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SOUND POLLUTION EVALUATION IN INDUSTRAL ACTIVITY

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Abstract: *The work presents the theoretical appropriateness for the application of noise pollution in the industrial activity. The paper contains the sound diminish in the air, taking into account the steps and the application of the noise evaluation in the noise map. This paper is a part of the important study regarding the sound pollution evaluation in the industrial activity.*
Key words: *sound pollution, sound diminish, noise map, industrial activity.*

1. GENERAL THEORY

The concept of noise cannot be separated from the concept of sound. In terms of physical sound is a wave generated by a mechanical vibrating system [MOR 01].

For the analysis of airborne noise emitted by machines-tools is necessary to determine important sources of noise in the overall cause of noise and transmission mode [1957/2-87]. Starting at the source, noise transmission is done by air (propagation by air) and structural (propagation through material objects).

Sonic pollution largely determines human conformity and unacceptable noise for long periods can cause harm to health, that must carry out activities to reduce noise. First need to identify the areas where noise pollution exceeds the accepted limits, and finally must be made of noise maps [ARG 08a] .

Noise maps are shaped with a software-based on data entry [ARG 08b]. These applications take account of environmental acoustic characteristic of land, today's weather, but also the other aspects of dissemination [PAŞ 11].

2. STUDY OF THE NOISE REDUCTION

Reduction of sound propagation in air with noise indicators, calculation for the noise caused by industrial activities [ISO 9613-2] is a detailed procedure for calculating the environmental noise levels generated by point source, noise sources as: surface type and line type.

Through instructions of ISO 9613-2 calculate the sound pressure level, A-weighted, continuously, equivalent, in weather conditions favourable to the propagation of acoustic emission sources are known, as well as sound pressure levels, weighted, averaged per period of time.

The method involves algorithms that calculate the averaged noise levels on the long period of time with an octave bands centred in nominal frequencies from 63 at 8000 Hz, and thus the difference between the calculation of the average sound level on the long period of time and the short period of time.

For long time interval, noise levels shall be calculated in the direction of the wind (favourable noise propagation due to strong winds from source to receiver), and for short interval of time, noise levels are calculated the same way, but using a weather correction factor, C_{me}t.

2.1. The Influence of Weather Conditions on Noise (Sound) Propagation

In the lower layers of the atmosphere, the temperature gradient and wind speed varies with height above the ground, so it can be negative (the normal case), or positive (temperature inversion) and gradient wind speed increases, generally with height above ground. The combination of these two gradients, gradients can create negative or positive velocity noise [MIR 11].

The accuracy of strategic noise maps for industrial noise depends on the nature of the sound power levels used in industrial noise sources and the precision with which it was digitilizată 's industrial area and the geometry of the surroundings, on the other hand. The best accuracy is obtained on the basis of actual measurement of sound power levels of industrial installations in full or, if possible, even of individual noise sources [11617-90].

Such C_{met} shall be calculated on the basis of the height of the source, the height of the receiver, the distance between source and receiver and a factor measured in decibels C_0, which depends directly on the local weather statistics for wind speed and direction.

For Romanien weather conditions, the C_0 correction coefficient is:

- $C_{0\,day}$=-10lg(50/100+25/100$\times 10^{-1,5/10}$ + 25/100)= - 1,4 db; (1)
- $C_{0\,evening}$= - 10 lg (75/100+12,5/100 $\times 10^{-1,5/10}$ +12,5/100)= - 0,7 db; (2)
- $C_{0\,night}$= 0 dB. (3)

2.2. Other Parameters That Affect the Noise Propagation

a). Geometric Divergence

Noise attenuation due to geometric divergence named A_{div} (decreasing noise inthe same time with the increase in propagation distance) is calculated on the basis of spherical propagation from a source point in free field (expressed in DB).

$$A_{div}=[\,20\ \lg (d/d_0) + 11\,] \qquad (4)$$

Where:

- d – the distance between source and receiver [m];
- d_0 – the reference distance (= 1m).

b). Atmospheric Absorption

Noise attenuation due to atmospheric absorption A_{atm} is calculated with the relationship (expressed in dB).

$$A_{atm} = \alpha d/1000 \qquad (5)$$

Where:

- α – it is the atmospheric attenuation coefficient [dB/km] for each octave Central frequency band;
- d – the distance between source and receiver [m].

c). Ground (Soil) Effect

Attenuation of noise due to ground effect, noted A_{sol} is caused by the interference of the reflected noise from ground and noise that propagates directly from the source to the receiver.

$$A_{sol}= 4,8 – (2h_m/d)[17+(300/d)] \qquad (6)$$

Where:

- h_m – the mean height of land above the propagation path [m];
- d - the distance between source and receiver [m].

Negative values of A_{sol} will be replaced with 0.

The study was realised for all the correction presented in this part of the paper.

3. SOUNDPLAN ESSENTIAL 3.0 PROGRAMM

Strategic noise maps used in the implementation of the plan action of noise has been made with the specialized program designed by SoundPlan 3.0 Essential [NET 1]. This is prodused by the German Company with the name Braunstein & Berndt GmbH. The program is internationally recognized.

The results obtained through the Essential 3.0 SoundPLAN were considered appropriate and the more stringent checks carried out by German institutions. Universities and institutions of Romania are the users design software package.

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3.1. Steps in the Sound Map

Step one – Map is a digital map of the area of study. They can use Google Maps to map. Because the study has not been Factory Street in a good resolution on the screen, that made several PrintScreen and with the help of a program that edit images, and put images next to each other, obtaining a map with a resolution that it can work.

Step two – Create a New Project what is done by opening the SoundPLAN Essential 3.0 and make the data entry project: project name, project number, engineer name, name of beneficiary, and project description (Fig.1). Noise sources should be selected that will let to your map geohazard (road traffic, railway, industrial area, parking) (Fig. 2).

Step three - Introduction of Level Ground Trading, and of Industrial Hall for this the Essential 3.0 SoundPLAN can equip and made drawings in AutoCad DXF format saved in. If there is to level the land shares, selected shares of point level, and import DXF file (Fig. 3).

Using certain editors of SoundPLAN Essential programme, have introduced noise of machine tools in a workshop of machining, such as acute WATER 40 machine, lathe, lathe SN 401 ZAN 210, with actual measured data at that workshop (Fig. 4). Enclosure dimensions are 2.7 6x12x.

4. EXPERIMENTAL RESULTS

Following the introduction of data, was made a table of all the spectral frequencies and corrections calculated by this program (Fig. 5).

Step four – switch analysis. It is a very important step in making the noise map, because at the moment that accumulate and analyze data, so to establish them compatibility with the computing system and analysis of the programm (Fig. 6).

Following the introduction of data has been obtained, a table of all the spectral frequencies and corrections calculated by this program (Fig. 7).

Step five – representation of noise map Noise map is a suggestive graphical representation, that the noise level is rendered topographical colour for the impression of the degree of pollution (Fig. 8).

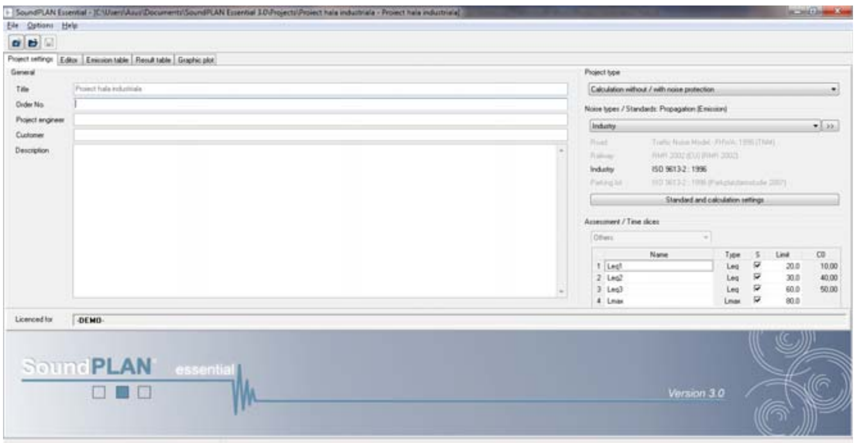


Fig.1. New Project.

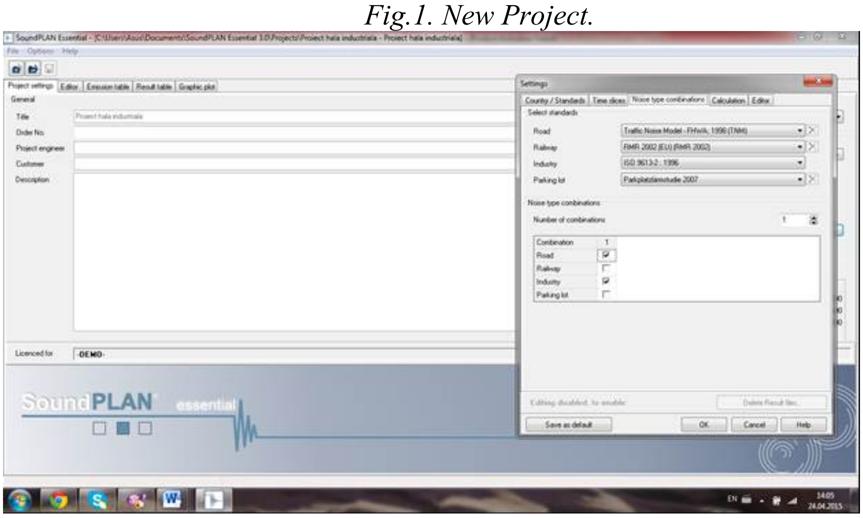


Fig. 2. Project Settings.

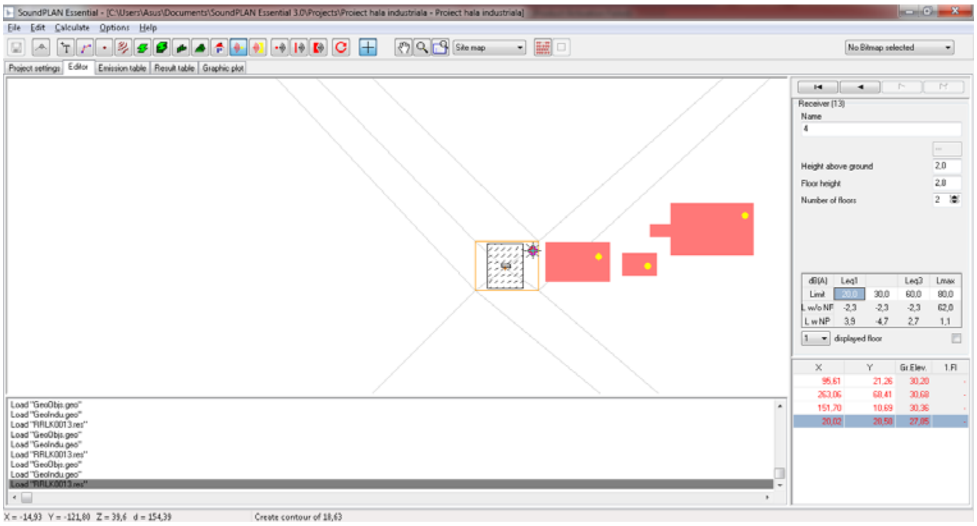


Fig. 3. Import Quota Level

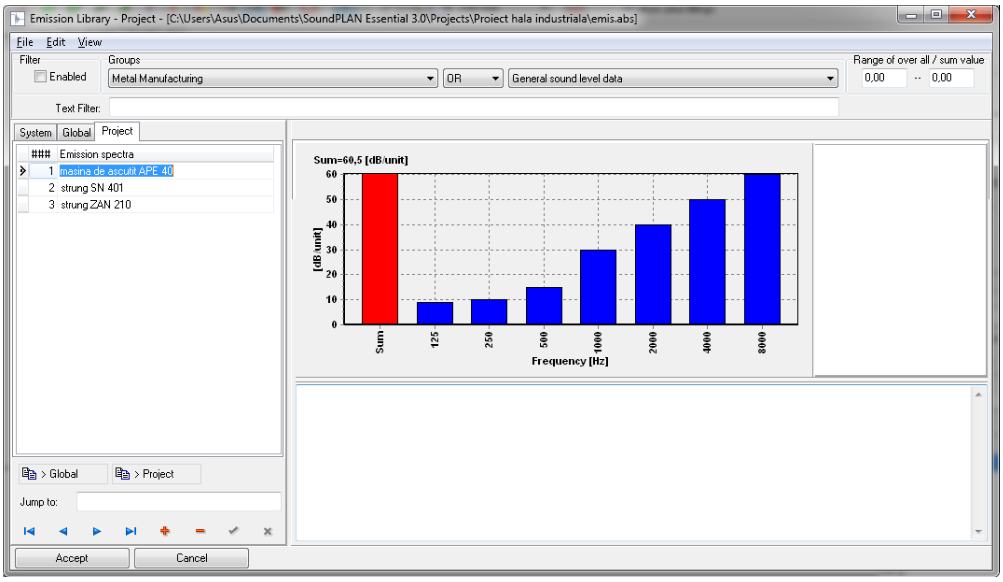
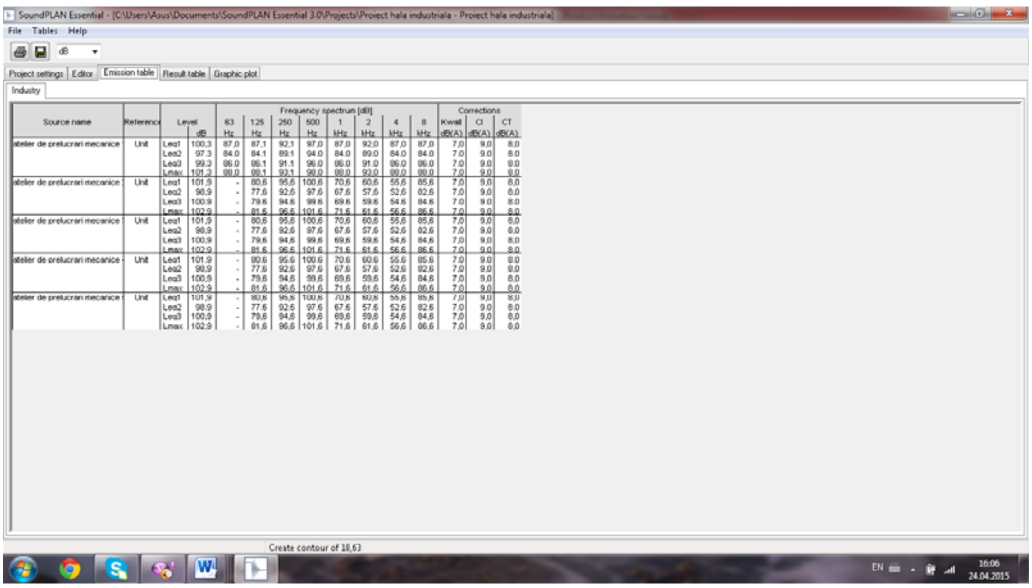


Fig. 4. Frequency Spectrum of Machine-Tools



Source name	Reference	Level	dB	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Kwall dB(A)	CI dB(A)	CT dB(A)
atelier de prelucrari mecanice	Unit	Leq1	100,3	87,0	87,1	92,1	97,0	87,0	92,0	87,0	87,0	7,0	9,0	8,0
		Leq2	97,3	84,0	84,1	89,1	94,0	84,0	89,0	84,0	84,0	7,0	9,0	8,0
		Leq3	99,3	86,0	86,1	91,1	96,0	86,0	91,0	86,0	86,0	7,0	9,0	8,0
		Lmax	101,3	88,0	88,1	93,1	98,0	88,0	93,0	88,0	88,0	7,0	9,0	8,0
atelier de prelucrari mecanice	Unit	Leq1	101,9	-	80,6	95,6	100,6	70,6	60,6	55,6	85,6	7,0	9,0	8,0
		Leq2	98,9	-	77,6	92,6	97,6	67,6	57,6	52,6	82,6	7,0	9,0	8,0
		Leq3	100,9	-	79,6	94,6	99,6	69,6	59,6	54,6	84,6	7,0	9,0	8,0
		Lmax	102,9	-	81,6	96,6	101,6	71,6	61,6	56,6	86,6	7,0	9,0	8,0
atelier de prelucrari mecanice	Unit	Leq1	101,9	-	80,6	95,6	100,6	70,6	60,6	55,6	85,6	7,0	9,0	8,0
		Leq2	98,9	-	77,6	92,6	97,6	67,6	57,6	52,6	82,6	7,0	9,0	8,0
		Leq3	100,9	-	79,6	94,6	99,6	69,6	59,6	54,6	84,6	7,0	9,0	8,0
		Lmax	102,9	-	81,6	96,6	101,6	71,6	61,6	56,6	86,6	7,0	9,0	8,0
atelier de prelucrari mecanice	Unit	Leq1	101,9	-	80,6	95,6	100,6	70,6	60,6	55,6	85,6	7,0	9,0	8,0
		Leq2	98,9	-	77,6	92,6	97,6	67,6	57,6	52,6	82,6	7,0	9,0	8,0
		Leq3	100,9	-	79,6	94,6	99,6	69,6	59,6	54,6	84,6	7,0	9,0	8,0
		Lmax	102,9	-	81,6	96,6	101,6	71,6	61,6	56,6	86,6	7,0	9,0	8,0
atelier de prelucrari mecanice	Unit	Leq1	101,9	-	80,6	95,6	100,6	70,6	60,6	55,6	85,6	7,0	9,0	8,0
		Leq2	98,9	-	77,6	92,6	97,6	67,6	57,6	52,6	82,6	7,0	9,0	8,0
		Leq3	100,9	-	79,6	94,6	99,6	69,6	59,6	54,6	84,6	7,0	9,0	8,0
		Lmax	102,9	-	81,6	96,6	101,6	71,6	61,6	56,6	86,6	7,0	9,0	8,0

Fig. 5. Summary table of the Frequency Spectrum

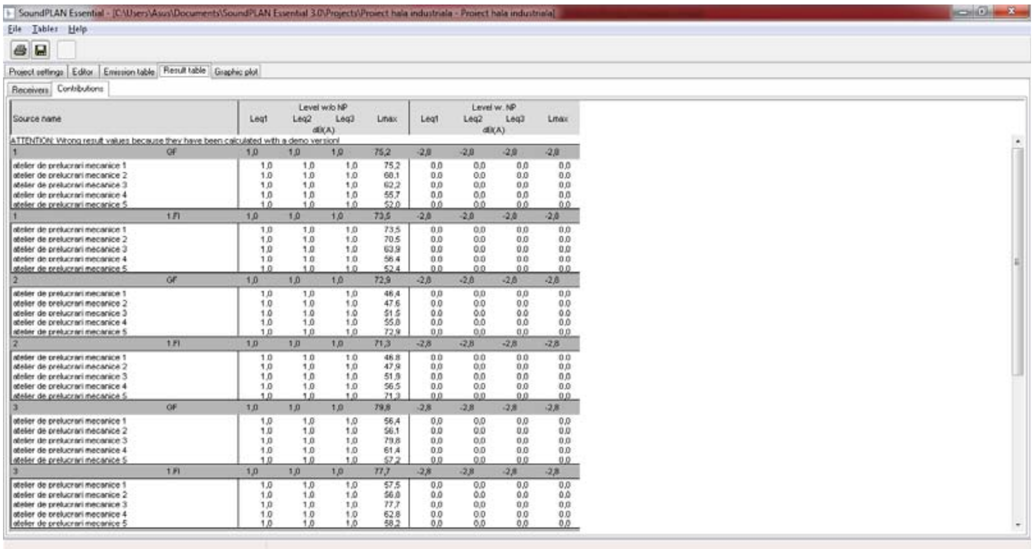


Fig. 6 The Results of the Program

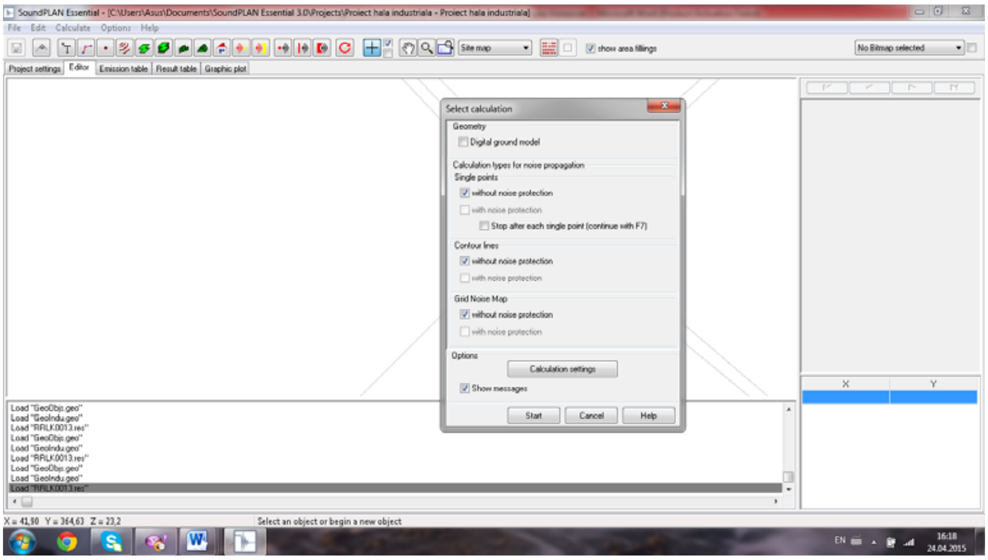


Fig. 7. Start of Camputation

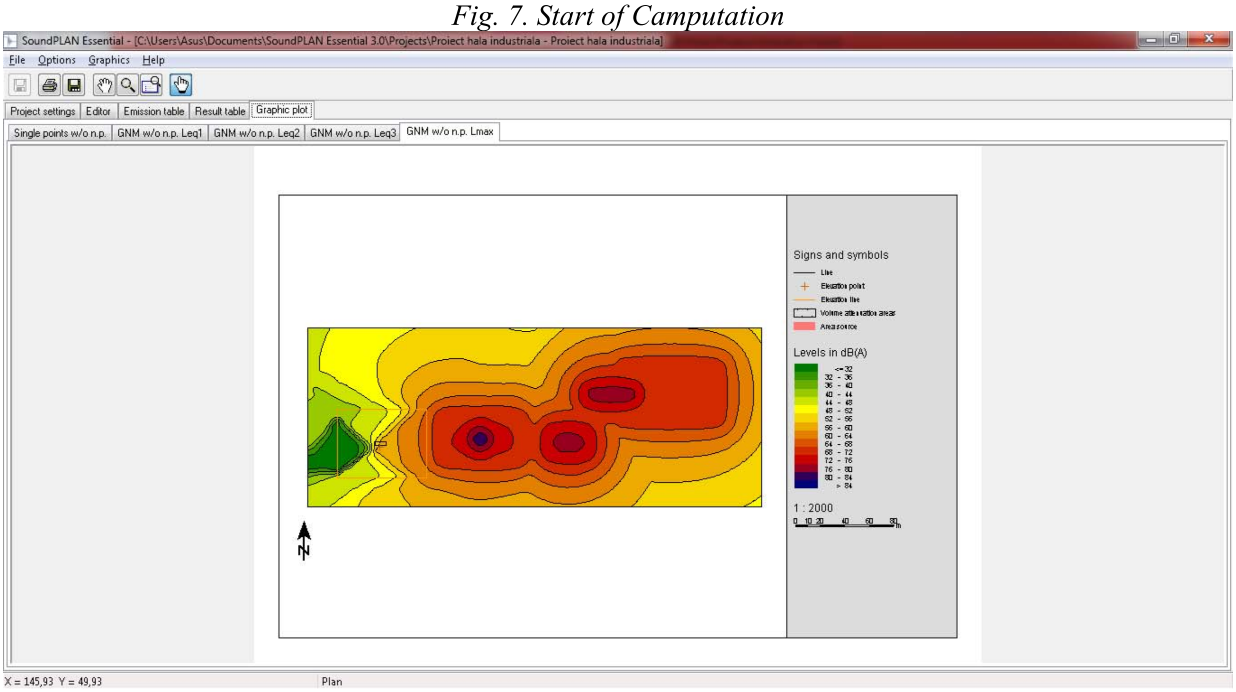


Fig.8. Map Editing

5. CONCLUZII

1. Hărțile de zgomot sunt elaborate pentru diferite tipuri de poluări fonice dintre care urechea umană nu poate face diferențe, adică efectul este unul complex. O soluție mai bună ar fi elaborarea unor hărți care cuprind toate felurile de zgomot la care sunt expuse locuitorii orașelor. Rezultatele astfel obținute vor fi mai aproape de situația reală, în folosul reducerii poluării fonice.
2. Hărțile de zgomot bazate pe măsurători sunt satisfăcător de punctuale numai dacă se bazează pe o mulțime de date colectate. Pentru acesta este nevoie de mult timp și energie investită.
3. Acele hărți care sunt efectuate prin software, nu sunt concludente deoarece simularea nu coincide cu faptul real, adică diferențele pot fi esențiale.

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Evaluarea poluării sonore în activitatea industrială

Rezumat: *Lucrarea prezentă aproximarea aplicării poluării sonore în activitatea industrială. Lucrarea conține studiul teoretic privind diminuarea sonoră în aer, în vederea aplicării pentru succesiunea paşilor de care trebuie să se țină cont pentru evaluarea poluării sonore la întocmirea hărțiilor de zgomot, care se face cu pachetul de programe SoundPlan. Această lucrare este o parte a unui studiu important în ceea ce prineşte evaluarea poluării sonore în activitatea industrială.*

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