

A soundscape analysis for selected parks in Bydgoszcz

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Abstract. Areas that are considered human-friendly are green spaces. The existing urban parks are designed to fulfill the role of relaxation, recreation, and entertainment. However, in many cases, these are historic places, which at the time didn't have much of an impact on external factors. Sustainable development issues are related to the quality of life and the usage of the environment and its resources by present and future generations. Noise and noise protection is an issue that is part of sustainable development. The inadequate implementation of the principles of sustainable development and non-inclusion of noise can noticeably lead to negative effects now and in the future. The aim of the paper is to analyze the soundscapes of two Bydgoszcz parks located in the city center. The values of the equivalent sound level for these areas were obtained from the existing Bydgoszcz acoustic plan. Subsequently, the resulting distribution of noise was compared with the results of subjective perception of sounds by visitors. On this basis, conclusions can be drawn regarding the ways of shaping such areas while taking into account the perception of visitors.

1 Introduction

Green areas improve the quality of life of residents. Their functions are primarily conditioning human health through contact with nature - reducing stress and improving physical condition. An important role of green areas in the city is also to improve the microclimate. It can be noticed that such areas satisfy the aesthetic needs of mankind. Greenery also affects the reduction of noise by absorbing or scattering the sound wave [1, 2]. Protection against noise and vibration is taken into account in legislation and campaigns in the field of environmental protection and management [3]. Current acoustic requirements are formulated in the form of mandatory limit values. In the case of industrial sources, the requirements are more stringent than in the case of road or rail noise. Such differentiation results from a subjective assessment - industrial noise is perceived as more burdensome than railway noise of the same level [4]. Formal and legal tools used in noise management can be replaced or supplemented with economic tools. The use of such mechanisms is a part of the concept of sustainable development. Opinion polls are a good tool to define an acoustic situation. Often, the survey results diverge from the conclusions based on sound level measurements [5, 6, 7]. The article includes two Bydgoszcz parks, referring the results

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of the subjective assessment of the acoustic space to the existing acoustic map. On the basis of the surveys, sound sources appearing in these areas were listed and their reception was analyzed by visitors. The conclusions concern the existing situation and include comments relating to the acoustic situation of such areas.

2 Material and method

In order to determine soundscape character, two parks were selected in the center of Bydgoszcz. The first area is Jan Kochanowski Park of with an area of 3.15 ha, located between the following: 20th of January 1920 Street, Adam Mickiewicz Avenue and Ignacy Jan Paderewski Street (Fig. 1). The park, created in 1901, is an example of English style by Konrad Neuman. This park is located in a "music district". The buildings which directly adjoin the park are the the Bydgoszcz Philharmonic building, the Polish Theatre and the Academy of Music, and this fact definitely influences the formation of its acoustic climate. In 2013, the revitalization of the park began in order to restore its splendor to before the war and to emphasize its historical character and the relationship with the district music. The playground for children has also been expanded.

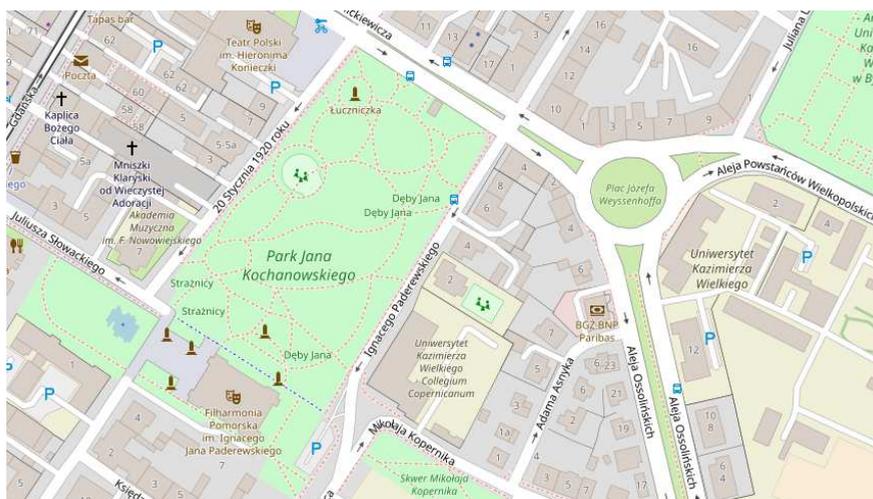


Fig. 1. A map of Jan Kochanowski park [8].

The second object is the Kazimierz Wielki Park - the oldest municipal park in Bydgoszcz. Its creation dates back to the first half of the seventeenth century, and its area is 2.24 ha. It is located in the central part of Bydgoszcz – the Śródmieście district, among such streets as Konarskiego, Gdańska, Jagiellońska and Wolności Square. The park is surrounded by the following buildings: a church, the provincial office, the municipal art gallery, hotels, a club, the Gastronomic School Complex and the Art School Complex (Fig. 2).

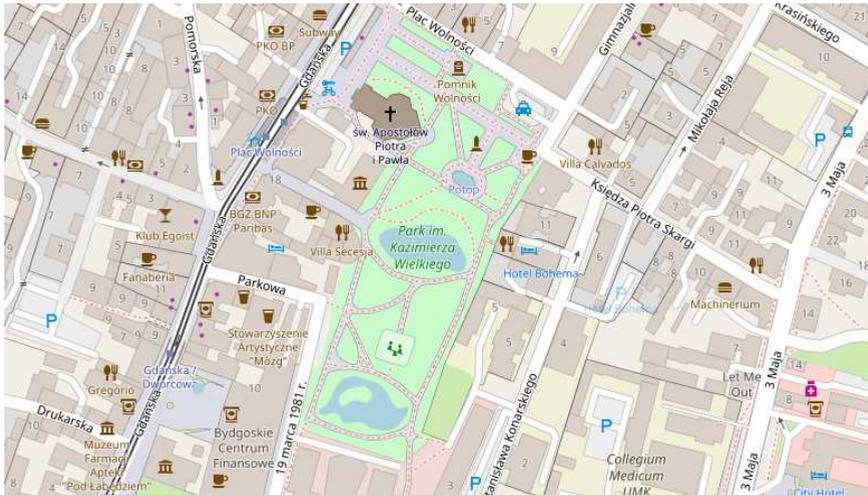


Fig. 2. The map of the Kazimierz Wielki park [8].

A common feature of both parks is primarily their city center location. It has an impact on shaping their acoustic climate. The source of noise is the public transport and traffic coming from the streets surrounding the parks. According to the Act on Environmental Protection Law [3], Bydgoszcz is a city which has an obligation to carry out acoustic plans. Analyzing the acoustic map for the park areas, we can observe the penetration of road noise into these areas (Fig. 3, 4).

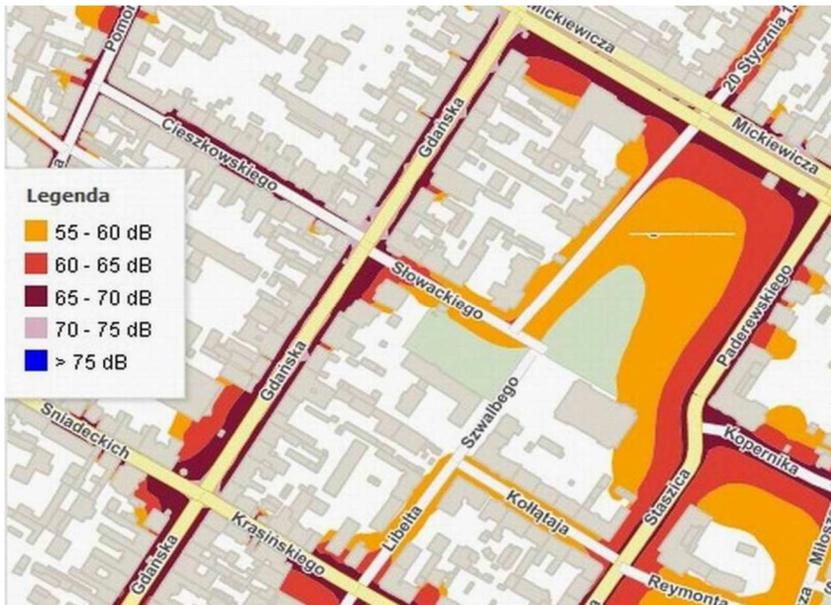


Fig. 3. A part of the Bydgoszcz acoustic plan - road noise - Jan Kochanowski Park [9].

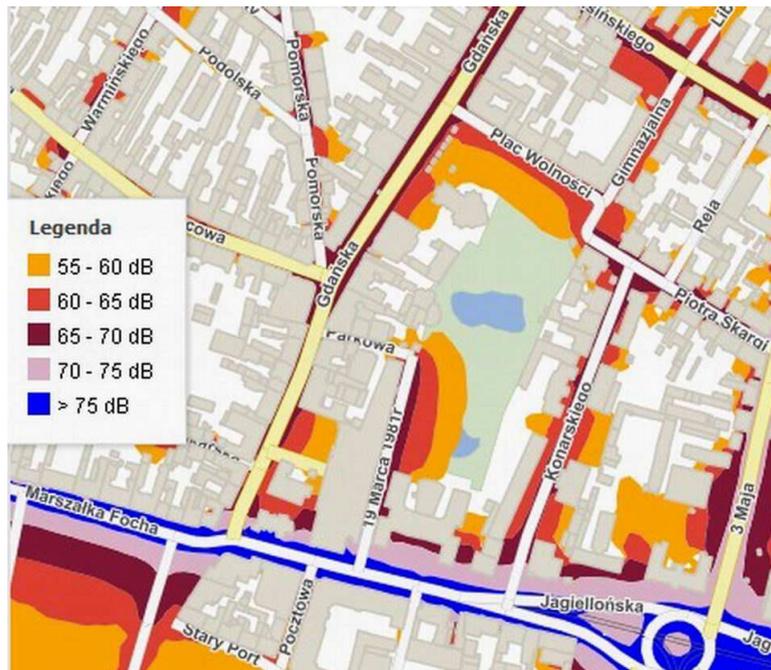


Fig. 4. A part of the Bydgoszcz acoustic plan - road noise - Kazimierz Wielki Park [9].

In order to compare the measured values of the sound level with the sensations of visitors, surveys have been conducted. Their main objective is to know the opinion of the general public and the ability to analyze present trends in society. They were carried out on weekdays in the summer season. The survey involved about 50 people per survey. One of the questions concerned the sources of noise in the park. The respondents, in both parks, mainly specified 3 sources:

- cars,
- the number of people staying in the park,
- the playground.

In Jan Kochanowski Park, the respondents also mentioned the noise coming from the Academy of Music. Figure 5 contains the percentage of affirmative answers to the question whether these sound sources disturb them while staying in the park.

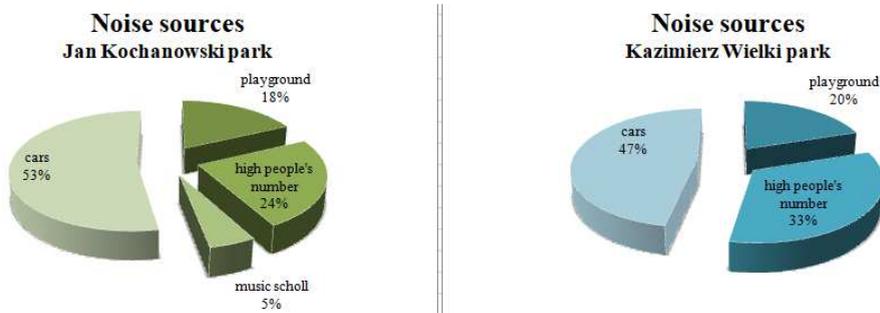


Fig 5. The sources of noise and the percentage of respondents who are disturbed by the noise.

The preferences regarding the sounds perception depend on individual human characteristics. The basic parameter, a characteristic of the surveyed, was their age. The

following Fig. 6 shows the structure of affirmative answers in correlation with the age of the respondents.

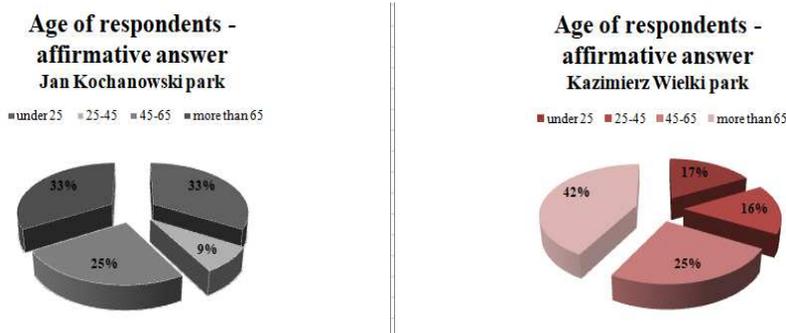


Fig. 6. The percentage of affirmative and negative answers according to the age range.

The above diagrams show the differences in the perception of generated sounds. First of all, there are new noise sources, which are not taken into account while monitoring and protecting against excessive noise in existing green areas.

3 Discussion

The noise in the environment of a human habitation should be restricted. Places, where people can rest from the city noise, should be located at an accessible distance. Parks in city centers meet this requirement. However, quiet zones in these areas are difficult to separate [10, 11]. The statement about acoustic nuisance occurring in the park does not have to coincide with the noise distribution determined on the basis of the measurements. Persons staying in the park may pay attention to the noise, which is not taken into account in the standard provisions.

A full assessment of these feelings can be obtained on the basis of the surveys carried out among people staying in this area. The analyzed parks are not new establishments. The progress of civilization has changed their acoustic climate. Readable values from the acoustic map show that there is no exceedance of the acceptable sound levels (68 dB) in the areas of the analyzed parks. However, we can see the penetration of road noise, especially into Jan Kochanowski Park. This is the result of the lack of barriers stopping the spread of the noise from the street. Kazimierz Wielki Park, due to it being surrounded by buildings, has a much smaller reception area of this type of noise. The survey made it possible to identify other sources of noise present in these areas and which have an influence on the staying comfort. The results concerned the summer season as it seems to be the most dynamic period in the use of the park. The respondents indicated that apart from the cars, there are also other sources of sound. These are sounds generated by co-visitors. In both cases, the age group disturbed by excessive noise consisted of people over 65 years old. In the analyzed parks, there is no clear zoning allowing separating leisure from recreational zones. The permissible environmental noise levels specified in the regulations are not a clear concept in the subjective assessment. The value of this level is also influenced by other, non-acoustic factors (human feelings). Making changes in existing spatial layouts is not an easy task.

The unused tool is the lack of records in planning documents that could allow using specific ways of developing and using the park space, affecting its acoustic quality.

4 Conclusion

The above study provided basic information on shaping the acoustic space of selected Bydgoszcz parks. It showed that the objective assessment of noise and its subjective reception must be correlated. The main source of noise in selected areas is traffic noise. The survey also indicated that there were other sources, such as the excess of people in the park and children making noise. It is interesting to notice that visitors to the park are disturbed by other people. The location in the city center and the age of the parks also affect the limited possibilities of introducing any changes. The construction of artificial barriers may disrupt the existing architectural layout. A frequently used solution is the introduction of so-called "white noise" emitting sources. The "Flood" fountain in Kazimierz Wielki Park is such a place.

An inadequate understanding and implementation of the principles of sustainable development in spatial management, as well as not taking into account all the factors, including noise, which shape the environment of living, working or resting, can result in negative effects that will affect not only present, but o future generations as well.

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