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NOISE POLLUTION MAPS IN THE PERIMETER OF GALATI MAIN PORTS

Costică Hogaș
"Dunărea de Jos" University of Galati,
Faculty of Naval Architecture,
47 Domnească Street, 800008, Romania,
E-mail: costica_hogas@yahoo.com

Alin Pohilcă
"Dunărea de Jos" University of Galati,
Faculty of Naval Architecture,
47 Domnească Street, 800008, Romania,
E-mail: alinpohilca@gmail.com

Costel Iulian Mocanu
"Dunărea de Jos" University of Galati,
Faculty of Naval Architecture,
47 Domnească Street, 800008, Romania,
E-mail: costel.mocanu@ugal.ro

Ioan Bosoancă
"Dunărea de Jos" University of Galati,
Faculty of Naval Architecture,
47 Domnească Street, 800008, Romania,
E-mail: ioan.bosoanca@ugal.ro

ABSTRACT

Noise mapping is one of the modern methods of evaluation of urban acoustic pollution due to the presence of road traffic, rail traffic (train or tram), industrial noise and air traffic. A noise map is the map of an urban agglomeration or geographical area, coloured according to the noise level. Following the noise mapping, conflict maps are developed to set the noise levels for each noise source. Strategic noise maps are compiled taking into account the provisions of the Order of the Minister of the Environment no. 1830/2007 that sets the guide on the development, analysis and evaluation of strategic noise maps. On the basis of the noise maps results, the strategy for human personnel protection in the areas where the maximum admissible limits are exceeded is established and a series of measures are implemented.

Keywords: noise pollution, permissible levels, noise map, IMMI

1. INTRODUCTION

In the present paper, the Galati Port noise maps is presented, including the Mineral Port, Docks Port and New Basin Port. The responsible authority according to the decision 1260/2012 for revision of the strategic noise maps and action plans of the Galați Port included in the agglomeration of Galați Municipality is the National Maritime Danube Port Administration Company, Galați.
Sources of input data:

- National Maritime Danube Port Administration Company Galați;
- City Hall of Galați (GIS Maps)
- Open Street Map
- Digital map of Romania (Road2013)
- Google Earth

For the present study, the agglomeration of Galați Municipality must be analysed to identify the level of noise produced by the following areas: Commercial Port, Mineral port, Docks Port and New Basin Port and their impact over the city.

The activity of these ports, although lower in the past 30 years, is through port equipment used to load or to unload vessels and transport the goods, generating noisy noise. These are the subject of the study below.

Each of the equipment used in the listed ports is noise sources and will be taken into account.

The map is presented in figure 1 with the location of the main three ports of Galati town.

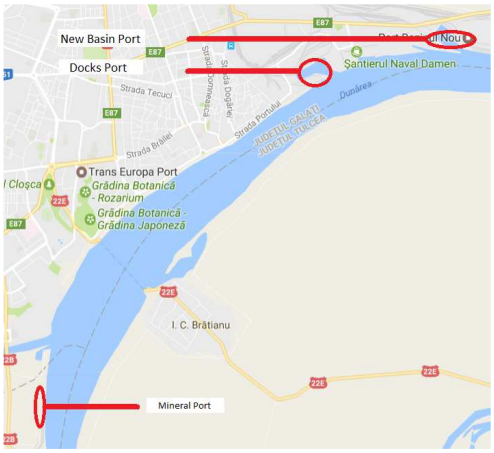

Fig. 1. Location on the map of the 3 ports.

2. INPUT DATA

Steps to review the strategic noise maps of Galați Port:

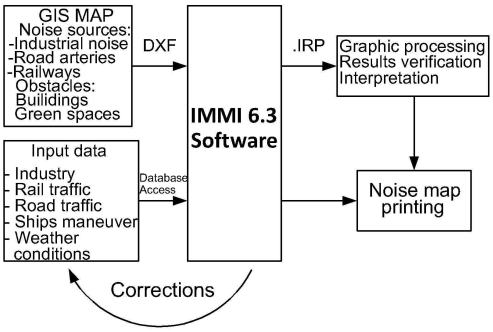

Fig. 2. Steps to create the noise maps with IMMI software.

To create the noise maps, the new sound sources must be identified and modelled accordingly. Various data is required for this such as:

- Data for modelling the noise produced by industrial sources
- Data for modelling the noise produced by road traffic
- Data for modelling the noise produced by rail traffic
- Data collected from field measurements

The following measuring tools were used to measure the noise levels:

1. Sonometer, type 220
2. Microphone preamplifier, type ZC 0032
3. Microphone, type 4189
4. Noise calibrator. Type NC-74
5. Wind screen, type UA 1650
6. Software to download data from the sonometer to computer, type BZ 5298
7. Analysis software, in frequency NOISE EXPLORER, type 7815.

3. DESCRIPTION OF THE NOISE MAPPING SOFTWARE

To create the noise maps, we used IMMI mapping software, version 6.3 which has been developed on the 2003/613/EC (6 August 20003) guidelines. This software meets the evaluation and management requirements of environmental noise regulations:

- The calculation is made for L_{DEN} and L_N indicators;
- 3D objects (buildings, obstacles), land and noise sources can be used and modelled;
- Input data on the noise produced by industrial sources can be input manually;
- Imports/exports .dxf file formats;
- Displays data on the maximum noise levels identified on a building (the most exposed façade) and indicates the quiet facades;
- Allows calculation for conflict maps;
- Performs the calculation at a height of 4 m from the ground and at the receiver.

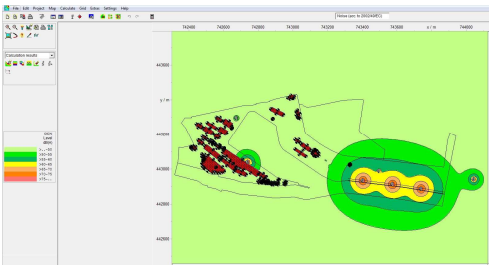

Fig. 3. The IMMI mapping software interface.

According to Annex 2 of HG 321/205 for the development of strategic noise maps the following noise indicators are used:

- L_{DEN} indicator: day-evening-night noise level expressed in decibels, defined with the formula:

$$L_{den} = 10\lg\frac{1}{24}\left(12\cdot 10^{\frac{L_{day}}{10}} + 4\cdot 10^{\frac{L_{evening}+5}{10}} + 8\cdot 10^{\frac{L_{night}+10}{10}}\right)$$

- L_{day}: the sound pressure level, weighted A over a long period of time, as defined in SR ISO 1996-2:2005, determined by the sum of the day periods of one year and is associated with daytime discomfort.

- $L_{evening}$: the sound pressure level, weighted A over a long period of time, as defined in SR ISO 1995-2:2005, determined by the sum of the evening periods in a year and is associated with the discomfort during the evening.

- L_{night}: the sound pressure level, weighted A over a long period of time, as defined in SR ISO 1996-2:1995, determined by the sum of the night periods in a year and is associated with night-time discomfort.

Time intervals:

L_{day}: 07:00 – 19:00 – 12 hours;

$L_{evening}$: 19:00 – 23:00 – 4 hours;

L_{night}: 23:00 – 07:00 – 8 hours.

Grid size: Phase I: 10m x 10m.

Receptor height: receiver points were considered at a height of 4 m for noise assessment.

Receptors on facades: receptors are placed at an average distance of 5 m between them to achieve high accuracy. The *Minister's Order 1830, Pct. 3.5.2. Receiver points* recommendations are followed.

4. THE DWELLING AND INHABITANTS NUMBER DISTRIBUTION EXPOSED TO NOISE LEVELS

The revision of population and building exposure to the noise generated by Galati Port activity was based on the GIS map provided by the contracting authority and the images offered by the digital maps Google Earth and Google Maps which contain databases permanently updated.

Table 1. Limit values for Lden and Ln indicators

LDEN – DB(A)		
Noise sources	The target to reach for maximum values 2012	Maximum permissible values
Industrial areas	**60**	**65**
LN – DB(A)		
Noise sources	The target to reach for maximum values 2012	Maximum permissible values
Industrial areas	**50**	**55**

Table 2. Criteria (limit values) for the definition of quiet areas..

Noise sources	Maximum permissible values Lden-DB(A)	Minimum area for which the quiet area is defined [ha]
Industrial areas	**55**	**4.5**

5. RESULTS

The resulting noise maps were represented on scale 1:10.000 respectivly 1:5000. After performing the IMMI calculation the post-processing part was done in QGIS software. Using this software is presented in figures 4, 5, 6 the level noise map for the location taken in consideration. There is presented also the chart sound in decibels indicating with different colours the level of noise. This chart can be used after to predict and to reduce the noise using different solutions. The noise on the ground level is reduced usually using panels build from absorbant materials.

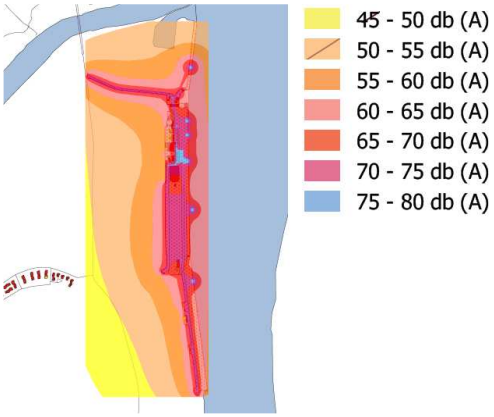

Fig. 4. Noise map – Mineral Port – LDEN.

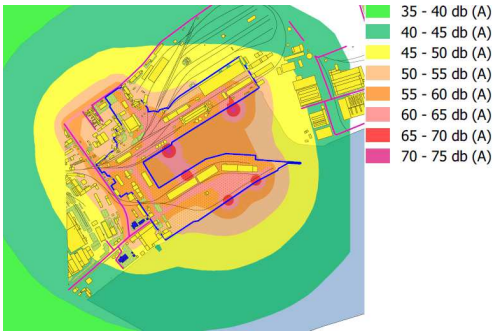

Fig. 5. Noise map – Docks Port – LN.

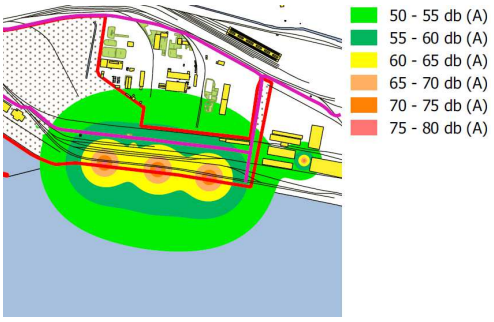

Fig. 6. Conflict map – New Basin Port - LDEN Conflict.

6. CONCLUSIONS

It is very important to ascertain the correct level of noise within and close the perimeter of industrial areas such as ports to identify the number of inhabitants affected by unacceptable noise levels.

Analyzing the results obtained, a series of measures shall be implemented in the second stage of the study and the maps will be compiled again to asses the effect of the implemented measures. This is an iterative action that aims to reduce as much as possible the impact of noise on the population and the municipal area.

7. REFERENCES

[1]. *Environmental Noise Directive 2002/49/EC* - European *Parliament 2002.*
[2] *Strategic Plans for the Galati Port Development*, CN APDM Galați 5 June 2015, CN APDM Galați Contract 206/01.10.2014, *http://www.romanian-ports.ro/PSDPG/*
[3] *Caiet de sarcini (Solicitare de Ofertă)*– CN APDM Galați, 20.01.2017.
[4] *2002/49 CE Directive*, 25 June 2002
[5] *Good Practice Guide on Port Area Noise Mapping and Management, NoMEPorts*
[6] *OM 1830/2007 pentru aprobarea „Ghidului privind realizarea, analizarea şi evaluarea hărţilor strategice de zgomot"*
[7] *Standardul francez XP S31-133*
[8] *OM 678/1344/915/1397* din 2006 pentru aprobarea *„Ghidului privind metodele interimare de calcul a indicatorilor de zgomot pentru zgomotul produs de activităţile din zonele industriale, de traficul rutier, feroviar şi aerian din vecinătatea aeroporturilor"*
[9] *CNAPDM - Harta GIS a Portului Mineralier, CNAPDM - Harta GIS a Portului Docuri, CNAPDM - Harta GIS a Portului Bazinul Nou*

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Appendix 1 –
Docks Port Lden – Population Exposure

Docks Port LDEN									
VBEB method - inhabitants assigned proportionally to façades.									
Category	Sum	>50-55	>55-60	>60-65	>65-70	>70-75	>75-80	>80-..
		dB	dB	dB	dB	dB	dB	dB
Inhabitants	206	0	29	71	67	39	0	0
... with special insulation	0	0	0	0	0	0	0	0
... with quiet façade	0	0	0	0	0	0	0	0
Dwelling	98	0	14	34	32	19	0	0
school	0	0	0	0	0	0	0	0
hospital	0	0	0	0	0	0	0	0
kindergarden	0	0	0	0	0	0	0	0

Appendix 2 –
Docks Port Ln – Population Exposure

Docks Port LN (8h)									
VBEB method - inhabitants assigned proportionally to façades.									
Category	Sum	>45-50	>50-55	>55-60	>60-65	>65-70	>70-75	>75-80	>80-..
		dB	dB	dB	dB	dB	dB	dB	dB
Inhabitants	206	53	56	78	19	0	0	0	0
... with special insulation	0	0	0	0	0	0	0	0	0
... with quiet façade	0	0	0	0	0	0	0	0	0
Dwelling	98	25	27	37	9	0	0	0	0
school	0	0	0	0	0	0	0	0	0
hospital	0	0	0	0	0	0	0	0	0
kindergarden	0	0	0	0	0	0	0	0	0

Appendix 3 –
Mineral Port Lden – Population Exposure

Mineral Port LDEN

VBEB method - inhabitants assigned proportionally to façades.

Category	Sum	>50-55	>55-60	>60-65	>65-70	>70-75	>75-80	>80-..
		dB	dB	dB	dB	dB	dB	dB
Inhabitants	87	2	7	24	29	25	0	0
... with special insulation	0	0	0	0	0	0	0	0
... with quiet façade	0	0	0	0	0	0	0	0
Dwelling	42	1	3	12	14	12	0	0
school	0	0	0	0	0	0	0	0
hospital	0	0	0	0	0	0	0	0
kindergarden	0	0	0	0	0	0	0	0

Appendix 4 –
Mineral Port Ln – Population Exposure

Mineral Port LN (8h)

VBEB method - inhabitants assigned proportionally to façades.

Category	Sum	>45-50	>50-55	>55-60	>60-65	>65-70	>70-75	>75-80	>80-..
		dB	dB	dB	dB	dB	dB	dB	dB
Inhabitants	87	7	32	33	15	0	0	0	0
... with special insulation	0	0	0	0	0	0	0	0	0
... with quiet façade	0	0	0	0	0	0	0	0	0
Dwelling	42	3	15	16	7	0	0	0	0
school	0	0	0	0	0	0	0	0	0
hospital	0	0	0	0	0	0	0	0	0
kindergarden	0	0	0	0	0	0	0	0	0