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*The evaluation of intensity of traffic noise  
in different points of town routes*

Rapid urbanization and the development of transport system have a destructive effect on the environment. A cumulative effect of great number of harmful factors within towns poses a direct threat to human health and life. Adverse biological effects harmful to human health are connected with environmental pollution caused first of all by pollution of air, soil, water, and physical factors such as noise and vibrations. An increasing tendency to migrate and high speed of road transport and aircraft contribute to changes in human ecobiological system. Noise contributes to the deterioration of acoustic climate in the environment impairing its quality to such a degree that considerable areas of biosphere are not able to perform their functions.

The percentage of population exposed to excessive noise in the environment continuously increases. A harmful effect of noise on human health and any activity is often trivialized by the public due to poor education, as the effects of noise are not immediately noticeable. It has been found that persistent high intensity sound may produce adverse effects on the human body: emotional lability, physiological changes, increase in muscular tonus, changes in bowel habits. Functional changes in the brain, in the nervous system accompanied by balance disorders, impairment of sight and hearing have been also observed (2,3,7,10).

The condition of environment taking into account threat caused by noise is described by a set of factors called acoustic climate, which is the result of different types of noise and vibrations connected with transport (road transport, rail, aircraft and water transport) and industry.

The acoustic climate of the environment in Poland is affected by the rapid development of road transport that is reflected by the increase in the intensity of local and transit transport of goods and people. According to the report on the Condition of Environment in Poland presented by the Government Inspectorate for the Environmental Protection it is estimated that about 15mln people, that is about 40% of population, are exposed to upsetting/arduous effect of traffic noise (5,6,12, 14). The degree of traffic noise load is variously distributed in different places but inhabitants of towns are exposed most.

The aim of this study was the measurement of intensity of noise in chosen points of traffic routes in the town of Lublin.

## MATERIAL AND METHODS

The type and intensity of sounds produced in the environment as well as kinds and location of buildings influence in a high degree the acoustic climate found in the close neighbourhood of the sources of noise. In the centre of the town 4-5 storey buildings situated on both sides of narrow streets are attached to one another on both sides, while in housing estates houses are more scattered. The existing system of streets forming main transport routes is based on traditional system formed over the years in the centre of the town and new streets leading to large housing estates of blocks of flats and industrial complexes situated further from the centre (9,11).

Measurements of traffic noise were carried out in March and the first decade of April 2000 at 11 chosen measuring points in the town centre and roads leading out of the town. The measurements were taken in various weather conditions at different times (between 7 a.m. to 6 p.m.) during the day. From 9 to 15 measurements were taken at particular measuring points. The level of noise generated by traffic was changing depending on the time of the day. A noise meter ELM 2151 produced by "Elbro" with digital screen was used. Before every measurement the meter was calibrated.

## RESULTS

Mean values of noise level at particular measuring points at four points of time during the day range from 68 to 77 dB/A. The lowest mean noise level of 68.3 dB was recorded in Narutowicza Street, and the highest mean noise level of 77.2 dB at the crossing of Solidarności Avenue and Sikorskiego Street (Table 1, Fig. 1, 2).

Measuring point	Level of noise [dB]A			
	hours			
	7 a.m. - 9 a.m.	10 a.m. - 1 a.m.	2 p.m. - 4 p.m.	5 p.m. - 6 p.m.
1. Spółdzielczości Pracy Av.	70.0	71.5	68.8	69.7
2. Tysiąclecia Av. (castle)	71.2	71.6	71.5	72.5
3. Krakowskie Przedmieście Str.	72.7	71.0	75.3	74.6
4. Warszawska Av.	72.7	73.7	72.7	68.9
5. Solidarności Av./ Sikorskiego Str.	77.2	72.2	74.6	70.1
6. Kraśnicka Av.	71.7	72.5	73.7	76.8
7. Narutowicza Str.	72.3	68.3	71.4	72.6
8. Kunickiego Str.	72.8	70.9	71.8	73.0
9. Bychawski Square	74.0	73.1	72.9	68.8
10. 1 st May Str.	75.0	71.7	73.3	69.6
11. Fabryczna Str.	70.2	74.2	71.6	68.5

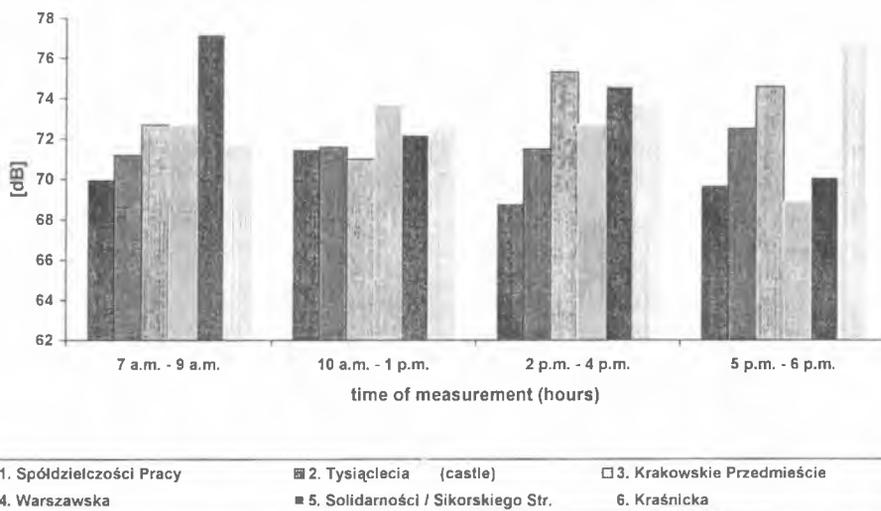


Fig. 1. Comparative distribution of the intensity of noise in the studied points in the town of Lublin

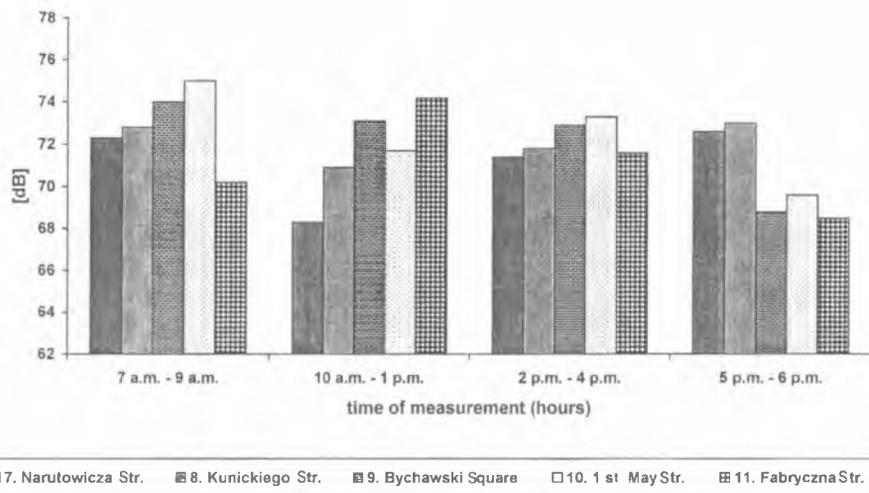


Fig. 1a. Comparative distribution of the intensity of noise in the studied points in the town of Lublin

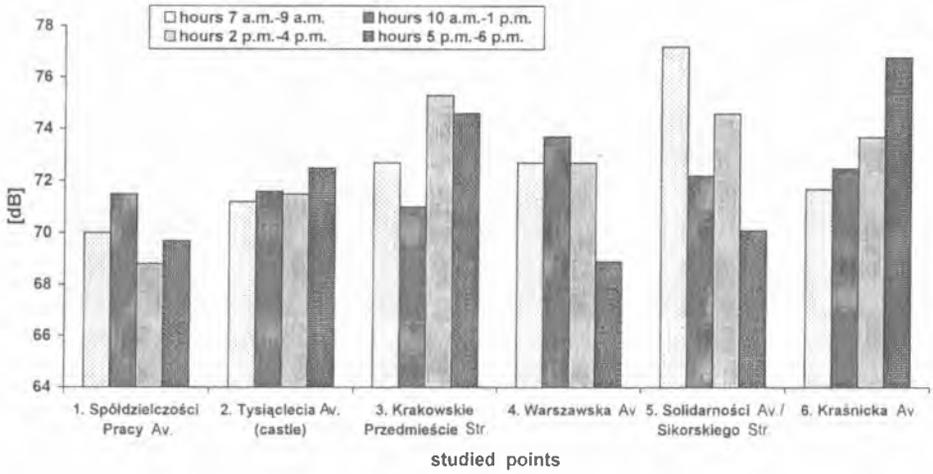


Fig. 2. Mean level of noise in the studied points of the town of Lublin

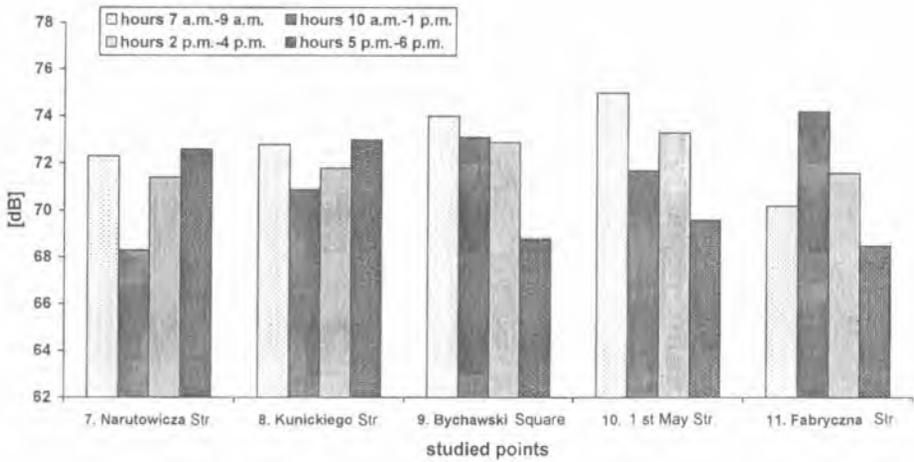


Fig. 2 a. Mean level of noise in the studied points of the town of Lublin

Values of noise level at measuring points in the centre of the town were of variable intensity. The highest intensity of noise was in the morning hours and in the afternoon about 5 p.m. The estimation of noise intensity at the crossings revealed that the most serious threat of traffic noise is found at the crossing of Solidarności Avenue and Sikorskiego Street. Variability in noise level at measuring points at the crossings is related more to operating traffic lights and the structure of traffic (the amount of large vehicles: lorries and buses) than to the time of the day. The widest fluctuation of noise level during the day was observed at the crossing of Solidarności Avenue and Sikorskiego Street.

## DISCUSSION

A suitable acoustic climate is necessary to stay healthy for any human activity. Parameters of acoustic climate in the environment decrease along busy motorways and near bus/coach or railway stations or airport. Traffic noise is characterized by great fluctuation in sound level. On the basis of the study carried out in Warsaw in 1997 at the crossing of Puławska Street and Armii Ludowej Street K o s z a r n y found out that in areas of high congestion/intensity of traffic there are significant differences between short-term measurements within a 24 h period and particular days of the week (1, 4, 8).

Evaluation of traffic noise in Lublin carried out in September and October 1998 and 1999 revealed that 18.9% of inhabitants (i.e. 67,360 people) are exposed to traffic noise of more than 60 dB, to noise exceeding 65 dB – 7.1 % (i.e. 25,290 people) and above 70 dB – 2.1 % (i.e. 7,330 people).

The condition of acoustic climate in Lublin has deteriorated due to a considerable increase in noise level in the last years. This increase was of 4-12 dB on average as compared with measurements carried out in 1981 to 1990, but as compared with measurements in 1993 to 1994 the increase is of 1-3 dB (9, 11).

The analysis of distribution of the noise level on the basis of own studies revealed that at 8 out of 11 measuring points the highest percentage are the values ranging from 71 dB to 80 dB.

On the basis of measurements of traffic noise carried out during the developing of the plan of acoustic climate for Lublin the mean level of traffic noise for the day was determined as 72.3 dB. The value of mean noise level in Lublin is almost identical as the national mean value of noise level in urban areas, which is 72.4dB during the day. In other towns of the Lublin province the mean values of noise level were as follows: in Zamość (1995) – 65.2 dB, in holiday villages situated within the Landscape Park: in Krasnobród (1997) – 61.5 dB, in Zwierzyniec (1996) – 57.1dB, in Nałęczów which is a health resort – 60.1 dB to 70.0 dB (13). The study revealed that in Lublin the process of stabilization of the noise level is achieved as a result of maximum traffic congestion in rush hours in some parts of main streets. It has been noticed that acoustic conditions deteriorate in the afternoon and evening, which is a nationwide tendency. In order to protect health and provide suitable acoustic conditions the authorities should aim at elimination or decreasing noise in the living environment. It is important to produce suitable vibroacoustic conditions in the environment by proper planning of new transport routes and housing estates. Increasing public awareness of the harmful effect of noise to health and its upsetting effect encourages/results in the development of new methods of monitoring the condition of acoustic climate.

## CONCLUSIONS

1. Traffic causes variable noise, depending on types of vehicles and traffic intensity.

2. Mean values of traffic noise level at studied measuring points ranged from 68 dB to 77 dB/A. The highest mean level of noise intensity was recorded at the crossing of Solidarności Avenue and Sikorskiego Street, and the lowest in Narutowicza Street.

3. Passing heavy vehicles has caused a transient increase in the level of sound even up to more than 90 dB/A.

4. Out of 11 measuring points the area of Bychawski Square presented high congestion/concentration of traffic in a small area and high intensity of noise.

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## SUMMARY

The aim of the study was measuring noise intensity in the selected points of traffic routes in the town of Lublin. Investigations were carried out at 11 points located in the centre of the town and at escape roads. Noise value levels showed variable intensity, the highest being observed in the morning and afternoon hours. The highest mean level of noise intensity was recorded at the crossing of Solidarności Avenue and Sikorskiego Street, and the lowest in Narutowicza Street.

### Ocena intensywności hałasu drogowego w różnych punktach miejskich szlaków komunikacyjnych

W wybranych punktach szlaków komunikacyjnych Lublina oceniano intensywność hałasu. Badania przeprowadzono w 11 punktach zlokalizowanych w centrum oraz przy drogach wylotowych. Wartości poziomów hałasu wykazały zmienną intensywność. Największe natężenie hałasu było w godzinach rannych i popołudniowych. Na skrzyżowaniu al. Solidarności i ul. Sikorskiego wykazano największe natężenia hałasu w ciągu dnia. Najmniejszy średni poziom hałasu zanotowano przy ul. Narutowicza.

