CAUSES OF HIGH NOISE LEVEL IN CITIES OF KAZAKHSTAN

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In this article an information on the causes of high noise level in Kazakhsatn cities is provided as well as on the role of transport noise in the process of city environment formation. The development of all transport means, transport ways has led to the fact that a man is constantly exposed to an impact of high-level noise. It is known, that the main factors that alter a noise regimen of the city transport flow are the traffic character and the content of a transport flow, traffic intensity and speed. Noise is dependent on planning solutions (longitudinal and transversal streets' profile, height and intensity of building) and such convenience elements as road coating and a presence of green planting. The main reasons of high noise level also are: micro-district and block territories are not isolated from the penetrating noise from arterial streets, a significant part of territories that are supposed to be recreation area or children playgrounds, are used for transport movement.

Keywords: noise level, Kazakhstan, city

Scientific-technical progress that leads to the acceleration of social-economic society development, including an improvement in labour conditions and a men' household, sometimes carries potential danger of an aggravation of harmful factors' impact in connection with their intensiveness and prevalence. To these factors we can rightfully refer urban noise [1]. Technical industry and agricultural complexes' rearmament, increase in transport movement speed, introduction of technical means that facilitates and hasten intellectual labour, development of household technics, etc. led to the transformation of urban noise into an ecologically-significant factor of city environment [2]. Urban environment includes a multiplicity of technical constructions, transport ways, industrial, sports, and municipal objects that are active noise sources [3].

Noise levels in dwelling places from different sources reach some quite high indexes: elevator noise while closing – 90 dBa, rubbish chute – 83 dBa, washing machine – 82 dBa, child cry – 80 dBa, sound of music in a room – 78 dBa, entrance door shutting – 78 dBa, phone talk – 75 dBa, water flush in toilet – 70 dBa [4]. However, the main reasons of urban noise are, first of all, transport noises (automobile, railway, and aviation).

Transport noises in cities grow every year, as power of cargo machines and the unber of transport units annually grow on arterial streets. In big cities transport noise grows in average by 1 dBa per year [5]. In rush hours noise reaches 100 dBa on intense city arteries, and in dwelling apartments and work places – 60-85 dBa. The concept of «urban transport noise» is more equalized with the idea of «arterial streets noise». The highest noise levels are being registered on cities' arterial streets. Average traffic intensity reaches 2000-3000 transport units per hour and more, and maximum noise levels – 90-95 dBa [6].

Noise background of arterial streets is dependent on traffic intensity, content of cargo transport in traffic, especially those with diesel engines as they are the noisiest ones; movement speed; longitudinal streets' inclination; condition of road; rail transport presence [7]. Each of the described factor itself can alter a level of transport noise within the limit of 70 dBa[8].

Transport noise level on a distance of 7-25 meters from the road equals 70-85 dBa. This noise put more than 25 % of people who live in apartment, oriented to streets, into unsatisfactory life conditions [9]. According to E.S. Pronin, the area of dwelling micro-districts and blocks that are exposed to intense transport noise impact, reaches 50 % [10].

Noise in apartments with open windows that are oriented to streets, is only 10-13 dBa lower than average noise level on a road [11].

The main sources of the «pollution» of a man's habitat in dwelling are: penetrating noise from transport arteries, work of engineer sanitary-technical equipment (elevators, rubbish chutes, fans, pumps, etc) [12].

Noise causes tiredness, source of which is in consumption of great quantity of psychological energy for, so called, defense braking of nervous system [13]. Under terms of continuous impact it becomes one of the major and most harmful sources of nervous and psychological diseases [14]. A lot of works, especially clinical, provide results of investigations on the impact of high power noise irritants (90 dBa and more) upon the functional condition of a man, especially his hearing aid. Research by I.L. Karagodina showed that a noise impact on a man begins at its level of much lower than 65 dBa. Depending on the informative content of noise, personal condition of a man, and a great number of other parameters, unfavourable effect of noise upon a man's hearing aid starts at the level of 50 dBa, and its impact upon his psychology – at even lower noise [15]. Noise can affect not only a man's work process, but also his rest, sleep, disturb oral communication,

harm hearing, and cause other physiological reactions. Particularly, it hasten gerontological processes in a man's organism, and, what is typical, noise affects the whole organism, not only hearing aid, as some people think, as its impact indirectly reduce the general resistancy of an organism against pathogenic factros of a man's environment [16].

However, a study of diverse character of urban and dwelling noise impact upon an organism meets significant difficulties that arise in relation with their complicated interaction with other physical and chemical factors of our environment, and also because of individual sensitivity to a noise impact of different people [17].

According to the data of research, carried out in Germany and Great Britain by P. Ising and co-authors (1997), transport noise that exceeds 65 dBa leads to chronic stress, and can even cause death. The risk of heart disease development in this case increases by 20%. Under the noise level increase up to 70 dBa the risk equals 30% [18].

Studies, carried out by W. Schade [19] on analysing noise levels in four European cities (in Germany, Switzerland, Netherlands, and Italy), showed that noise pollution is a widespread problem. The author investigates environment and noise pollution from three positions: subjective population attitude to noise, protection of dwellings that are situated along roads, and fighting noise via legislative acts and laws at the governmental level. The population of these countries suffers from pollution, caused by transport: 17% in Italy, 40% in Netherlands, 64% in Switzerland, and up to 70% in Germany. More than 50% of these countries' population are disturbed by the noise of air transport. Noise is the third in the list of environment pollution factors in Europe. In the same article W. Shade provides data o noise level condition in developing countries (India, Pakistan). Regardless of low traffic intensity, noise level in these countries is significantly higher than in industrially-developed countries. Average noise level within a day equaled 80 to 92 dBa, the highest index was 140 dBa.

G.L. Osipov claims that the present trend for a noise level growth in modern cities will remain urgent within the next 40-50 years. He also underlines that current technical abilities of transport means' improvement are yet not able to secure the necessary clearness of atmosphere and noise level decrease, that makes the problem of environment protection in cities even more acute [20].

Researches, carried out by us on the evaluation of urban noise regimen in Kazakhstan Republic (Temirtau, Schuchinsk, Ust'-Kamenogorsk) showed that the major sources of urban noise are means of traffic movement, industrial enterprises, railway, airports, and other places of massive people accumulation (entertaining complexes, cafes, restaurants, other nterprises of trade and sport complex) that corresponds to researches of other Kazakhstan authors [21, 22].

In terms of cities' building territories the main impact upon the noise regimen have urban transport arteries of different purpose. Noise that emerges on an artery road, spreads not only into the adjoining territory, but also deep into a dwelling. Thus, under the terms of the highest noise impact located parts of blocks and micro-districts that are placed alongside street arteries of municipal importance.

Traffic intensity on street arteries at the moment of research in cities Temirtau, Schuchinsk, Ust'-Kamenogorsk equaled 185-950 units per hour. The heaviest traffic of public transport (buses, trolleys) was registered on arteries of municipal significance.

A dependence has been revealed, according to which an increases in cargo automobiles' content in traffic and their movement speed, especially those with diesel engines, leads to a dramatic growth in the noise level that considerably projects out of an artery noise background in form of noise peaks. The highest equal sound level from 72,4 to 76,5 dBa was registered in sections of high-speed roads. Minimal equal noise level (56,3 dBa) is character for dwelling streets, where traffic is relatively even (passenger transport).

Dwelling streets within inter-arterial territories are free from transit transport. Here only insignificant traffic of passenger and, rarely, cargo transport was registered. Equal noise levels are 58-60 dBa, that exceeds sanitary regulations and rules («Protection from noise», level of noise pressure within building area must not exceed 55 dBA during the day and 45 dBa in night hours).

The analysis of transport noise range showed the maximum of noise energy in intervals of low (63 Hz) and middle (500 Hz) frequencies. The heist significance in the formation of noise range has the composition of traffic. Under an increase in content of big cargo machines with diesel engines the range moves into the area of middle frequencies, noise harm for the population grows.

It has been set, that urban noise that reaches high levels, because of its low-frequency nature, can spread far outside the borders of arterial streets, easily overcoming obstacles. That is why urban (transport) noise can transform into the major and continuous part of the adjoining territories' acoustic environment. Noise freely penetrates dwelling, administrative-public, cultural-entertaining, trade centres and territories from roads, considerably exceeding sanitary regulations (SNiP -3677-84). The most uncomfortable in acoustic meaning is the functional area of 7,5-25 meters from roads in

all studied cities. The highest equal noise level from 7 a.m. to 8 p.m. was registered on territories of the main avenues in cities Temirtau, Schuchinsk, Ust'-Kamenogorsk.

The definition of transport noise spreading index from roads showed that at the distance of 15 m from an artery the noise level oscillates from 46,5 to 70,3 dBa, 30 m – 45,6 to 60,1 dBa, 60 m – from 45,2 to 49,1 dBa.

Noise levels at distance from 7,5 to 15 meters from roads deep into dwelling buildings decreased within 0,1-6,8 dBa, in other words, stayed the same. It can probably be explained by the lack of green plantings and large area of adjoined asphalted territory. Noise attenuation at distance from 15 to 30 and 60 meters from an artery was more intense. Thus, at the distance of 15-30 m noise level decreased by 7,4-10,8 dBa, at the distance of 30-60 m – by 11,2 dBa. Noise decrease from the standard point (7,5 meters from a road) led to its alteration at the distance up to 60 meters by 22,5-24,6 dBa.

Exceeding of acceptable noise levels near automobile arteries was observed in a daytime, the highest indexes were registered within the period of 7 to 11 a.m., and also in «rush hours» from 6 to 7-30 p.m.

Thus we have found out that the main factors that alter noise regimen of urban traffic are traffic character and transport flow structure, its intensity and speed. All these indexes usually are variable. For example, the number of transport units per hour is dependent on an artery bandwidth, time of the day, day of the week, and other conditions of cargo and passenger flow on a given direction.

The transport means' combination is also impermanent: speed is dependent on the number of transport units per hour and also on the traffic organization terms, road condition, presence of crossroads, their technical solution. Since the noise from traffic flows can alter significantly, the noise regimen in the adjoining territories (micro-districts) will alter correspondingly.

Thus, a level of street noises is defined by an intensity, speed, and character (content) of traffic. Besides, it is dependent on planning solutions (longitudinal and transversal street profile, building height and density) and such convenience elements, as road covering and presence of green plantings. The major reasons of high noise level are also the following: territories of micro-districts and blocks are not isolated from the noise, penetrating from roads, considerable part of area that is supposed to be recreation territory, is used for transport movement, especially for riding motorbikes and scooters. Urbanization, violation of sanitary regulations, formation of low and middle frequency sound waves, alterations in transport composition in favor for big cargo machines point out the danger of further noise level growth in big cities.

Considering the described, further investigation of noise in other Kazakhstan Republic cities is an urgent problem for the development of legislative documents, aimed for the solution of the noise problem and also short-term and long-term preventive programmes for non-admission of ecologically-determined diseases development, decrease in pathology growth and transfer of present diseases into chronic form.

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