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NOISE IN THE TOURIST RESORT - AN ENVIRONMENTAL PROBLEM OR LUXURY THAT FOLLOWS EVERYDAY LIFE

Abstract: *In developed countries citizens clearly recognize problem with exessive noise as factor that negatively affects population health. Unfortunately, this is not the case in our country where this problem is especially pronounced in the coastal region during summer seasons. In order to verify these claims in practice, recordings of environmental noise levels were carried out in the tourist settlement Donja Lastva within the Tivat municipality. The measurement results indicate the presence of environmental noise in the tourist settlement Donja Lastva. Deviations observed in both summer and winter period, classify enviromental noise in a group of pollutants that significantly affect the lives and health of people. Exceeding of the allowed values also indicate the presence of problems that could endanger future generations.*

Key words: noise, environmental problem.

INTRODUCTION

Compared with other environmental factors, there is little understanding regarding the control of communal noise, and it is not considered as one of the priorities to be addressed in order to protect the environment and health. Insufficient knowledge about effects of noise on human life, health and the environment can be specified as a reason, particularly when exposure to noise lasts for an extensive period of time. This is particularly evident in developing countries where institutions responsible for dealing with noise problems considered communal noise as "luxury" that follows everyday life. In developed countries, citizens clearly recognize the problem and point to the noise as the main factor that negatively affects entire population. Unfortunately, this is not the case in Montenegro where noise problem is prominent in the coastal region, especially during the peak of tourist season. In order to verify these claims in practice, recordings of environmental noise levels were carried out in the tourist resort Donja Lastva within the Tivat municipality. Following noise sources have been identified: road traffic noise taking place along the Adriatic highway and local traffic routes close to the coast, air traffic noise connected with Tivat airport, noise caused by loud music from tourist and hospitality facilities, from floating facilities, noise created by air conditioners and noise due to the presence of large number of people.

METHODOLOGY

Tourist settlement Donja Lastva extends close to the shore. In the area from the the church "St. Roch" to playground "Zog" series of stone houses, waterfront, several "small moles" and small beaches are located. Four positions characterized with different noise sources were selected to perform the experiment (Figure 1).

Figure 1. *Satellite image of settlement with measurement points (marked with stars)*

First selected position (position 1) is located close to the local road and in front of the church "St. Roch". Nearby is located riva which brings together a large number of bathers and which also serves as a dock. Noise sources originate from motor vehicles, motorcycles, boats, ships and bathers.

Second measurement position (position 2) is also next to the the road in front of a local cafe bar "Mar-Mar". This position was selected in order to determine impact

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of noise generated by the guests, the music program emitted in cafe, as well as traffic taking place on local roads.

The third position (position 3) is right in front of a residential building, which is located along the street equipped with airconditioning system. This position was selected in order to determine noise emitted by vehicles and air conditioning system.

The fourth measurement position (position 4) is located right next to road in front of the former cafe "Donja Lastva" and a small beach. Presence of a large number of people during the summer months is typical for this position, as well as the presence of "urban canyon" (two buildings separated by streets, which ensures the propagation of sound without significant reduction of of energy that is otherwise characteristic when range-distance increases in relation to the noise source).

Data on noise generated by the people, the traffic, and the effect of increasing the level of noise due to the "urban canyon" were collected at this position. Sound levels were measured using precise modular analyser (Brüel and Kjær, type 2250, meets IEC 6160804). In accordance with the ISO 1996 standard, the measuring instrument is set to be on the minimum distance of 1.5m from any reflective surface and the height of 1.2m from the ground. Selecting of measurement interval is observed by Article 6 in Rulebook of measurement methods and instruments to be met by the organization to measure the noise[1]. According to this Rulebook, changeable noise levels are measured in three intervals during the day (06h-22h) and two intervals during the night (22h-06h). Minimum duration of the measurement interval is 15 minutes.

The first measurement interval was from 07:00 h to 07:15 h.

The second measurement interval was from 11:00 h to 11:15 h.

The third measurement interval was from 18:00 h to 18:15 h.

The fourth measurement interval was from 23:00 h to 23:15 h.

The fifth measurement interval was from 01:00 h to 01:15 h.

Values of environment noise level are normatively regulated (2), so that noise levels in residential areas must not exceed the permissible value for a particular residential zone. In this case, residential area is classified in zone V, where the equivalent noise level limit shall not exceed a value of 60 dB for daytime and evening period, while during night time, equivalent noise level must not exceed 50dB. Characteristics of climatic conditions during the measurement process are clear and quiet weather (air speed ≤ 5 m/s), temperature varied in the range 13-320C, air pressure was in the range 880-1020mbar, and humidity of 59-93 %.

RESULTS

Analysis of the obtained results will determine whether equivalent noise levels on the selected measurement points exceed the allowable limits for exposure to environmental noise, as well as causes of excessive noise. Measuring instrument performs a statistical analysis of noise levels. Measured noise levels are grouped in classes width 0.2 db. Based on the data for equivalent noise levels, percentile levels, the distribution of noise and the cumulative distribution are determined (Figure 2). At the same time, the instrument performs a parallel real-time analysis of the defined bandwidth. Measurement parameters were determined from a sample of variable noise in all frequency bands with a defined bandwidth and center frequency (Figure 3).

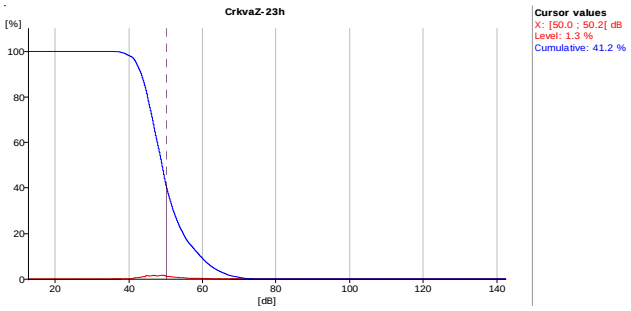

Figure 2. *Cumulative distribution of noise levels*

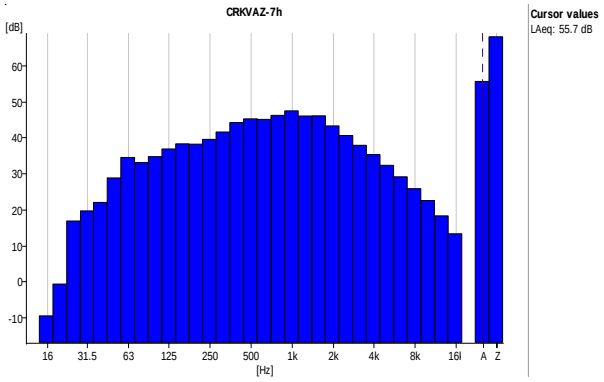

Figure 3 *Frequency analysis diagram of noise levels*

Analysis of results of measurements performed in winter season

During January 2014 the measurement of noise levels were conducted on four selected measurement ositions in five different measurement terms lasting 15 minutes. Measurement results for all measurement positions show a table (Table 1).

Table 1. *Measurement results of noise levels in winter season for all four positions in five terms*

TERM	Poz. 1 $L_{Aeq[dB]}$	Poz. 2 $L_{Aeq[dB]}$	Poz. 3 $L_{Aeq[dB]}$	Poz. 4 $L_{Aeq[dB]}$	Allowed $L_{Aeq[dB]}$
TERM 1	56	48	59	51	60
TERM 2	55	44	55	52	60
TERM 3	51	55	57	72	60
TERM 4	57	59	52	62	50
TERM 5	50	51	49	51	50

Table 1 shows that exceedences in relation to he allowable value of equivalent noise levels for day and evening hours were not recorded at three selected positions. The exception is the result for the position 4 in the term 3, where equivalent noise level was Leq = 72dB. Deviation from the allowed value is 12 dB, and there is a need for more detailed analysis. From the diagram (Figure 4), it is evident the presence of a sound event in which level of equivalent noise amounts to Leq = 85.1dB.

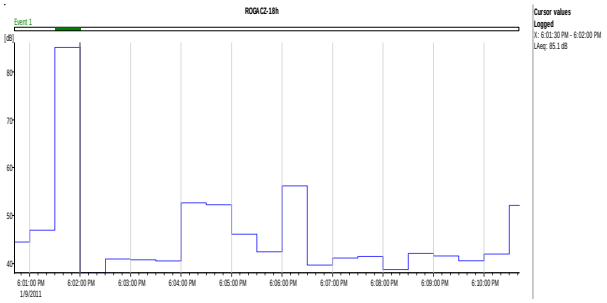

Figure 4. *Leq change for the position 4 in the term 3*

Diagram (Figure 4) shows that over time of recording level of the noise was in the range from 40-60 dB, ie. within the allowed limits. Therefore single event has caused the equivalent noise level for the whole period of recording to raise and cross the permitted value of 12 dB. To determine the characteristics of this event, a diagram of frequency analysis was analyzed (Figure 5).

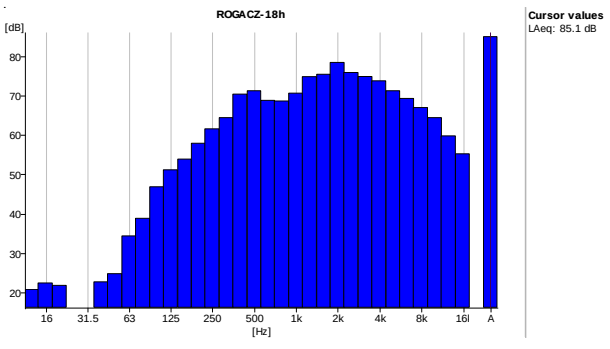

Figure 5. *Frequency analysis diagram of sound events with Leq = 85dB*

The diagram shows that the highest values recorded Leq that varies between 1.5kHz to 3KHz, ie. at higher frequencies. Given the duration of the event, it can not be characterized as an impulse event. Therefore, this event for its duration, frequency characteristics and of equivalent level of generated noise, refers to traffic noise, ie. noise from motorcycles. [3] Therefore is considered that passing of the motorcycle on road that is located right next to measuring point, caused more noise pollution. Given the level of the recorded noise of 85,1 dB, it was probably a motorcycle that passed at a speed greater than 50km/h or had been damaged / with revised exhaust system [4].

Differences that were recorded in night hours were in the range from 2 dB to 12 dB. As the main sources of noise there have been identified vehicles running local road and two external air conditioning units that were activated during recording.

Analysis of results of measurements performed in summer season

Noise levels measurements during the summer season were made in the period from 15-18.7.2014. for all four measurement positions. In period 31.7-1.08.2011 measurement were at Position 1 and Position 4 in all terms, in order to check the noise level in the peak of tourist season on places where large number of bathers is gathered. Measurements for all positions are presented (Table 2).

Table 2. *Measurement results of noise levels in summer season for all four positions in five positions*

TERM	Poz. 1 $L_{Aeq[dB]}$	Poz. 2 $L_{Aeq[dB]}$	Poz. 3 $L_{Aeq[dB]}$	Poz. 4 $L_{Aeq[dB]}$	Allowed $L_{Aeq[dB]}$
TERM 1	58	50	51	51	60
TERM 2	81	64	63	78	60
TERM 3	71	65	65	73	60
TERM 4	64	54	57	61	50
TERM 5	66	52	52	55	50

Table 2 showed that in daily terms (Term 1, Term 2, Term 3) recorded values exceeding the allowable values at all four elected positions. Exceedings are somewhere in range between 3 dB to 21 dB. In order to determine the causes of these exceedings, diagrams of the equivalent noise level changes during the measurement period were analyzed. As an example, we can present considering the value of a position for Term 3, designated as the place where it gathers a large number of swimmers and boats dock. The diagram (Figure 2) shows noticeable presence of five events that describe the noise of about 80 dB, resulting from the passage of vehicles or motorcycles. The noise level is mainly ranged from 60 dB to 75 dB as a result of the presence of a large number of people and music that comes from the coffee bar nearby.

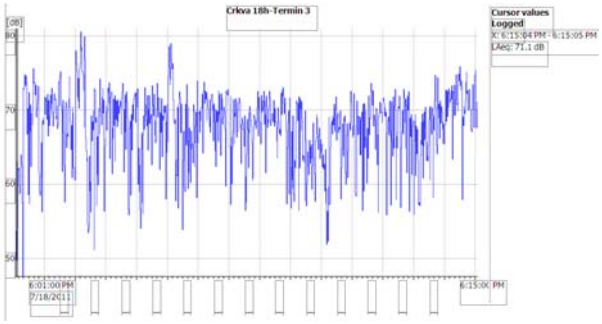

Figure 5. *Change of the equivalent noise level in time for position 1 in the period from the 18h CET*

From Table 2, for night periods (Term 3 and Term 4), we can see clear deviations in the range from 2 dB to 16 dB. A detailed analysis showed that the main causes of noise exceeding are motorcycles, which presence is expressed in the summer. Also, noise that coming from the restaurants and the noise made by tourists during the summer season, gathering people in groups and parties that lasted till early morning hours.

CONCLUSION

Measurement results indicate presence of increased environment noise level in the tourist settlement Donja Lastva in Tivat. Significant exceeding are especially pronounced in the peak of tourist season. Exceeding noise level which is up to 21 dB indicates the presence of a problem which is certainly a disturbing factor. Range and magnitude of negative impacts on the life of local population, tourists and the environment from identified noise sources (cars, motorcycles, air conditioners, music from the restaurants, meeting more people), is an issue which should be carefully considered by competent authorities and the entire community.

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BUKA U TURISTIČKOM NASELJU - EKOLOŠKI PROBLEM ILI LUKSUZ KOJI PRATI ŽIVOTNU SVAKODNEVNICU

Aleksandar Nikolić, Mladenka Vujošević

Rezime: *Stanovnici razvijenih zemalja jasno prepoznaju prekomernu buku kao faktor koji negativno utiče na ljudsko zdravlje. Nažalost, to nije slučaj u Crnoj Gori u kojoj je ovaj problem posebno izražen u primorskom regionu tokom letnje sezone. U cilju provere te činjenice u praksi, izvšeno je merenje nivoa buke u životnoj sredini u turističkom naselju Donja Lastva u opštini Tivat. Rezultati merenja ukazuju na prisustvo buke u životnoj sredini u turističkom naselju Donja Lastva. Odstupanja koja su uočena i u letnjem i u zimskom periodu svrstavaju buku u životnoj sredini u grupu zagađivača koja značajno utiče na život i zdravlje ljudi. Prekoračenje dozvoljenih vrednosti ukazuju na prisustvo problema koji bi mogli da ugroze buduće generacije.*

Ključne reči: buka, životna sredina, turističko naselje.