



” Noise pollution in the city

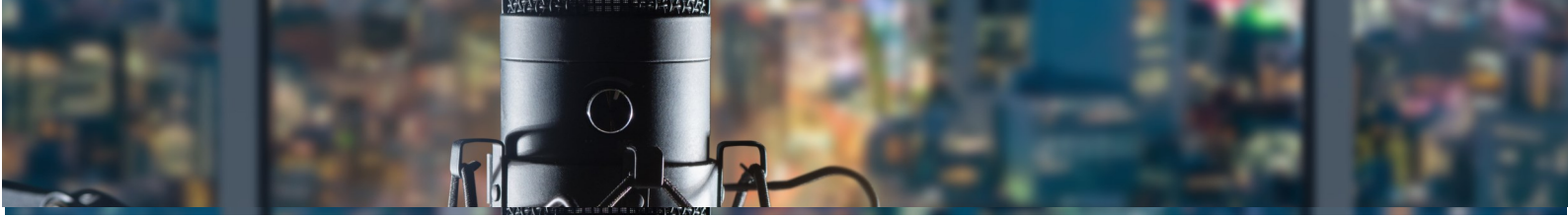
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AMRON CENTRE ANALYSIS

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Noise is one of the biggest nuisances of living in a big city. According to the World Health Organization, noise pollution is the second largest civilization cause of ill health after smog. When buying or renting a property, it is worth examining acoustic conditions in the property and its surroundings. It is also good to read the planning documents to find out if there are any troublesome investments planned near the place we are interested in that will have a bad impact on our well-being and health in the future.

NOISE – A NUISANCE OR A REAL THREAT?

Noise is a term for excessive sound influence, which in the long term negatively affects human and animal activities. Long-term noise is one of the environmental pollutions, among others like waste, sewage, air and water pollution and light pollution. Not only it is a nuisance that decreases life comfort, but also seriously affects biodiversity, concentration at work, cognitive development of children, physical and mental health, and even human life expectancy. In contrast with easily detectable pollutants such as smog or waste, noise is an invisible enemy, and its constant impact accumulates like radiation and affects the whole body. There are three main categories of man-made noise: roadway, industrial and noise inside buildings. The first two are called environmental noise and they are matters of special interest to such agencies as WHO, EU and municipal offices. As defined in Directive 2002/49/EC of the European Parliament and of the Council of June 25, 2002 relating to the assessment and management of environmental noise, environmental noise shall mean ‘unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity’. However, in scientists’ eyes, noise inside buildings can be even greater burden on the body due to its duration, as we spend most of our time in confined spaces.

We are exposed to this noise in buildings such as shopping centres, supermarkets and other public buildings, as well as in means of transport – especially on board aircraft and in the subway. Unfortunately, it can also occur in places where people spend many hours every day – in schools, open space offices, and even in residential buildings.

IMPACT OF NOISE POLLUTION

There are many effects of noise pollution. Firstly, the well-being of wild nature is deteriorating. Secondly, it has a significant effect on human mood and health. We are so accustomed to many types of long-term and less intense noise that we tolerate or even ignore it.

Stress, anxiety, nervousness, depression, reduced productivity and efficiency, Chronic Fatigue Syndrome, as well as memory and concentration loss are common effects of prolonged exposure to noise experienced by most city dwellers. The most commonplace serious and irreversible health problem is hearing loss (NIHL). Other typical health problems include hypertension, heart disease, insomnia, digestive disorders, metabolic problems, memory impairment, neurosis, vision disorders and diabetes.

Children are particularly vulnerable to the health effects of prolonged noise that causes their mental development disorders. It has been shown that children living near noisy airports or streets suffer from stress and memory impairment in particular. Another group of the particularly vulnerable are young adults - often renting apartments on busy streets.



In addition, people who work in open space offices, schools, shopping malls, on the construction site, in industry and in means of transport are also especially vulnerable. The group of increased risk also includes the elderly, the sick and pregnant women. Noise has an extremely negative effect on the development of the fetus by increasing the level of stress in the pregnant woman. According to the European Environment Agency's report *Noise in Europe*, one in four Europeans is exposed to road noise levels above the EU limit of 55 dB Lden on a daily basis. According to the same report, noise causes sleep disturbances in more than 13 million EU citizens, 72 000 hospitalisations and 16 600 premature deaths in Europe each year.

NOISE METERS

The noise level is measured in decibels [dB]. This unit objectively determines how loudly it is in the environment. The subjective perception of sound depends on both the actual noise level and the sound intensity compared to other ambient sounds. Depending on the prevailing conditions, the human ear increases or decreases its sensitivity. For example, during an evening rest at home, there may be a nagging sound that would not disturb during the day. At night, even too loud noise of the refrigerator, ventilation or elevator disturbs healthy sleep. Therefore, the legislation sets different permissible levels of noise in the environment for the time of day and night. Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise introduced the term of noise indicator. It means 'a physical scale for the description of environmental noise, which has a relationship with a harmful effect, where harmful effects shall mean 'negative effects on human health'. The directive lists four indicators. Lden is the noise indicator for overall annoyance, adjusted for different sensitivities in the morning, afternoon and night. L_{day} defines annoyance during the day, L_{evening} – in the evening, L_{night} – at night. The European Union defines the level of long-term exposure to noise as high if it reaches 55 dB according to the L_{den} index and 50 dB according to the L_{night} index, so we could say the noise pollution starts from these values. In Polish law, the L_{dwn} and L_n indicators apply to the control of long-term average sound levels. According to the Act of 27 April 2001 Environmental Protection Law, they are used to compile strategic noise maps and environmental noise protection programs. L_{dwn} takes into account all days of a year and all parts of a day (24 hours). It is used to determine the general annoyance of noise. The L_n indicator takes into account all nights of a year (night time is from 22.00 to 6.00). This indicator is used to determine sleep disorder.

To determine and control the conditions of using the environment in relation to single day, the Act distinguished L_{Aeq} and L_{Aeq N} indicators – that mean an equivalent sound level for the time of day (in this case from 6.00 to 22.00) and for the time of night respectively.

The level of sound intensity at which we begin to feel discomfort is considered to be 55 dB, and long-term noise at the level of over 75 dB is absolutely harmful to health. For comparison, the rustle of leaves is a sound at the level of 15 dB, ordinary conversation - 40 dB, motorcycle engine - 80 dB, low-flying passenger plane - 85 dB, electric lawn mower and subway train - 90 dB, drill - 100 dB, loud concert - 110-120 dB, thunder and jet take-off - 120 dB, alarm siren - 140 dB, and firecracker explosion - 160 dB.



In addition to the noise sources located outside the building, against which the external partitions are to protect, an important issue is also air and impact noise generated by building dwellers and installation noise (pumps, furnaces, elevators, ventilation, etc.). The impact noise in poorly designed buildings is felt far from the source – vibrations are transmitted through the structure even at a distance of many floors. The permissible level of noise in rooms where people stay, generated by technical equipment devices and caused by the operation of service premises is regulated by the PN-B-02151 standard (part 2) - it sets the permissible values of the equivalent and reference maximum noise level in buildings, incl. residential buildings, hotels, schools and hospitals. The standard also regulates the requirements for sound insulation in buildings. According to WHO guidelines, there should be less than 30 dB in the bedroom at night to ensure good sleep quality, and less than 35 dB in classrooms to ensure good teaching and learning conditions.

SOLUTIONS

The level of noise pollution depends largely on the actions of the city. The solutions introduced by the municipal authorities include, among others, the installation of acoustic screens on roads and railway lines, although this solution has many opponents due to the destruction of the city's landscape. Today, well-judged strategic actions and reducing the noise sources are more valued.

Such activities include investing in modern urban infrastructure like electric and hybrid vehicles, low-noise asphalt or green tram tracks. Strategic actions also include appropriate spatial planning adapted to the different acoustic sensitivity of individual areas, preserving quiet areas, development of bicycle networks, Park & Ride car parks, carpooling, limiting vehicle traffic in the centre, reducing truck thoroughfares, lowering the permissible movement speed and introducing quiet hours at airports. Solutions for buildings include acoustic insulation of buildings, for example using special acoustic screens, green walls, soundproof windows, as well as the use of mechanical ventilation.

What we can do in person for our protection is protecting our ears with earplugs or noise-cancelling headphones when being in a noisy place, paying attention to the volume of household appliances and electronics, and making a right choice about place to live. Before choosing a property, it is worth verifying the acoustic standard of the building. Good acoustics are guaranteed by tenement houses, while in prefabricated blocks good acoustic practices are usually not preserved. Unfortunately, also in new construction there are often too thin walls and building materials that do not meet acoustic requirements (e.g. polystyrene instead of mineral wool used to silence ceilings). If we have doubts about the acoustics in the property, it is worth analysing the construction documentation with an expert, and in older apartments you can make construction measurements. Another way which can help with the right choice is to interview potential neighbours, that not only will help us assess the level of noise coming from the street or the acoustics of the building, but also will evaluate the behaviour of other residents. It is worth remembering that even met standards will not protect us from too loud neighbours. Additionally, when planning a purchase or rent, it is worth coming to inspect the property during the hours when we expect noise. You can also use the phone app to measure the noise level. Moreover, it is recommended to pay attention to any sources



of noise in the environment and to analyse the available official documents. Strategic noise maps can help to verify the level of noise reaching the apartment from the outside.

If we are already residents of a property and we have encountered a not very annoying noise, simple arrangement procedures such as heavy curtains, fluffy carpet and photo wallpapers are helpful. The more objects scattering and muffling sounds there are in the apartment, the quieter it can be. If the noise is more annoying, only a major renovation can help. It is possible to soundproof the apartment by putting acoustic mats or cork to the floor, making a dropped ceiling, and insulation with mineral wool. It is also good to purchase front door and windows with high R_w coefficient or to enclose the existing doors with upholstery or special sandwich slabs, as well as to put double front door and enclose the balcony with roller blinds or window shutters (in case of the consent of the housing association). Alternatively, you can also set acoustic screens, nevertheless this solution is expensive and reduces the usable area of the apartment by several meters.

NOISE MAPS

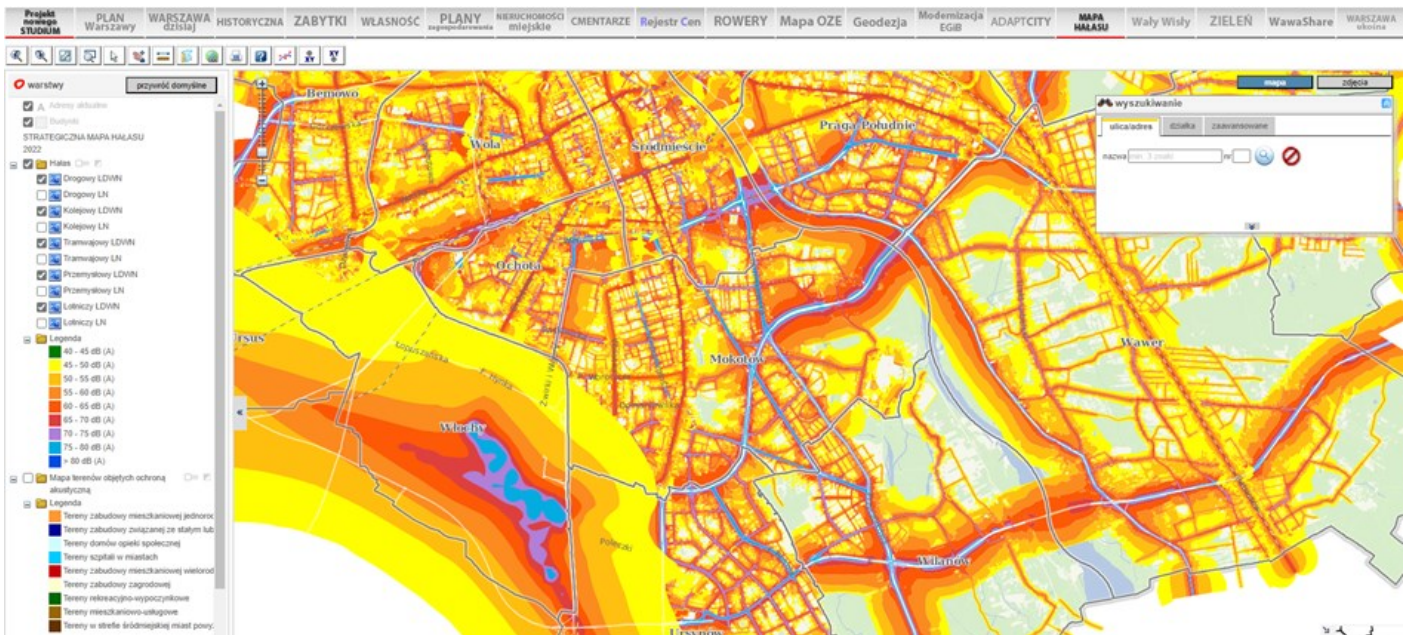
According to the Environmental Protection Law of 27 April 2001 and Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and control of environmental noise levels, there is an obligation to prepare noise maps for:

- agglomerations with more than 100 000 inhabitants,
- major roads which have more than 3 000 000 vehicle passages a year,
- major railway which have more than 30 000 train passages per year,
- major airports which have more than 50 000 movements per year.

The noise map has an informative function and it is the basis for the development of the Noise Protection Programme. It contains information about the level of traffic and usually also industrial noise according to the L_{dwn} and L_n indicators. It is worth to become acquainted with it if you plan to live in a big city. Usually, cities make it available on their geoportal with the possibility of searching an address. There are examples of projections from noise maps below.

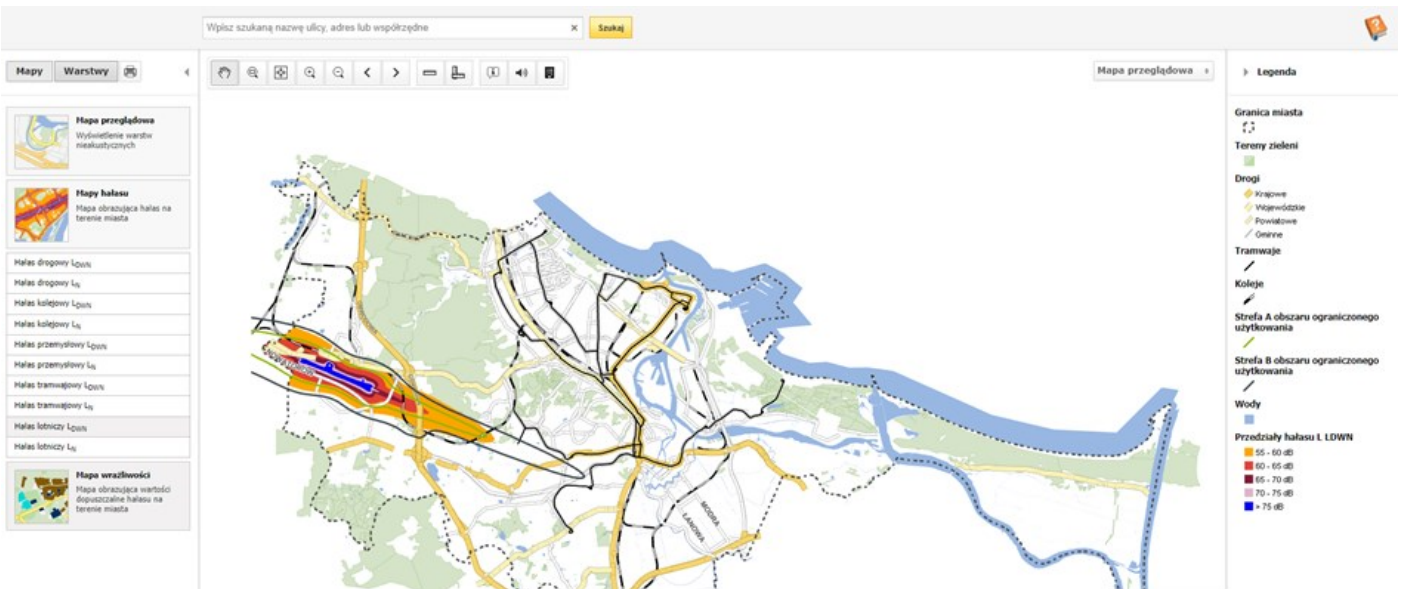


FIGURE 1. STRATEGIC NOISE MAP OF THE CITY OF WARSAW



Source: Strategic noise map of the City of Warsaw, mapa.um.warszawa.pl

FIGURE 2. NOISE MAP OF THE CITY OF GDAŃSK



Source: Portal of permanent monitoring of traffic noise of the City of Gdansk, mag.bmt.com.pl



Cities often provide both immission and emission maps. To see the volume of sound that reaches a location, after taking into account the terrain and other factors, select the immission map. In addition, there are also sensitivity maps that illustrate noise limit values in different parts of the city.



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