[1.]Tale GERAMITCIOSKI, [1.]Vladimir MIJAKOVSKI, [1.]Vangelce MITREVSKI

ENVIRONMENTAL NOISE POLLUTION IN THE UNIESCO CITY OF OHRID

[1.]University "St. Kliment Ohridski" Bitola, Technical Faculty Bitola, NORTH MACEDONIA

Abstract: In this paper a research is made by analyzing the noise level variations in the area of city Ohrid. City of Ohrid is one of the 28 sites that are part of UNESCO's World Heritage of Cultural and Natural treasures and it is also the largest city on Lake Ohrid, making it a vast tourist attraction. One of the main complaints by the tourists during the tourist season is the level of noise that is produced by several sources. For better understanding and analyzing the noise pollution in the environment, two kinds of research are made. Firs research is made by public survey and the second one is made by measurement of the level of noise produced in specific locations that are most frequent with visitors. A set of measures are made for reducing the noise pollution, making better environment and improving locals and tourist accommodation.
Keywords: environment, noise pollution, Ohrid

INTRODUCTION

The Municipality of Ohrid is located in the southwestern part of the Republic of North Macedonia. Ohrid is also the name of the city where the municipal seat is found. Ohrid is a small resort city on the hilly shores of Ohrid Lake in the southwest of the Republic of Macedonia (Fig.1). In the city's compact old town, medieval churches, monasteries and open-air ruins stand alongside traditional houses with red-tiled roofs. The massive walls of the centuries-old Samoil's Fortress, at the top of the hill, dominate the city skyline (Fig.2).

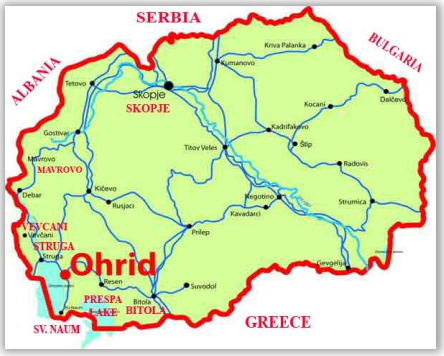

Figure 1. Location of Ohrid in south-west region of Republic of North Macedonia

Ohrid region which includes Ohrid Lake and the mountain Galichica, allow Republic of North Macedonia to be among the few countries with rich diversity of habitats for wildlife. In 1958, due to the characteristic location, extremely rich flora and fauna and exceptional natural beauty and landscape values, Galichica Mountain was declared as a National park "Galichica" with 25,000ha protected area. On the other hand, in 1979 the Ohrid Lake was declared under UNESCO protection. With its unique flora and fauna, the lake is one of the largest biological reserves in Europe. The Ohrid Lake is one of deepest and the oldest in Europe, preserving a unique aquatic ecosystem with more than 200 endemic species. The lake fish fauna include 17 native species, of which 10 are endemic (two of which belongs to Salmonide family). Ten from the fish species have a commercial value. But also a lot of snails (85%), worms, and sponges are endemic species. Littoral zone is characterized by considerable communities of the plant and animal species. The red belts at this part of the lake have a big ecological importance as biotopes for a lot of other organisms, places for fish reproduction, and bird nesting place. Related to bird nesting over 60,000 birds have been observed in the Lake.

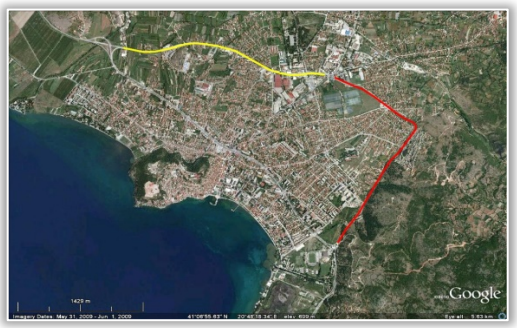

Figure 2. Map of Ohrid city

Environmental noise is a severe problem in urban cities similar as Ohrid. Noise pollution and its consequent influence over the environment and life quality of human beings may be considered a "hot topic" in scientific research. Many noise surveys treating the problem of noise pollution in many cities throughout the world have been conducted (Curitiba, Brazil [1], Sa˜o Paulo [1], Rio de Janeiro [2], Belo Horizonte [3] and Porto Alegre [4,5]. Sounds are part of our everyday life and they are often unwanted or harmful in outdoors environment created by human activities. Environmental noise affects primarily the quality of life, disruption of the normal rhythm of work and rest. It causes both physical and psychological problems among population by disturbing the basic activities of man such as sleeping,

rest, study, communication, and it reflects especially on hearing impediment. Noise is constantly growing and it is especially difficult to control in densely populated agglomerations and residential areas near airports, railways and highways [4-8].

MATERIAL AND METHODS

— Research methodology

Some researches [6] use methods that develop SILENCE Work package H.2 for monitoring roadside noise and identifying noisy vehicles, and [8] take the measurements that are carried out according the ISO 1996-2 standards, other are made [7] by analyzing the sound level data collected from different points and vulnerable institutions, which were selected according to the importance and vulnerability.

For the purpose of defining the future policy for environmental noise as one of the main environmental problems in the Republic of North Macedonia, noise management is regulated in the provisions of the Law on Protection against Environmental Noise [11]. This Law has transposed the basic Directive on environmental noise - 2002/49/EC (12), by which the main recommendations of the European Union have been fulfilled and full management of environmental noise has been enabled. The Law provisions specify:

- Methods of assessment by noise indicators;
- Methods of assessment for harmful effects;
- Adoption and implementation of planning documents, as well as
- Undertaking of measures for protection against environmental noise.

Based on the Law on Protection against Environmental Noise, the Ministry of Environment and Physical Planning, in cooperation with the competent ministries has so far adopted several bylaws in order to enable full implementation of the Law on Protection against Environmental Noise. These bylaws regulate detail inspection supervision, environmental indicators and their application, noise monitoring, adoption and implementation of planning documents and conditions and technical measures for protection against environmental noise caused by specific sources.

The Law stipulates the main carriers of the obligation for environmental noise management, these being [27-30]:

- Bodies of the state administration;
- Municipalities (in our case study, Ohrid Municipality), City of Skopje and municipalities in the City of Skopje;
- Legal and natural persons.

Control and reduction of environmental noise has two main goals, first to protect us from noise that annoys us or disturbs everyday activities and second, to protect us in future from increased noise levels that will further deteriorate the quality of the environment, like in [1-4,6-8].

Measurement and monitoring of noise in the Republic of Macedonia is not a continuous process. One of the basic measures for achievement of high level of noise control and reduction is to establish noise monitoring, which is systematized measurement, monitoring and control of the state of environmental noise. For the above reasons exactly, it is necessary to establish state and environmental local noise monitoring networks, especially for agglomerations, main roads, main railways and airports as specified in the Decree for agglomerations, main roads, main railways and airports for which strategic noise maps should be prepared. Collected, verified and processed data and information on the state of environmental noise make the official database of the state of noise in the environment, serving as basis for noise management and protection against noise.

For the purpose of avoiding, preventing or reducing harmful effects on human health and environment, limit values for noise levels are specified to limit the levels of all sources of noise, including time period, position of the source and types of areas where noise is generated.

According to the extent of protection, limit values for the basic noise indicators Ld and Le range from 50 dB (A) for areas of first extent, to 70 dB (A) for areas of fourth extent, while for the basic indicator Ln they range from 40 dB (A) for areas of first extent, to 60 dB (A) for areas of fourth extent.

According to the type of premises when measured inside the premises, limit values for the basic noise indicators Ld, Le and Ln range from 30 dB(A) to 55 dB(A). Limit values for noise levels in areas outside urbanized locations, depending on the area, for the basic noise indicators Ld, Le and Ln range from 35 dB(A) to 70 dB(A).

RESULTS AND DISCUSSION

On (Fig.3) are presented the hot-spots in the central city area that is protected by the UNESCO as a cultural and natural treasure, where largest noise generators are located such as the crowded restaurants and bars with frequent tourist visitations.

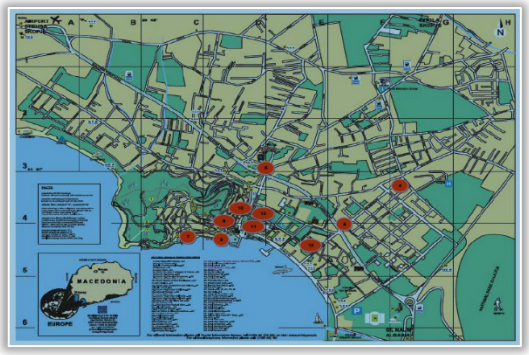

Figure 3. Hot-spots for noise measurement in Ohrid City

Indentified noise sources [6] in the municipality of Ohrid mainly originate from:

- local noise,
- traffic noise,
- noise from industrial plants and factories and est.

Local noise-originate from the restaurants, cafe bars, night bars, open party events.

The level of noise is highest in the old city core such as the area of the Old City, City Square, Ohrid Bazaar and Ohrid Lake Port and Lake Shore where the intensity of tourist is in a large number. This level of noise is also present on the beaches through the day.

Traffic noise- [6] Problems that originate from traffic occurs as a result of:

- Increasement of vheicle frequency during the rush hours especialy during tourist season
- Lack of parking places in private and manicipality sector
- Power engines and sirens from vheicles and motor boats
- Airplanes noise from taking off and landing
- Loud music originating from powerful sound sistems in cars and boats
- Lack of bycycle paths and standards for their usage as a transport method
- Lack of public transportation

Noise form industrial plants and factories-originate from everyday activities from the local industrial plants and the ones in the industrial area in Ohrid municipality.

For complete analyses of the noise distribution, several measurements are made in the locations presented on the map. Measurements are made in several time intervals during morning hours (lowest frequency of people movement), afternoon hours (high frequency of people movement) and in the night hours (highest frequency of people movement).

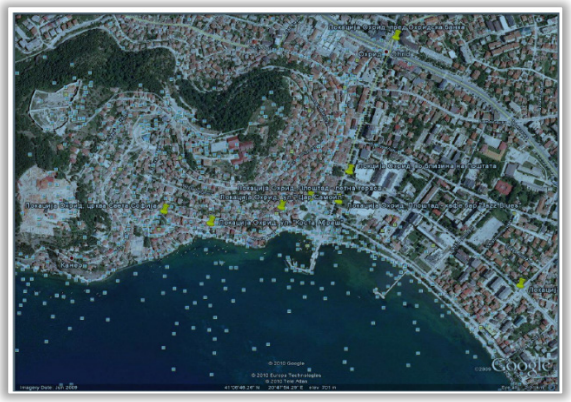

Figure 4. Points for noise measurement in Ohrid City

The first noise measurement was made in the period between 30-th of April and the 1-st of May 2010, a period in which the number of tourists was increased as a result of the holidays. Measurements where made in the defined points (Fig.4) in different periods of the day.

Second noise measurement was made in the period between 22-nd and 24-th of July 2010 on the same defined points (Fig.4). This set of measurements was upgraded with additional points of noise measurements as a result of the alarming noise pollution that was register at the measuring points. This period is also known as starting point of the tourist season.

From the obtained results from all of the measuring points the conclusion is that in all of the time intervals day or night, values are over the maximum limit of noise set by the Law on Protection against Environmental Noise.

The maximal values that are over the limits are measured during the night hours. The extreme values of noise are registered in the measure points set on the street Car Samoil, Kosta Abrash and the city square where values reaches up to Leq=81.9-89.9 dB(A).

These streets are full of cafe bars, night bars equipped with powerful sound speakers producing loud music. In the night hours are registered noise from young people conversations, singing and laughter etc. All of these factors contribute of stepping over the appropriate limit of noise production.

In a comparison of the results with the one obtained from the period of 30-th of April – 1-st of May 2015 the same specified locations have values that are over the noise limits in the night hours that are up to Leq=75 dB(A) on street Car Samoil, Leq=68.1dB(A) at measuring point Leskoec, Leq=66.9dB(A) measuring point bul. Turisticka-Jane Sandanski, Leq=68.1dB(A) measuring point near Ohridska Banka etc.

From the field inspection of the given locations the results are leading toward conclusion that the main reasons for noise pollution are:

- not abiding the laws and its requirments
- unapropriate working regulations
- lack of behavior from the locals and tourists
- distance and splace planning in the Old City area
- unapropriate sound issolation in the local coffe bars and restourants
- high viacle frequency, lack of parking places
- driving with high speed etc.

CONCLUSION

The Seventh Environmental Action Programme (7EAP) "living well in the boundaries of our Planet", has an objective to provide, by 2020, significantly reduced air pollution in EU and approach to the levels recommended by WHO. It also recommends that this will require implementation of updated policies for noise harmonization with the latest knowledge and measures for reduction of noise and its sources, including improvements in urban planning. In short-term, the European Commission will undertake

review of the Directive on environmental noise in the course of 2014, which might result in proposal to amend Directive and strengthen its implementation.
In order to achieve the objective of the7EAP and enable prevention and reduction of noise which causes harmful effects on human health and reduce the number of people exposed to harmful noise levels, the following recommendations should be followed:

- Adoption of all bylaws deriving from the provisions of the Law on Protection against Environmental Noise;
- Provision of maximum implementation of the provisions of the existing legislation in the area of environmental noise;
- The process of preparation of spatial and urban plans and acts for their implementation, in the frames of the content on protection, should include protection measures against noise as well;
- Planning documents for structures that are subject of building approval should fulfill specific conditions and measures concerning standards for protection against noise in buildings;
- Preservation of quiet zones in agglomerations as such;
- Provision of modernization of installations by remediation of existing and introduction of new solutions for noise reduction;
- It is recommended that the Ministry of Environment and Physical Planning and agglomerations obliged to prepare strategic maps to commence the process of preparation in the course of2014;
- It is recommended that the Ministry of Environment and Physical Planning forms a working group composed of professional representatives of the relevant institutions to work on determination of national method for noise mapping;
- It is necessary to establish noise monitoring as systematized noise measurement, monitoring and control of the state of noise in environmental media and areas;
- It is recommended that the Ministry of Environment and Physical Planning in cooperation with the Ministry of Health, prepares the Annual programme for work of the state noise monitoring network and the Programme for public health in the segment of protection against noise;
- It is necessary to establish Information system of the state of environmental noise as part of the overall environmental information system in the Republic of North Macedonia to cover data obtained from noise monitoring, strategic maps and action plans for noise and other relevant data obtained by individual noise measurements; and
- Based on processed data on environmental noise in the three cities in the Republic of North Macedonia, undertake measures for reduction of environmental noise in them.

Note: This paper is based on the paper presented at IIZS 2019 – The 9th International Conference on Industrial Engineering and Environmental Protection, organized by Technical Faculty "Mihajlo Pupin" Zrenjanin, University of Novi Sad, in Zrenjanin, SERBIA, in 03–04 October, 2019.

References

[1] Paulo Henrique Trombetta Zannin*, Fabiano Belisar rio Diniz, Wiliam Alves Barbosa, Environmental noise pollution in the city of Curitiba, Brazil, Elsevier, Applied Acoustics 63 (2002) 351–358
[2] Bertoli SR, Paiva CEL. Exposic¸a˜o na˜o ocupacional ao ruı´do de passageiros de trens metropolitanos da grande Sa˜o Paulo. XIX Meeting of the Brazilian Society of Acoustics, 15–19 April 2000, Belo
[3] Arruda FR, Coelho JLB, Slama JG. Aapectos do Controle de Ruı´do Urbano na Cidade do Rio de Janeiro. In: XIX Meeting of the Brazilian Society of Acoustics, 15–19 April 2000, Belo Horizonte/
[4] Barros CJO. Ana´ lise Espacial do Controle da Poluic¸a˜o Sonora em Belo Horizonte. XIX Meeting of the Brazilian Society of Acoustics, 15–19 April 2000, Belo Horizonte/Minas Gerais, Brazil, p380–5
[5] Sattler MA. Urban noise survey for the city of Porto Alegre. Acustica 1999;85:356.
[6] Rolf Annecke, Truls Berge, Steve Crawshaw, Lars Ellebjerg, Selina Mårdh, Ernst Pullwitt, Heinz Steven, Andreas Wiberg, Uta Zimmermann, Noise Reduction in Urban Areas from Traffic and Driver Management, European Commission DG Research, Sixth framework programme priority 6 sustainable development, global change & ecosystems integrated project – contract N. 516288
[7] M. A. Haq, M. M. Islam, M. S. Ali, M. F. Haque and M. M. R. Akhand, Status of Noise Pollution in Mixed Areas of Dhaka City: a GIS Approach, J. Environ. Sci. & Natural Resources, 5(1): 09-17, 2012
[8] Zekry F. Ghatass, Assessment and Analysis of Traffic Noise Pollution in Alexandria City, Egypt, World Applied Sciences Journal 6 (3): 433-441, 2009
[9] Reina Ezzeddine, Basma Hallak , Fawzi Khalifeh, Tamer Ladan, Nabeeha Shokor,URBAN NOISE MITIGATION, American University of Beirut, CIVE 402 - Final Project Report, May, 2005
[10] Noise Control for Nightclubs, Restaurants, Bars, and Cafes Product and Services Guidance Sheet http://www.nyc.gov/html/dep/pdf/noise_consultants_list.pdf.

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