



25-27 October 2023

DETERMINING THE LEVEL OF NOISE POLLUTION PRODUCED BY THE RAILWAY MODERNIZATION ACTIVITY IN PETROȘANI MUNICIPALITY

Tataru D.^{*1}, Tataru A.C.² Stanci A.³

1. Universiti of Petrosani, Petrosani, Romania, dorintataru@upet.ro
 2. Universiti of Petrosani, Petrosani, Romania, andreeatataru@upet.ro
 3. Universiti of Petrosani, Petrosani, Romania, aurorastanci@upet.ro
- *Corresponding author: dorintataru@upet.ro

Abstract: *Construction site noise is a source of major noise pollution in the big cities in Romania, and from year to year it becomes an increasingly bigger problem, with consequences for the health of the population. Occupational health and safety legislation sets out the minimum requirements for the protection of workers against their health and safety caused or likely to be caused by exposure to noise. In this work, we set out to determine the level of noise pollution produced by the railway modernization works in the municipality of Petrosani. Determining the level of noise pollution is necessary in order to establish solutions to reduce the level of noise pollution for the residents of the areas adjacent to the construction sites and for the protection of the employees on the construction site.*

Keywords: *Noise pollution, safety, protection, railway*

1. INTRODUCTION

Environmental noise affects a large number of Europeans. The public considers it to be one of the major environmental problems. It can affect the population both physiologically and psychologically, having influence on elementary activities such as sleep, rest, study and communication. Even though these impacts on human health have been known for a long time, recent research shows that they occur at lower noise levels than originally thought.

Noise is a harmful and unwanted outside sound, it spreads, both in duration and geographical coverage. Noise is associated with many human activities, but the

noise produced by road, rail and air traffic is the one that has the greatest impact. This is particularly a problem for the urban environment; approximately 75% of Europe's population lives in cities, and the volume of traffic is still increasing. National analyzes show that the number of complaints related to noise is increasing in many European countries.

Because noise is persistent and cannot be avoided, a significant proportion of the population is exposed to it. The EU Green Paper Future policy on noise emissions states that around 20% of the EU population suffers from noise levels that health experts consider to be unacceptable, i.e. those that can lead to annoyance, disturbance sleep and adverse effects on health. The World Health Organization (WHO) estimates that approximately 40% of the EU population is exposed to road traffic noise at levels exceeding 55 dB(A) and that over 30% of the same population is exposed to levels exceeding 55 dB(A) per during the night.

Quantifying the causes of morbidity associated with environmental noise is an emerging challenge for policy makers. Exposure to noise not only leads to disturbance, annoyance and hearing disorders, but also to other health problems such as cardiovascular diseases. The causes of noise-related morbidity have not yet been quantified. The World Health Organization is currently developing a study that addresses several effects of noise on health.

2. THE NOISE

In Romania there is a tendency, which also manifests itself on a global level, of increasing the level of noise and the production of vibrations, the sources of which appear with the impetuous development of all branches of the economy and transport.

Sounds are vibrations transmitted through an elastic medium in the form of waves. For certain intensity and frequency values, sounds are perceived by the human ear, producing auditory sensations.

Sounds can be simple or complex. Disturbing sounds, regardless of their nature, are noises. They have a harmful influence on the nervous system, causing a state of fatigue. For this reason, sound insulation is necessary, both in civil and industrial buildings, to stop the spread of noises produced inside and outside the buildings.

Sounds can be studied and appreciated under two aspects:

a) Physical phenomenon (objective), produced by the mechanical vibration of solid and fluid bodies. In this case, sounds are characterized by quantities specific to oscillations (waves): amplitude, period, wavelength, frequency, pulsation, as well as by energy quantities: sound energy, sound pressure, sound intensity, etc.

b) Physiological (subjective) phenomenon, which means the sensation perceived by the auditory organs. In this situation, the sounds are characterized by: height, timbre, loudness level.

The permissible limits of Lech-equivalent noise levels outside buildings, at a distance of 2.00 m from the facade and a height of 1.30 m from the ground or the level considered for protected buildings during the day are indicated in table 1. Maximum permissible noise level during the night it is 10 dB lower than during the day.

Table1. Permissible noise level limits near protected buildings:

Nr. crt.	Protected buildings	The permissible limit of the equivalent noise level dB (A)
1	Homes, hotels, dormitories, guest houses	55
2	Hospitals, polyclinics, dispensaries	45
3	Schools	55
4	Kindergartens, nurseries	50
5	Office buildings	65

3. AREA DESCRIPTION

Petrosani is a municipality in Hunedoara County, Romania. It has a population of 34,331 inhabitants, according to the 2011 census and is located at an altitude of 615-620 m in the Petrosani Depression or popularly "Jiu Valley", being the main municipality of this area. It is recognized as a mining town.

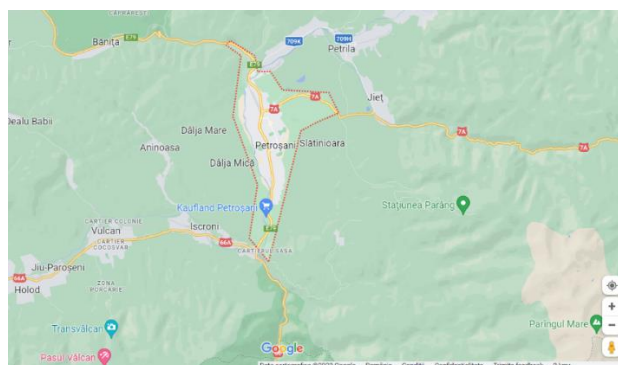


Figure 1: Location of Petrosani Municipality

The municipality of Petrosani is located on the north-south railway axis that connects Transylvania with Oltenia, through the Jiu Valley (Simeria-Petrosani-Tg. Jiu-Filiasi) Towards Transylvania there is the Petrosani-Simeria railway axis (with branches to the main cities (Deva, Arad, Cluj).

The railway is located on the western side of 1 Decembrie 1918 Boulevard.

4. RESULTS AND DISCUSSION

Rail transport is a method of transporting passengers and goods using wheeled vehicles running on a track provided with rails. These tracks are also known as railways. Rail tracks are made of steel rails that are installed on sleepers placed on a bed of ballast. Unlike road transport, where vehicles travel on a relatively flat, purpose-built surface, rail vehicles (rolling stock, usually equipped with metal wheels) are guided directionally by rails.

In 1865, following a plan drawn up by the engineer Freund, work on the railway began and the new route, from Simeria to Petrosani, officially opened on August 18, 1870.

Currently, modernization works are taking place on the railway axis that crosses the Petrosani Municipality. Along with the works that take place in the modernization process, a significant amount of noise is also produced.

In order to determine the level of noise pollution produced by the process of moderating the railway axis in the Municipality of Petrosani, we made a series of meters.

In order to determine the noise pollution, I used the multimeter device PCE-222 (Fig. 2), it is a multifunctional sound meter for environmental parameters (with acoustic sensor, light, temperature and relative humidity), with RS-232 interface and software compatible with Windows, having an accuracy of $\pm 3.5\text{dB}$ in the measurement of acoustic intensity.



Figure 2: Sound level meter PCE-222

The measurements were carried out in accordance with the STAS in force, at a distance of 2 m from the railway works, on 01.05.2023. The measurements were carried out both during the break period and while working.

The machines used in the process of modernizing the railway crossing Petrosani Municipality are tippers, bulldozers and excavators.



Figure 3: Machinery used in the modernization of the railway within Petrosani Municipality

The values obtained as a result of the measurements made during the break period are presented in figure 4. The recorded values of the sound pollution level are given by the car traffic related to the road DN 646. The minimum value recorded is 35.5 db while the maximum value recorded is 92.2 db. The maximum value was recorded when a truck passed by.

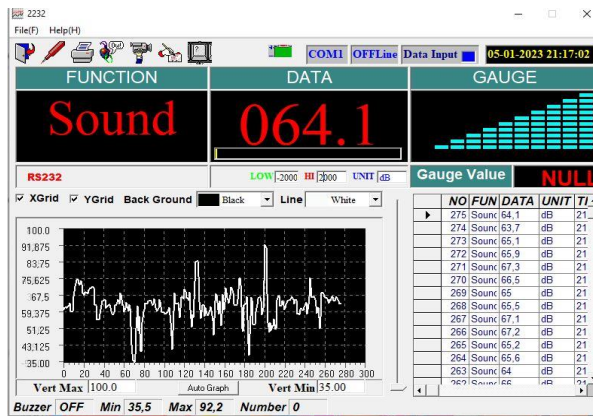


Figure 4: The values obtained from the measurements made during the break period

The values obtained as a result of the measurements carried out during the work period for the modernization of the railway that crosses the Petrosani Municipality are shown in figure 5. The recorded values of the noise pollution level are given by the car traffic related to the DN 646 road and the equipment used for the modernization. The minimum recorded value is 35.5 db while the maximum recorded value is 100 db. The maximum value was recorded when the tippers were emptied and when they were loaded.

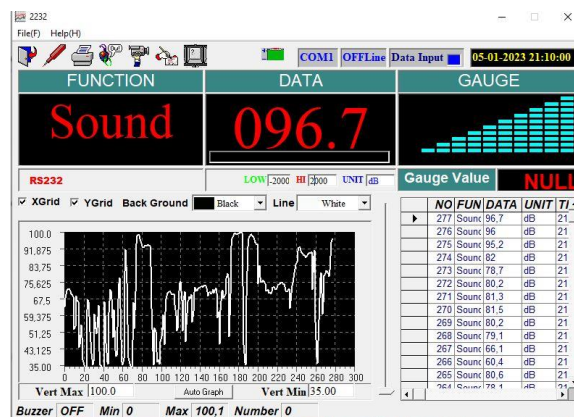


Figure 5: The values obtained as a result of the measurements carried out during the work period for the modernization of the railway that crosses the Petrosani Municipality

Following the measurements, it is observed that the level of allowed decibels exceeds the maximum allowed limits. Due to the working schedule only during the day and the fact that the noise at very high values is only for certain activities in the construction site, soundproofing solutions for the construction site area are not required for the protection of the inhabited areas in their vicinity. Noise protection solutions for employees are needed

According to the updated Law 319 of 2006, the law on occupational health and safety, the employer must take measures to equip employees with specific protective equipment.

To prevent occupational diseases, in the technical book, the noise level will be maintained, which must not exceed the values below:

- noise emitted in the environment: during work 80 dB(A);
- noise emitted at the level of the driver's ears: during work 87 dB(A);

If the noise during the work schedule exceeds the above values, then the employer is obliged to provide approved personal ear protection equipment. The employer is also responsible for employees who carry out their daily work in places with noise above the permissible limit and must ensure that employees undergo regular medical checks.

Personal ear protection equipment can be sound-isolating headphones or approved earplugs.

5. CONCLUSIONS

The construction site related to the railway modernization works in Petroșani Municipality represents a source of noise pollution.

The level of noise pollution in the construction site area is given both by the noise produced by the machinery on the construction site and by the road traffic on DN 66.

Recorded values of the sound pollution level produced only by traffic on DN 66 range between 35.5 and 92.2 dB.

The highest values were recorded for the circulation of large tonnage machines

Recorded values of the level of noise pollution at the railway modernization site in the Petrosani Municipality of values between 35.5 and 100 dB.

The maximum value was recorded when the tippers were emptied and when they were loaded.

Due to the working period during the day and the fact that the high noise level is only occasional, no noise protection measures are required for the inhabited areas in the vicinity of the chain link.

In order to comply with the safety and health regulations at the workplace, at the values of the pollution level in the railway modernization site in Petrosani Municipality, noise protection equipment is required.

Personal ear protection equipment can be sound-isolating headphones or approved earplugs.

BIBLIOGRAFIE

- [1] D. Stepan, I. Ionel, W. Stefanescu, L. I. Dungan, Noise control in railway vehicles, *Journal of Environmental Protection and Ecology*, vol. 13, no 2, 561–570, 2012
- [2] Darabont, A., Costin, A. *Poluarea sonora și civilizatia contemporana*, Editura Tehnica, Bucuresti, 1982.
- [3] G. E. Mocuta, Noise pollution emitted as a consequence of the urban transport development, *Journal of Environmental Protection and Ecology*, Vol. 13, No 2A, 852–861, 2012
- [4] I Chilibon, *Acustica și metodele ei de testare*, Editura ELECTRA, ISBN 978-606-507-024-0, (2009).
- [5] Nicolae Enescu, Ioan Magheți, Mircea Alexandru Sârbu, *Acustica tehnică*, Editura ICPE, ISBN 973-98801-2-6, București, 1998.