

V.A. Gorin, A.S. Danielyan
DETERMINATION OF RESTRICTED ZONES IN DWELLING
BUILDING IN THE AREAS OD AIRPORTS UNDER NOISE CONDITIONS

GOUVPO Kuban State Technological University
Russia, 350072 Krasnodar, Moskovskaya str.,2
Tel.: (861) 255-0967; Fax (861) 255-0967
E-mail: ss6lad@mail.ru

The authors treat the questions of the methods for estimation the levels of aviation noise in the areas of airport environs. The article shows the analysis of the existing standard, reference and technical documentation, determining the level of territory fitness for building in the areas of airports of civil and military aviation. The results of the measurements of the different types of the aircraft determined the noise levels, created by them on the locality, depending on the conditions of flights (take-off, landing, flight in a circle). The authors obtained the maximum sound levels on the locality, during the test of aircraft engines on the start place, what was not taken into account in the methods for calculation the admitted boarders of the dwelling building to the Air-Force airports in the conditions of aviation noise. The experimental data permit to specify the belonging of such airplanes to the types according to the noise. The authors executed the analysis of the excising method for calculation the sound levels on the locality, effected by the airplanes for the Air Force airports. It was fixed, that the obtained calculated equivalent sound levels on the locality, were overstating and this fact caused the artificial increasing of the values of curves equal maximum sound levels on the locality. The results, obtained during the investigations gave the possibility to specify the method of calculation the permissible approaching the dwelling house to the Air Force airports with the conditions of aviation noise.

Among the problems of protection of people of the urban noise the important place have the questions, connected with aviation noise. In the result of the development of populated areas, especially big cities, the breaks between them and airports reduced. Many airports, built during the war years and after war on the enough, as it seemed then, distance from the cites, at the present time are found near its boarders and sometimes the city building enveloped the territories of the airports from two or three sides. It is necessary to mention, that the aviation noise have high levels of sound and large area of noisy territory.

The main point, in the determination the mutual location of urban territories and airports is the establishment of the restricted zones for the dwellings near the airports, where such zones will permit to use the dwelling territory, taking into account the noise conditions. The dimensions of these zones are determined by the characteristics of the airport as noise source, from one side, and the requirements to the noise levels on the territory from the other side.

In many cites the situation with the aviation noise, the necessity of the reservation of large territories, suitable for urban building according all the parameters, except noise, very often bring great problems for town planners. More difficult problems occur in case when the urban building is under the influence of aviation noise, which exceeded the norms.

In the existing legislation of our country we have a great number of documents, regulating the noise influence on population. Because of the fact, that such documents (GOSTs, SN, SNiPs, etc.) are accepted by different authorities, which have the certain disconnection, this fact caused the lack of agreement between them in many cases. The same concerns the methods of estimation of different noise sources, including the airports.

The authors of the article met with such problems while executing the works for determination the restricted zones for the dwelling building in the environs of Air Force airports for noise conditions.

It is known that, the permitted levels if aviation noise on the territory of the dwelling building are fixed by the special standard GOST 22283-88 [1]: the equivalent sound level 65 dBA during day time (from 7.00 up to 23.00) and 55 dBA during night time (from 23.00 up to 7.00), the maximum sound level – 85 dBA dating day time and 75 dBA during night time. These sound levels are higher on 10 dBA the normative values, fixed in SN 2.2.4/2.1.8.562-96 [2], so it is necessary to use the noise protective buildings to have the levels of penetrated noise, answered the normative requirements.

In order to reduce the break between the airport and dwelling building and for partial usage the territories for dwelling building, where the aviation noise exceed the permitted requirements

according to GOST 22283-88, in was necessary in agreement with sanitary supervision authorities, to arrange the zones around the airports, which will determine the fitness of the territory for building according the noise levels [3]. The levels of aviation noise in zone A correspond the requirements of SN 2.2.4/2.1.8.562-96, in zone B GOST 22283-88, in zone C the levels of aviation noise during day time correspond the requirements of GOST 22283-88, during night time the levels are higher the fixed ones on 5 dBA, because during night time the usage of the territory was not urgent and the intensification of sound insulation of the external barrier for the required value will not cause the deterioration of the comfort for population.

In practice, the accuracy in calculations and construction of zones, determining the level of fitness of the territory for dwelling building and other types of its usage in the location of airports for civil aviation, was satisfactory enough according the method [3]. The results of the measurements on location of aviation noise of different types of aircraft, having the different regimes of flights (take-off, landing, flight in a circle) was correlated with the rated data well enough.

The practical works for estimation the noise regime caused by the Air Force airports, hold on by the method, fixed by Ministry of Defence of Russian Federation, show the lack of correspondence of rated data and measurements on location. The analysis of the calculation method permit to reveal the reasons of this lack in correspondence.

Thus, the given maximum noise level for each type of the aircraft, flying on airway, separately for day and night time are determined according to the formula:

$$L'_A = L_A - \Delta_1 \quad (1)$$

where L_A - the permitted levels of maximum noise for day and night time, dBA

Δ_1 - amendment with consideration the difference in the levels of maximum noise, caused by aircraft, of the treated and the initial groups.

The given equivalent noise level for each type of the aircraft, flying of the airway, separately for day and night time is determined according to the formula:

$$L'_A = L_A - \Delta_2 + 25 \quad (2)$$

where Δ_2 - amendment with consideration the difference in the levels of the equivalent noise, caused by the aircraft of the treated and initial group and is determined depending of the given number of flights N.

The given number of flights is determined according the formula:

$$N = \sum n_i \cdot K_i \quad (3)$$

where n_i - number of flights of i group on the airway separately for day and night time;

K_i - transition coefficient with consideration of the aircraft group and the regime of flights on the airway.

It is seen from formulas 1 and 2, that the values of the given maximum and equivalent sound levels depend on amendments Δ_1 and Δ_2 . The amendment Δ_1 , which consider the difference in the levels of maximum noise, caused by the aircraft of the treated group and the initial group, is in the limits from -25dBA up to + 2 dBA. The amendment Δ_2 , which consider the difference in the levels of equivalent noise, caused by the aircraft of the treated and initial groups and is determined in dependence of the given number of flights N and restricted by the values - 10 dBA and +15dBA.

The similar method of determination for the given maximum and equivalent noise levels is accepted in the method of calculations for the limited zones of dwelling building, taking into account noise conditions in the environs of the civil airports. This method is given in the article [3]. However, in this article the value of the amendment is in the limits from -15dBA up to +5dBA, and the amendment Δ_2 is determined as follows:

- for day time

$$\Delta_2 = 14.34 \lg N - 21.38 \quad (4)$$

- for night time

$$\Delta_2 = 14.34 \lg N - 17.12 \quad (5)$$

Substituting the limit values of the amendments Δ_1 and Δ_2 in the formulas 1 and 2, we can obtain the following values of the minimum dimensions for the zones with restricted building according the maximum and equivalent sound levels:

- for the given maximum sound level
for day time

$$L_A^j = L_A^{per} - \Delta_1 = 85 - (-25) = 110 \text{ dBA};$$

for night time

$$L_A^j = L_A^{per} - \Delta_1 = 75 - (-25) = 100 \text{ dBA};$$

- for the given equivalent sound level
for day time

$$L_A^j = L_{A_{eqv}}^{per} - \Delta_2 + 25 = 65 - (-10) + 25 = 100 \text{ dBA};$$

for night time

$$L_A^j = L_{A_{eqv}}^{per} - \Delta_2 + 25 = 55 - (-10) + 25 = 90 \text{ dBA},$$

where L_A^{per} and $L_{A_{eqv}}^{per}$ - permitted maximum and equivalent sound levels on the territory of dwelling building, dBA, correspondingly.

The maximum dimensions for the restricted zones according the given maximum and minimum equivalent sound levels is :

- for the given maximum sound level
for day time

$$L_A^j = L_A^{per} - \Delta_1 = 85 - 2 = 83 \text{ дБА};$$

for night time

$$L_A^j = L_A^{per} - \Delta_1 = 75 - 2 = 73 \text{ дБА};$$

- for the given equivalent sound level
for day time

$$L_A^j = L_{A_{eqv}}^{per} - \Delta_2 + 25 = 65 - 15 + 25 = 75 \text{ дБА};$$

for night time

$$L_A^j = L_{A_{eqv}}^{per} - \Delta_2 + 25 = 55 - 15 + 25 = 65 \text{ дБА}.$$

Here we can see, that having the minimum limited value for the amendment $\Delta_2 = -10\text{dBA}$ and the value of the amendment $\Delta_1 = -25\text{dBA}$ the value of the given equivalent sound level is higher the maximum sound level on 10 dBA. In case $\Delta_1 = -15\text{dBA}$ these values coincide, and only having $\Delta_1 > -15\text{dBA}$ the values of the given maximum sound level become larger, than the values of the given equivalent sound levels. Such a restriction in the minimum value of the amendment $\Delta_2 = -10\text{dBA}$ for determination of the given equivalent sound level in the treated method of calculation is unwarranted. In this case, even having the flight of one aircraft, the dimension for the restricted zone for sound is determined artificially by the given equivalent sound level, and not by the value of the given maximum sound level.

That means that, in order to bring into accord the calculated values of the given maximum and equivalent sound levels it is necessary to exclude the restriction, introduced for amendment and to calculate it according to the formulas 4 and 5.

Having the maximum limited values of the amendment $\Delta_2 = +15\text{dBA}$ and the value of the amendment $\Delta_1 = +2\text{dBA}$, the dimensions of the restricted zone, for the noise condition, determine the equivalent noise levels, what was explained by the formulas 4 and 5. That is, increasing the given number of flights N , the value of the equivalent sound level rose, and the maximum sound level remained fixed.

Besides, the experimental investigations revealed, that some types of the aircraft do not correspond the groups, fixed in the treated method according to noise conditions. So, the values of the

sound level on the locality of the aircraft TU-154 were reduced, and for aircraft Il-76 were risen. The same concerns some types of training battle planes.

The limits of the zones with noise conditions were specified testing the engines of the planes on start in the direct closeness to the airports.

It means, that the executed calculated and experimental investigations for the estimation the noise regime, caused by the Air Force airports permit to arrange the restricted zones for dwelling building, having noise conditions, in total extent and according to GOST 22283-88.

REFERENCES

1. GOST 22283-88. Aviation noise. Permitted noise levels on the territory of dwelling building and methods of measurements. M.: Issue of standards, 1989. - 14 p. (In Russian).
2. SN 2.2.4/2.1.8.562-96. Noise on working places, in living rooms, civil buildings and on territory of dwelling buildings: Sanitary norms. – M.: Information and issue center of Ministry of Health of Russia, 1997. – 20 p. (In Russian).
3. Recommendations for arrangement of the restricted zones of dwelling building in the environs of civil airports with noise conditions/ NIISF. – M.: Stroyizdat, 1987. – 32 p. (In Russian).