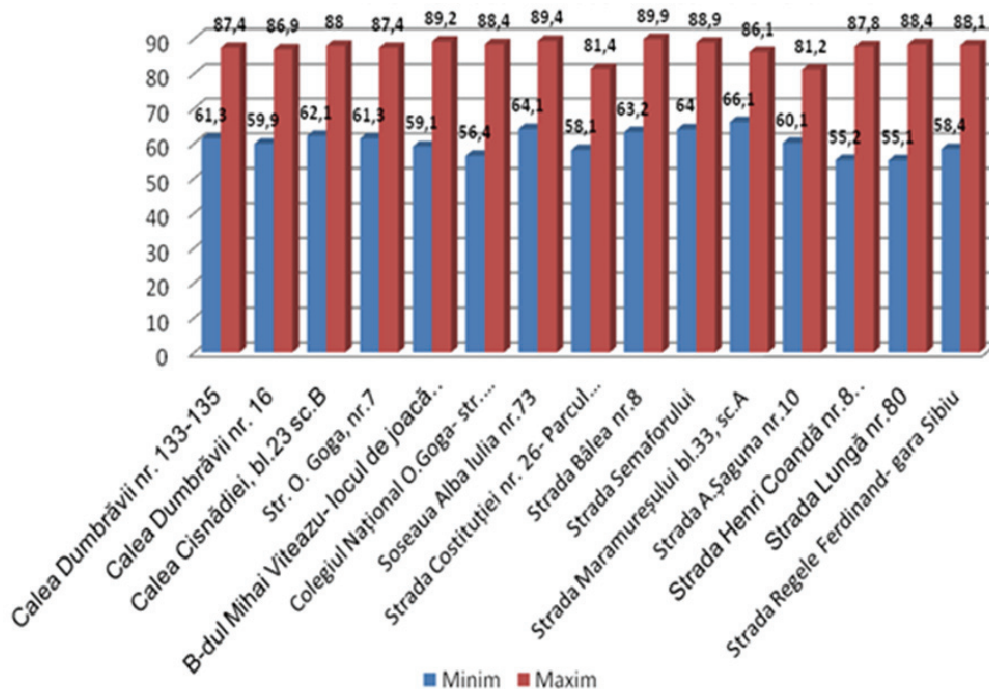


Figure 5. The values measured in the time interval 7-9 in the 15 locations in the city of Sibiu.

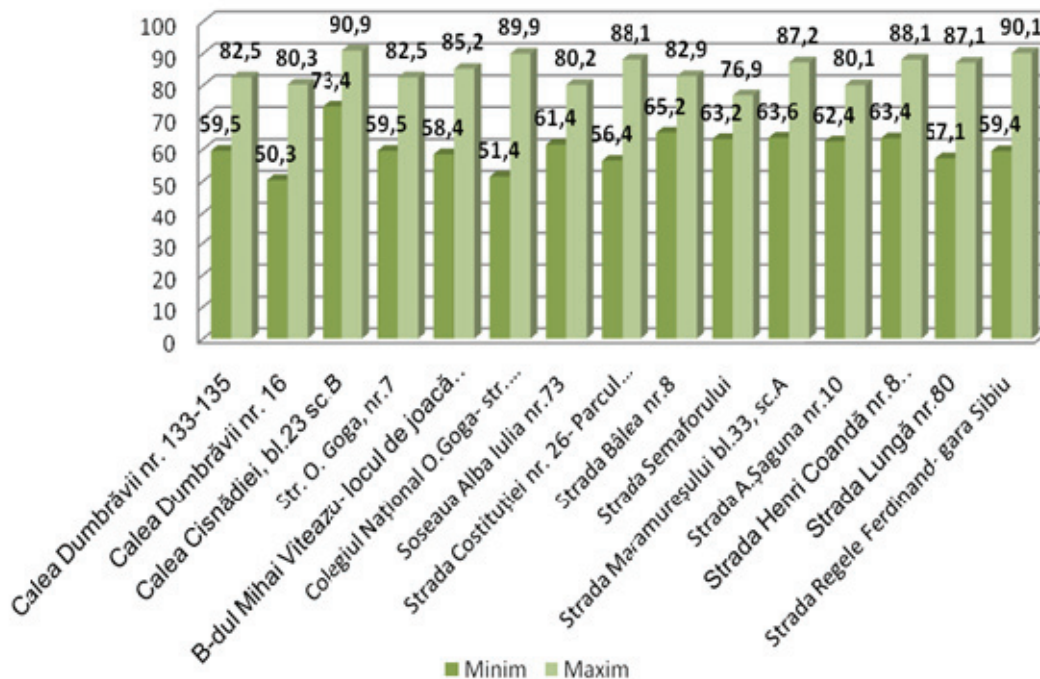


Figure 6. The values measured in the time interval 12-14 in the 15 locations in the city of Sibiu.

From the analysis of the data collected in the 12-14 interval (Fig. 6), when the population in the city of Sibiu circulates to various locations and destinations, or brings children home from school, the minimum recorded value was 50.3 dB at the location in Calea Dumbrăvii no. 16 (Figs. 7; 8) and the maximum of 90.9 dB on Calea Cisnădiei street no.23 (Fig. 9).

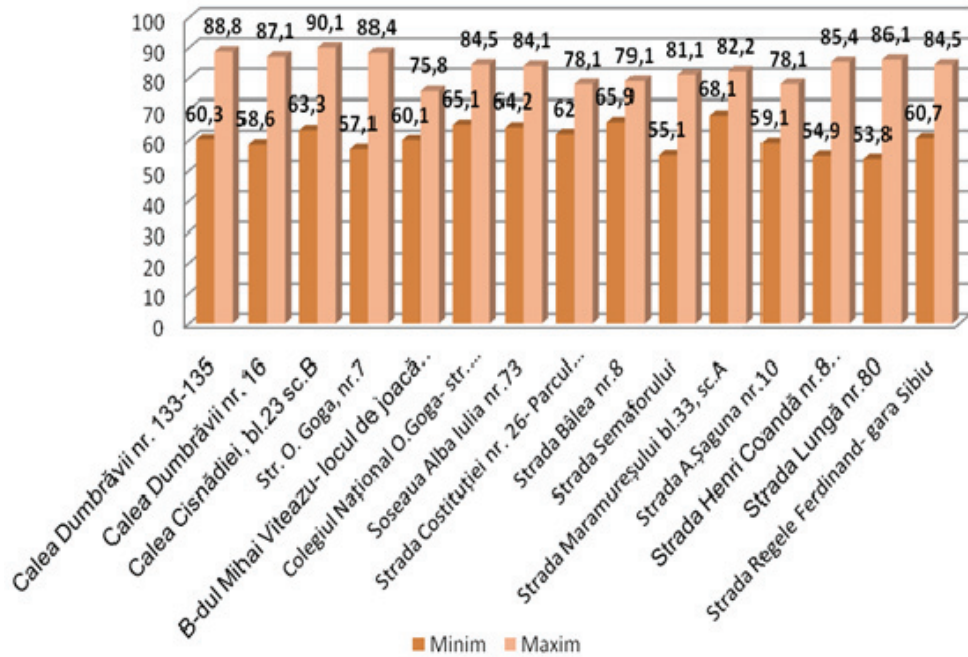


Figure 7. The values measured in the time interval 12-14 in the 15 locations in the city of Sibiu.

From the interpretation of the data collected in the time interval 16-18 (Fig. 7), when the population of the city returns from work places or goes for supply in the commercial areas of the city, the minimum registered value was 53.8 dB on Lungă no. 80 and a maximum of 90.1 dB in Calea Cisnădiei no. 2-3.

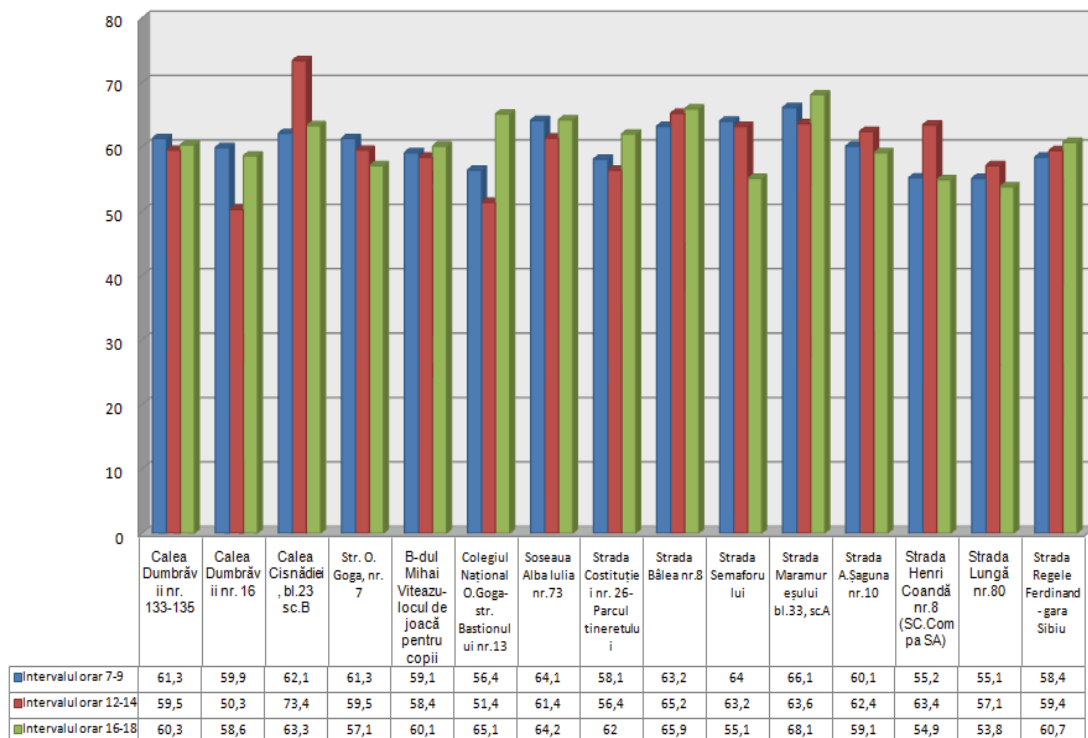


Figure 8. Minimum values determined in the three-time intervals.

The maximum limits according to the standards in force are 70 dB (A) for road traffic, and following the interpretation of the analysed data we can say that this limit was exceeded in all the three hourly intervals due to the large number of vehicles traveling within the city of Sibiu.

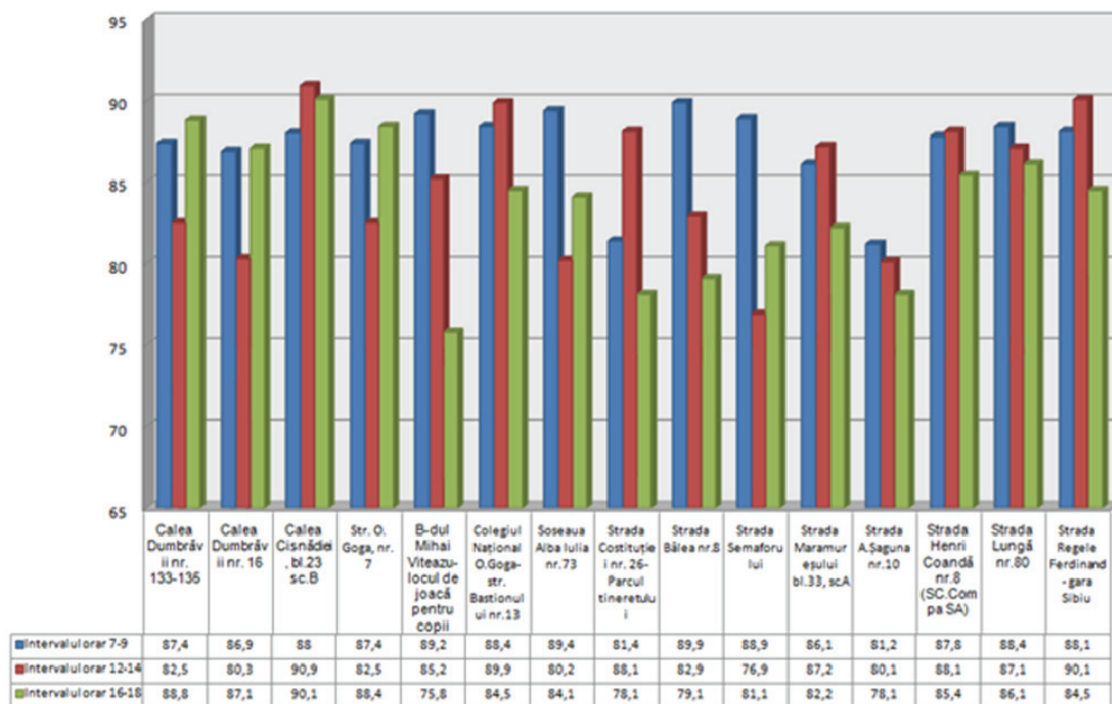


Figure 9. Maximum values determined in the three-time intervals.

Table 1. The values measured in the 15 locations in the city of Sibiu.

Location	Time interval 7-9 Values determined in dB		Time interval 12-14 Values determined in dB		Time interval 16-18 Values determined in dB		The values allowed in dB, according to STAS 10009/1988
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
Calea Dumbrăvii no. 133-135	61,3	87,4	59,5	82,5	60,3	88,8	65
Calea Dumbrăvii no. 16	59,9	86,9	50,3	80,3	58,6	87,1	70
Calea Cisnădiei, bl. 23 sc. B	62,1	88,0	73,4	90,9	63,3	90,1	65
Str. O. Goga, no. 7	61,3	87,4	59,5	82,5	57,1	88,4	70
B-dul Mihai Viteazul - children's playground	59,1	89,2	58,4	85,2	60,1	75,8	75
National College O. Goga - str. Bastionului no. 13	56,4	88,4	51,4	89,9	65,1	84,5	75
Soseaua Alba Iulia nr. 73	64,1	89,4	61,4	80,2	64,2	84,1	90
Str. Costiuiței nr. 26 - Parcul tineretului	58,1	81,4	56,4	88,1	62,0	78,1	45
Str. Bălea no. 8	63,2	89,9	65,2	82,9	65,9	79,1	70
Str. Semaforului	64,0	88,9	63,2	76,9	55,1	81,1	70
Str. Maramureșului bl. 33, sc. A	66,1	86,1	63,6	87,2	68,1	82,2	65
Str. A. Șaguna no. 10	60,1	81,2	62,4	80,1	59,1	78,1	70
Str. Henri Coandă no. 8 (S.C. Compa S.A.)	55,2	87,8	63,4	88,1	54,9	85,4	65
Str. Lungă no. 80	55,1	88,4	57,1	87,1	53,8	86,1	70
Str. Regele Ferdinand - gara Sibiu	58,4	88,1	59,4	90,1	60,7	84,5	70

CONCLUSIONS

The interpretation of the data reflected in the map of the city (fig. 4) where the sampling points of the sonometric samples were marked led to the conclusion that road traffic is the strongest source of noise pollution in the city of Sibiu. The most polluted areas are: “Calea Cisnădiei” no. 23, “Str. Regele Ferdinand” - Sibiu station, “Str. Semaforului”, where the noise exceeded the value of 88 dB in all the hourly intervals; the explanation may be the following: due to the development of the urban area, this is an intensely circulated street of blocks in the residential area of the Architects, the access road is insufficient for the large number of inhabitants and the vehicles crossing this area.

The quietest areas in the city are: “Calea Dumbrăvii” no.16, Str. “Lungă” no.80, “National College O. Goga “-Str. “Bastionului” no.13, the explanation being the one-way streets that are crossed by a smaller number of vehicles every day.

Following the completion of the present study, which we consider to be of great importance, starting from the information gathered from the field, after analysing and interpreting them, we recommend that the mayor of Sibiu should provide for the elaboration of strategic noise maps, an action plan containing measures that can be taken to reduce the noise level inside the city in order to respect the norms in force and to increase the quality of life of the inhabitants of the city of Sibiu.

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