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New methods and approaches to acoustic monitoring and noise mapping of urban territories and experience of its application in conditions of Samara region of Russia

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Abstract

For the time being, acoustic impact to human inhabited areas has significantly increased. Imported methods of urban noise reduction are acoustic monitoring and noise mapping of urban territories. Important measures which allow for reductions of negative noise impact are acoustic monitoring and noise mapping of urban territories. The peculiarities and negative features of existing methods of monitoring of acoustic pollution have been considered. New methods of monitoring, using automated systems are suggested, allowing the undertaking of continuous measurements of noise, and of the other parameters in the environment. A new approach to noise mapping is suggested. New approaches to monitoring of acoustic pollution are applied in conditions of the urban territory of Samara region of Russia. By using the results of noise measurements and developing a program provision, noise maps of the urban territory of Samara region have been developed.

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1. Introduction

Presently, the negative impact of acoustic pollution has significantly increased, especially in the territory of inhabited areas. Among the most intensive sources of acoustic pollution are transport noise (especially automobile

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transport noise) and noise from industrial enterprises. There are also other noise sources: building and construction works, local noise sources etc. [1-7].

According to some research, half of the world's population is impacted by increasing noise levels. Noise in towns is trending towards growth. The noise level in towns has increased every year by up to 0,5-1,0 dBA per year [2]. In Russia, more than 35 million people are affected by transport noise exceeding sanitary norms.

Efficient reduction of noise radiated into environment may be achieved only by the realization of a complex of arrangements. One of the most important measures is monitoring of acoustic pollution. Using existing methods of monitoring of acoustic pollution does not always provide efficient noise analysis and forecasting. Thus, a provision of high quality acoustic monitoring and of noise mapping of urban territories is a very important task [1, 3, 5, 6, 7].

This paper discusses modern methods and approaches to monitoring of acoustic pollution of urban territories and the results of approbation in conditions of the Samara region of Russia.

2. Analysis and disadvantages of existing methods of monitoring of acoustic pollution

Analysis of existing methods and approaches to monitoring of acoustic pollution of environment allows us to point out the several main stages of monitoring:

- determination of the noisiest zones of urban territories;
- calculating research of noise propagation along on the territory of inhabited areas using calculation methods and program provisions (e.g. LIMA, SoundPlan, CadnaA, etc.);
- noise measurements in conditions of urban territories by using measuring equipment (Bruel&Kjaer, 01 dB, SVAN, Octava etc.);
- experimental data processing and conclusions about correspondence to normative requirements;
- noisemapping;
- development of measures for reduction of the impact of acoustic pollution.

It is possible to conclude that during the use of existing methods of acoustic monitoring the following significant problems have arisen:

1. Dependence of measurements results from environmental conditions: meteorological conditions (wind, temperature and temperature variations, humidity, atmospheric pressure), obstacles in the form of barriers and buildings, absorption and reflection by soil and atmosphere.
2. Dependence on the distance from the noise source.
3. Dependence of final result of monitoring from the qualification of the measuring personnel.
4. Other noise sources are influencing the results of measurements, and are introducing some errors.
5. Significant labor intensity of final processing of measurements results.

Using of measurements results achieved only for the one day period leads to a constant error related to atmospheric conditions and the state of the earth's surface. The degree of such error may reach up to 10 dB. Moreover, one day results of measurements contain errors from the influence of other noise sources.

Also it should be noted that approaches to noise monitoring in Russia and in Western countries have a number of differences [7-10]. In particular, it is connected with such significant features as непрерывность, and sustainability of measurements. There are also some significant differences in Russian and foreign countries standards in methods of noise estimation (e.g. in Russia only two periods are taken into consideration: day and night periods – the evening period estimation is absent), for methods of noise measurement and mapping [10] etc.

3. Method of continuous monitoring of acoustic pollution of urban territories

It is evident that long-term automated monitoring allows significantly an improvement in the precision of measurement results, and the quality of noise measurement processing [5, 6]. For achieving more detailed information about acoustic parameters of investigated urban territory, it is necessary to collect a large quantity of detailed data, which is difficult to structure and analyze using traditional methods and systems of monitoring. Presently, due to GPRS (or ADSL) technologies and Internet networks, it is possible to carry out automated

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