Biological Sciences

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Aliyev Anvar Abbas

Institute of Geography of Azerbaijan National Academy of Sciences

NOISE AND HUMAN HEALTH

Summary. *A developed transport network means big advantages for a society. Meanwhile, the development of this economic area affects the components of biosphere, chiefly the atmospheric air and soil cover. In addition to the harmful environmental effects of transport, the negative impact of noise may happen, too. This problem typically is faced in recent decades throughout the world as well as in Azerbaijan Republic, while the rapidly growing motor industry is the main source of the impact of noise. This work deals with the study of intensity of noise, caused by motor vehicles, and its impact on human health. The research was carried out by the 208 km-long highway of Baku-Guba-Russian border (M-1), which passes the lowland of Samur-Davachi, the north-eastern part of Azerbaijan.*

Key words: *noise, health, highway, traffic, population.*

Introduction. The areas of 100 m of width along the studied highway are 30800 hectares in total (See Figure 1).During the field researches carried out by us, the substations of observation were defined in order to survey noises and their impacts by the three different parts of the highway of Baku-Guba-Russian border. Sound ranges of noises, caused by vehicles of different kinds were studied by quarters of years through the use of 'SVAN 947' device in these substations.

The first place of survey was chosen by the 18th km part of the highway.

The place of the second point of survey was selected by the 146 th km part of the highway near Sunny village of Guba administrative area.

The third point was defined by the 195th km part of the highway.

Materials and method. The issues of this kind were broadly studied in a number of countries of the world (Simandonis, 1981; Wilson R., 1996; Pavlova, 2004; Tolsky, Butakova, Melnikova, 1995; Lukanin B.N., Gudtsov B.N., Bocharov N.F. 1981) while similar researches have been carried out weakly in Azerbaijan. The highway of Baku-Guba-Russian border is one of the three main highways of Azerbaijan, characterized by high traffic.

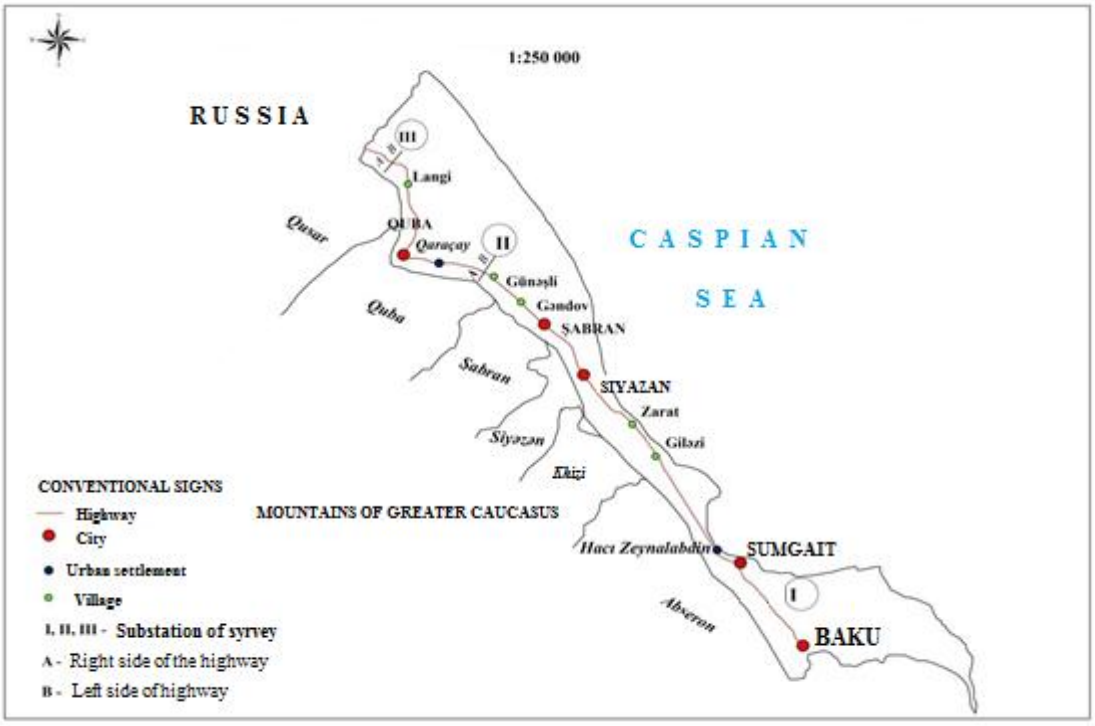

Fig. 1. Map-scheme of the highway of Baku-Guba-Russian border

As seen from Figure 2, the total number of vehicles grows by the first point (approximately by 10%) and the second point (by up to 15%) of survey, while the decrease at 31% by the third point is related to the problems observed in the border checkpoint in regard to trade operations between Azerbaijan and Russian Federation, as well as the conduction of reconstruction and construction works. However, taking into account the perspectives of the transport corridor of North-South passing the territory of Azerbaijan, the number of motor vehicles is expected to be increased significantly in the near future.

The main sources of noise observed in the highways are the certain parts of motor vehicles, namely engine, gearbox, leading bridge, ventilator, pipe of

exhaust gases, pumping pipe and wheels. In the meantime, such factors as relief of territory, composition and quality of highway, density and altitude of buildings, technical conditions of vehicles, traffic speed and regularity, the existence of greening areas are also responsible for the intensity of vehicles-related noise [1, 3, 4].

The impact of noise and related measures is regarded as the most urgent problems throughout the world in recent decades, although the problem is being studied scientifically from the end of the 19th century when the effects of noise on the human health was experienced due to the rapid development of industry. In 1868, the German scientist H. Helmhols (1821-1894) for the first time scientifically explained the physiology of hearing and vision. Since that time, studies on the negative impact of manufacturing (smiting, clinching etc.) on the hearing ability of humans were conducted from different aspects. The strength of noise, measured by dB is defined by the amplitude of oscillation in its source.

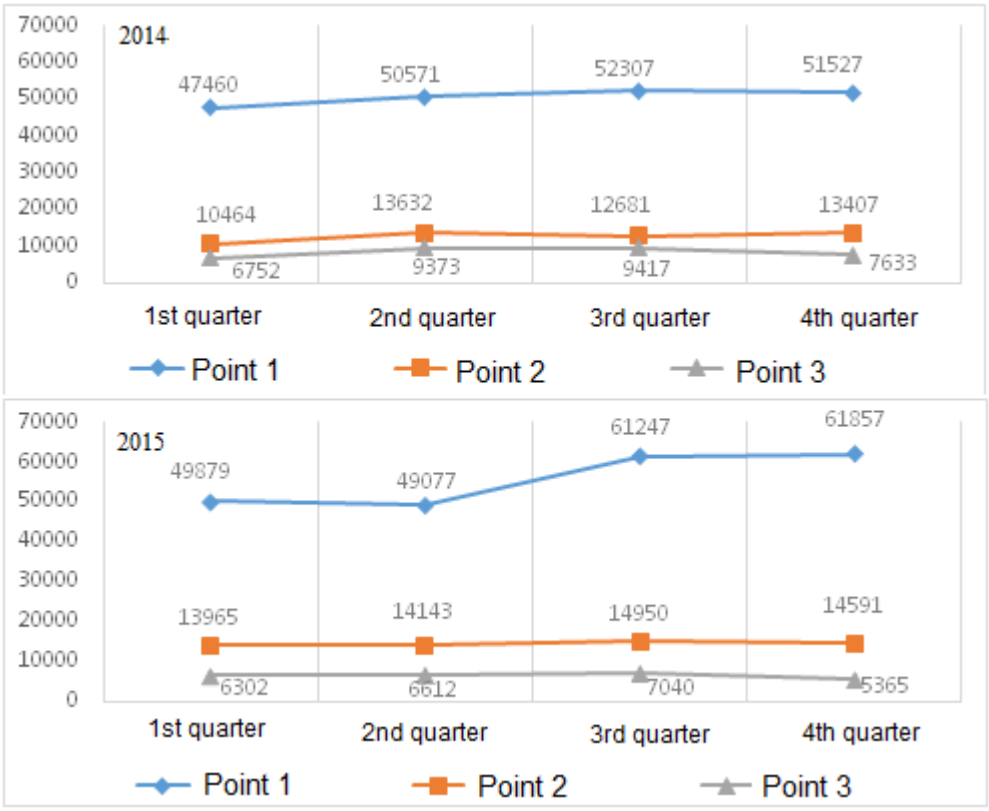

Fig. 2. Average daily intensity of traffic (number of vehicles) by the highway of Baku-Guba-Russian border (M-1)

For many years it was believed that the noise affects only the hearing organs. Therefore, for a long time the impact of noise on health was studied mainly from view of hearing. However, studies carried out by Tolski, Butakova, Melnikova(1995), Lukanin, Gudsov, Bocharov(1981) and other researchers revealed that the noise may be responsible for the origination of nervous, gastrointestinal and cardiovascular diseases, the chronic fatigue, the weakening of mental ability and memory, and may complicate the normal rest and power. It was defined that "acoustic pollution" may reduce the human life by 10-12 years in average.

According to researchers, noise is a biological irritator, affecting the human body and all organs and systems of human body generally and leading to different physiological changes. It is known that noise affects human health psychologically even if happens not at high frequency. Psychological impact of noise may cause insomnia, neurosis and atherosclerosis, particularly in regard those who are engaged in intellectual labor. It was revealed that noise of 30-35 decibels should be regarded as ordinary, and such level of noise does not cause inconvenience for people, while noise of 30-35 decibels may lead to reduction of hearing sensitivity and even loss of hearing. From medical point of view, limit of human endurance in regard to noise is 80 decibels, whereas 150 decibels may have killing effect. The allowable limit is 50 decibel for daily hours and 40 decibels for night time [1, 3, 4, 8].

In this work, the noise happening at different highways is counted in accordance with the formula offered by (12).

$$\mathbf{E = h \times (P_1 - P_2)}$$

where **E** - is the amount of noise in tote;

h - is the number of vehicles, passing the observation posts within an hour;

$\mathbf{P_1}$ - is the amount of actual noise, observed within an hour;

$\mathbf{P_2}$ - is the amount of allowable noise within an hour;

Here it should be noted that the permitted level of noise is 56 dB in the country since this indicator is identified by the Ministry of Health of Azerbaijan Republic.

Results and discussion. The application of the proposed formula, certain results were gained as reflected on Table 1.

Table1

Amount of noises above the allowed limit, caused by vehicles an hour at the highway of Baku-Guba-Russian border (in decibels, 2015 year)

Areas of survey	Kind of vehicle	Distance from the middle line of highway (in meter)		
		10	50	100
I	Car	56.336	24.144	–
	Lorry	11.984	8560	6848
	Bus	3712	2320	1392
II	Car	9898	4242	–
	Lorry	10.360	7400	5920
	Bus	1056	660	396
III	Car	5152	2208	–
	Lorry	3304	2360	1888
	Bus	528	330	198

As seen from Figure 3, in the areas located up to 10 m off the edge of highway, the difference between the total amount of real noise caused by cars and the total allowed amount of voice an hour makes up –56.336 dB. The 50 m long distance from the highway means the reduction of this indicator by 2,3 times whereas the voice wasn't observed at 100 m long distance. As for lorries, the reduction makes up only 1,4 times by 50 m long distance, while 100 m long distance means reduction at 1,3 times, which should not be regarded as satisfactory. In other word, lorries, moving along highways are the main sources of noise pollution that affects the health of population in the studied territory. This conditions has much adverse effect on the aged people and infants between 8:00 a. m. and 8:00 p.m., i.e. when they are at home as usual.

The impact of high-level voice of traffic on health is different by various groups of ages. As World Health Organization (WHO) indicates, the reaction to

noise depends on age, sex and conditions of health. The voice may have peculiar effect on the health of infants, old people and females, and particularly pregnant women. As usual, human body may suffer from noise at 60-70 dB such exposure happens in a short time. For example, 72% of old people wake up due to the noise of certain level while that noise may have similar effect only on 1% of infants at 7-8 years of age. The limit of noise capable to wake up infants is 50 dB, while the indicator equates 30 dB for old people. Older people heavily suffer from high and continuous noise, since the related effect may elevate their blood pressure, lead to the weakening of their heartbeat and cause the narrowing of their blood vessels.

The total number, the age and the sex composition of population, living along the studied highway (off less than 100 m) are reflected on Figure 3. The shown groups of population suffer from negative effects of noise caused by vehicles.

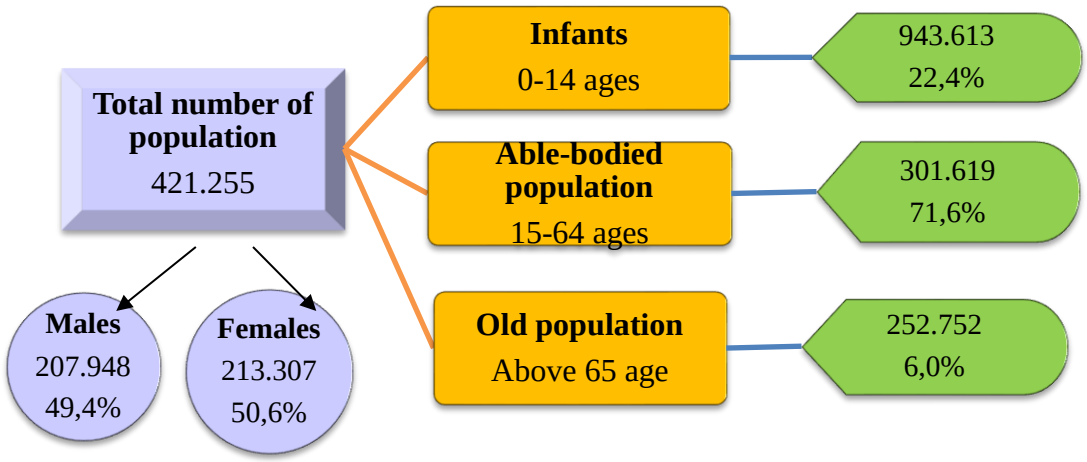

Fig. 3. Sex- and age composition of population living along the highway of Baku-Guba-Russian border (M-1)

As seen from Figure 3, most of people living along the highway are the infants below 14 years of age (22,4 %).

As mentioned above, the effect of noise is much harder for pregnant women since they are vulnerable group of population in general. They are more

sensitive in regard to noises even compared to infants of lesser ages. Some European psychologists suggest that the availability of much lesser number of children in families is associated with the overgrowth of noise in large urban areas. Even babies in womb can't be protected from the harmful effects of noise.

As Figure 3 reflects, the half of population of settlements along the highway is composed of females. Most of them are the able-bodied, while 35% are females of fertile age. During warm season of a year, most of those women typically spend their time in the open air since they are engaged in agricultural works, while this period is characterized also with the intensive traffic which means the increase of vehicle-related noise. In this regard, the relevant hazard concerns the health conditions of babies which are to be born in the future as well.

Conclusion.

1. The noise pollution of high extent must be regarded as one of the reasons, responsible for the spread of various deceases among the population, living near the highway of Baku-Guba-Russian border.
2. Since the highway of Baku-Guba-Russian border is characterized by high traffic and considerable growth of vehicles, the negative consequences of related noise pollution on the health of population along this highway (up to 100 m of vicinity) should be prevented by relevant agencies through the conduction of appropriate measures.
3. The noise pollution encompasses the settlements and the arable lands, located along with the highway of Baku-Guba-Russian border. With taking this into account, the conduction of needed measures must concern the population, both living and working in these areas. In this connection, the creation of greening belts along the highway should be conducted to reduce the impact of noise.

4. Awareness of vulnerable group of population - infants, pregnant women and older people about the negative impact of noise pollution must be ensured to reduce the relevant risk.

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