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Habitation and Noise

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1. Introduction

Noise is a physical phenomenon, which spreads along all traffic arteries, seizing more settlements every day, and especially expressive in large cities where it endangers the population, not only with its influence on hearing aparatus, but on the whole human organism.
The largest effects in preventing this phenomenon are accomplished by proper planning of the cities and by respecting all normatives and standards in order to prevent the noise.
While planning the new settlements, all sources of the noise must be taken into consideration; the intensity, the frequency and lasting of the noise must be estimated and appropriate measures must be proposed.
When urban tissue reconstruction is done, controlling the noise is much complex problem and challenge, because it is often necessary to preserve the existing urban grid and the buildings of the special cultural and historical significance. Considering that one of the solutions-widening the streets, is often impossible or very expensive, problem is solved by technical intervention in or outside the buildings, by traffic restriction, by transforming some parts of the city into pedestrian zones or by constructing the underground objects.
The principles and the elements of environment management are:

- protection of the environment politics
- planning
- introduction (introduction and carrying out)
- measuring and evaluation (checking and correcting measures)
- reexamination and improving
- permanent improvement

2. Noise as Environmental Problem

The noise in the settlements, mainly from the traffic, is one of the important environmental polluters. Depending on lasting and intensity, it leads to permanent organism damage, primarily effects the hearing apparatus, neurological-vegetative system, decreases the power of concentration and working ability.
It is interesting that even the ancient Romans had some regulations for noise protection, by which the blacksmiths and coppersmiths were banned to work in some periods of the day (in the afternoon and during the night).

In Yugoslavia, the first studies of communal noise from medicinal aspect were began in 1939. (S. Ramzin) and those measurements were conducted by subjective method, while the first measurements by objective method were taken during 1953. (Dr. R. Felix). The first medicinal technical research of harmful affects of communal noise were organized by Federal Institute of Public Health, Clinic of Medical School in Belgrade, Military-Medicinal academy and School of Electrical Engineering..

Beside the problem of communal noise, the problem of noise inside the buildings appeared, which is primarily connected to the change of construction methods, from traditional to industrial.

The noise is every undesirable sound. To be called the noise, it has to be strong enough to be heard. There is the difference between the noise from the **natural sources** (like thunder, wind, water, etc.), which is not relevant for urban environment, and the noise from **man made sources**, in working environment and in the rest of environment.

The noise is made at the place where the source is: on the street, in the apartments, in the backyard, etc. The noise can be various in types: **continual**-constant intensity (easier to bear); **discontinued** (more difficult to bear); **isolated sounds, murmurs**. It depends for example on traffic frequency and street width.

To alleviate the influence of noise on people's health, the noise protection measures are taken: the **preventive** and **sanitation** measures.

- **preventive** measures are those which are in the plan and project of the building, and where suggested means do not anticipate the possibility of noise creation
- **sanitation** measures are partial and restricted to sanitation of individual buildings

The measures which are taken in noise prevention are **technical** - on the way of the sounds; **physiological** - on organism protection and **legal** - regulations for allowed level of noise, and the measures which are taken in the buildings are **constructively-technical** which assume the wall construction, thickness, window and door solutions, etc.

3. Traffic Noise in Banjica Housing Project

The city of Belgrade covers the area of about 3221 km^2 (metropolitan area), where the urban aglomeration is about 765 km^2. Residential area covers the surface of 137 km^2 and traffic about 32 km^2. Belgrade has approximately 167 000 buildings. Banjica borough spreads on the surface of 85ha and has a population of 3500.

The urban noise is measured in Belgrade on 18 spots and the results show the high level of noise. The measurements in Banjica housing project are taken in 1999. on 9 measuring spots. The highest level of noise for this location as residential area are: during the day 55dB (A), and during the night 45dB (A). The measurements were done at the traffic arteries on the edge and in the heart of the settlement during the day with statistic analyzer (built in memory, type 4426 BRUEL):

- 2m away from the road at the height of 1,5m
- in the range of 36-100 dB (A)
- frequency range of 20-20 000Hz
- with 2 000 samples taken in the intervals of 0,2 sec
- all results are the statistic processing of the noise which lasted 6.6 min

The results showed the exceed of the maximum level of noise of 24,0 dB (A).

Measuring spot	MEASURED EQUIVALENT LEVEL OF NOISE		ALLOWED EQUIVALENT LEVEL OF NOISE		DIVERGENCE	
/	24.12.82.	01.03.99.	24.12.82.	01.03.99.	24.12.82.	01.03.99.
	dBA		dBA		dBA	
1	70,2	73,1	55	55	+ 15,2	+ 18,1
2	71,1	79,0	55	55	+ 16,1	+ 24,0
3	66,0	76,5	55	55	+ 11,0	+21,5
4	61,3	69,0	55	55	+ 6,3	+ 14,0
5	48,2	64,9	55	55	- 6,8	+ 9,9
6	61,3	59,8	55	55	+ 6,3	+ 4,8
7	68,9	76,3	55	55	+ 13,9	+ 21,3
8	63,3	60,7	55	55	+ 8,3	+ 5,7
9	53,6	53,9	55	55	-1,4	-1,1

Table 1. Overstepping of average values, or + 6,3 dBA of 16,1dBA, or +5,7 dBA of 24,0 dBA

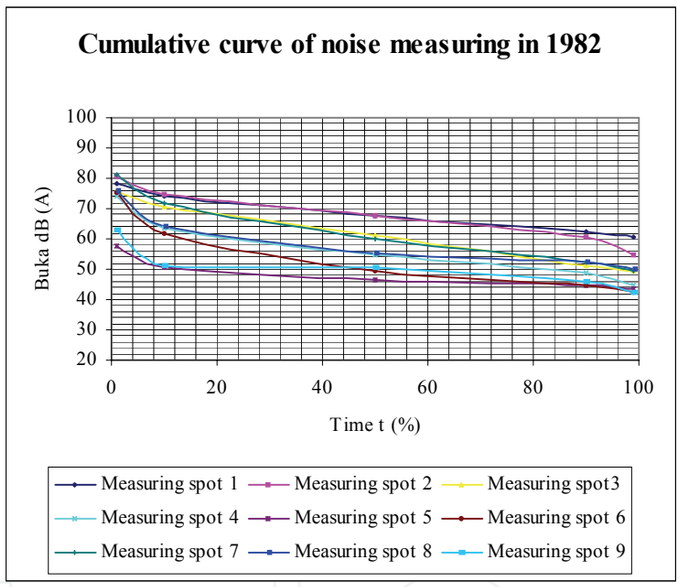

Fig. 1. Cumulative curve of noise measuring in 1982

On the base of the presented measurements, it is necessary to take some measures, primarily through the change in means of transportation (from individual to public transportation) and to minimize the need for traveling. Aiming that, it is essential to take the following measures:
preventive:

- long term strategy in organization of public transportation
- protection of the locations for future public transport
- setting the strategic frame for public approaches
- to define the environment criterion for new traffic installations
- constructing the housing projects beside already existing lines of transportation
- to build housing projects where infrastructure exists
- to revise the locations for construction which are accessible only by vehicle
- to prevent the construction on the locations with difficult approach

- to build the business centers near the housing projects

sanitation:

- traffic regulations (regulating traffic regime in the noisiest streets, modifying cargo transport to lighter vehicles, limiting transport hours, etc.)
- protection through sound barriers
- protection through vegetation
- sanitation of the most endangered buildings

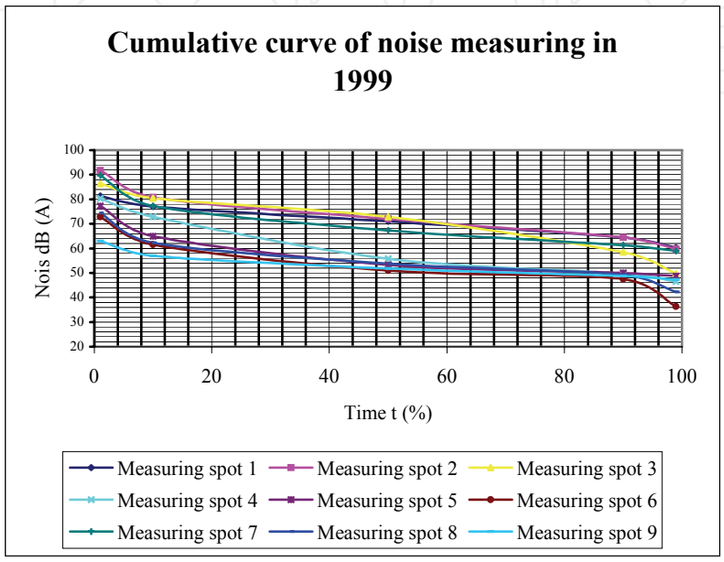

Fig. 2. Cumulative curve of noise measuring in 1999

4. Conclusion

Having insight into planned, technical documentation and by insight into the existing situation on terrain, it is established that Banjica housing project is a quiet city residential district.

The measurements, which were carried out inside the housing project, show some deviation on certain measuring places from noise level allowed by regulations. That calls for taking some measures of protection from the urban noise.

If the average level of noise in Banjica housing project is taken into consideration, and if the calculations are done on that base, it could be said that the results are satisfying.

5. Literature

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