GREEN CITIES
GREEN LOGISTICS FOR GREENER CITIES

7th International Conference Green Cities 2026 – Green Logistics for Greener Cities, 15-17 April 2026, Szczecin, Poland

Social dimension of sustainable air transport in urban areas

Karolina Kaśkosz[a,1], Natalia Drop[a]

[a]*Maritime University of Szczecin, ul. Wały Chrobrego 1-2*
70-500 Szczecin, Poland

Abstract

Sustainable transport development encompasses not only environmental and economic aspects, but also social perception and impact on the quality of life of residents. Aim of this article is to analyze the social perception of air transport from the perspective of its impact on the urban environment. The study included a review of the literature, noise measurements, and social acceptance of activities related to the operation of an airport near an urban agglomeration. The study also included a case study of a selected airport. Directions for possible interventions and technologies conducive to social acceptance in cities and regions with heavy air traffic were proposed. The article aims to highlight the need for greater public participation in the transport policy-making process.

Keywords: air transport, sustainability, quality of life, urban areas, transport policy, management;

1 Introduction

In an era of globalisation and open borders, air transport is the fastest growing mode of transport, enabling people to reach almost every corner of the world in a relatively short period of time. The volume of air travel is forecast to continue its upward trend year after year (Drop & Bohdan, 2025). Therefore, it is imperative that airports too match the growing demand, resulting in a higher frequency of aircraft take-offs and landings and, in some cases, maximum utilisation of airport capacity.

Airport operations are considered to be a nuisance due to high emissions of harmful substances and noise. This is relevant to the assumptions of the concept of sustainable development, which takes into account three dimensions: environmental, economic and social. Most scientific studies focus on environmental issues. However, social issues - understood as the impact of transport activities on the well-being of the population - are equally important, especially given that many airports are located in urban areas and therefore in close proximity to human habitats. This publication focuses on the topic of aircraft noise during the different phases of aircraft operations and the impact of this noise on the overall noise level in the city. The research was conducted at Szczecin-Goleniów Airport, which has so far been the subject of scientific publications addressing issues including, among others, traffic forecasts (Barczak, 2016; Drop & Bohdan, 2025) or traffic behaviour (Stoeck & Gołębiewski, 2016). However, there is a lack of studies in which the authors address the topic of noise around the airport in question.

A study using the AS - 200 sound meter showed that the lowest sound level in the area around the airport is 50.2 dB when no aircraft are present and no flight operations are taking place at the airport. The highest sound intensity, on the other hand, was recorded when an aircraft was taxiing for take-off and was then 83.7 dB. Such results confirm the annoyance of aviation activities for humans and the need for preventive measures.

2 Literature review

The development of the transport network and the increase in the mobility of society bring a number of benefits, of which the most important can be considered the prevention of transport exclusion, the integration of transport modes and the economic development of regions (Koźlak, 2020; Kuciaba, Kwarciński, Milewski & Załoga, 2013; Kutnik & Klamerek, 2023). On the other hand, however, higher traffic volumes in each transport mode lead to an increase in the external costs of transport, which include the costs of accidents, congestion, climate change, environmental pollution and noise. These are not costs borne directly by the transport generator or user, but by society as a whole (Zagozdzon, 2013).

[1] Corresponding author. tel.: +48 728 834 590; e-mail address: k.kaskosz@pm.szczecin.pl

When analysing a branch of transport such as air transport, the main focus is on nois/e and air pollution issues (Huderek-Glapska, 2014). Noise is a factor resulting from urbanisation and can have negative effects on people in the form of stress and sleep problems (Faulkner & Murphy, 2022; Brown & Van Kamp, 2017; Sørensen, Münzel, Brink, Roswall, Wunderli, & Foraster, 2020). Also, many airports are located close to cities and residential areas. Numerous studies indicate that proximity to an airport and associated noise has a negative impact on residential property values (Cohen & Coughlin, 2008; Zheng, Peng & Hu, 2020; Batóg, Foryś, Gaca, Głuszak & Konowalczuk 2019). The impact of aircraft noise on the well-being of the population remains a separate issue. The World Health Organisation reports that aircraft noise is significantly more harmful than noise from other activities (Yang, J., Wei, Xia, Wang, Bai & Xia, 2025). Studies indicate that in certain areas residents are exposed to noise levels in excess of 55dB around the clock (Ozkurt, Hamamci & Sari, 2015). In places, the average noise intensity is 72 dB and the peak is 95 dB, which directly translates into impaired quality of life and health, stress, hypertension, irritation and anxiety (Josimović, Krunić & Nenković-Riznić, 2016; Püschel & Evangelinos, 2012; Schreckenberg, Meis, Kahl, Peschel & Eikmann, 2010; Lawton & Fujiwara, 2016). Importantly, the negative impact of noise is not only observable among humans, but also among fauna living in peri-airport areas, including birds and bats (Dominoni, Greif, Nemeth & Brumm, 2016; Wang, Gao, Li, Deng, Zhou, Li, Zhou, Luo, Liang, Liu, Wu, Jing & Feng, 2022).

Taking these factors into account, it is essential to effectively monitor and then manage noise and take preventive action. Aircraft noise propagation is a phenomenon that can be mathematically modelled based on current noise distribution data (Liu, Sun, Tang, Fan, Lv, Fu, Feng & Zeng, 2025) or on publicly available aircraft certification (Andreana, Grampella, Martini & Scotti, 2024). Therefore, airport upgrades and expansions should be preceded by relevant studies. Particularly in cases where airports are located in urban areas. However, there are no clear guidelines for noise mitigation measures (Heyes, Hooper, Raje & Sheppard, 2021). Studies indicate that stakeholder engagement and effective airport stakeholder communication can result in improved noise management performance (Heyes, Hooper, Raje & Sheppard, 2021). Other researchers hypothesise that the effect of aviation noise mitigation should be the product of several components, that is, land-use planning and zoning, operational procedures, including take-offs and landings, and aircraft operating restrictions (Netjasov, 2012; Xie, Zhu, & Lee, 2023; Behere & Mavris, 2021. In addition, one of the solutions at some airports has been the introduction of curfews, when no aircraft operations take place at certain times, usually between 23:00 at night and 5:00 in the morning. Such a measure has been taken at WAW or BER airports, among others (Warsaw Chopin Airport; Aviation Market).

In summary, the state of knowledge to date indicates that aircraft noise is one of the most significant negative impacts of air transport on the environment. Studies confirm its detrimental impact on the health and quality of life of residents of peri-airport areas, property values and the functioning of fauna. At the same time, the literature shows that this phenomenon can be effectively monitored and modelled, which provides a basis for implementing measures to reduce its scale. This indicates that effective noise management should be based on an integrated approach, including both spatial and operational solutions and operational constraints.

3 Methods

3.1 Research Area

The research area of this paper was the Szczecin-Goleniów NSZZ Solidarność Regional Airport, serving both domestic and international traffic. The airport began operations in 1954 1955 as a military facility, equipped with a single runway with initial dimensions of 1800 m long and 45 m wide, and appropriate technical infrastructure including taxiways and parking stands. In 1967, civilian passenger traffic was transferred here from the Szczecin-Dąbie airport, with the launch of regular LOT Polish Airlines flights to Warsaw, Gdańsk, Katowice and Kraków. The transformation of the airport from a military to a civilian one necessitated the modernisation of the infrastructure, as a result of which the runway was extended to 2,500 m and widened to 60 m. In 1998, the management company Port Lotniczy Szczecin-Goleniów Sp. z o.o. was established, which sealed the change of the airport's character to a fully civilian one.

According to estimates, the airport covers a population of around 1.6 million. The airport has a 2,500 m long and 60 m wide runway and aprons with areas of respectively: 17,500 m², 28,500 m², 9,500 m² and 11,000 m². The passenger terminal has an area of 2,600 m² and two separate arrival halls (Schengen and non-Schengen), allowing up to 500 passengers per hour to be checked in. The airport has six parking stands for category C aircraft. The distance of the airport from Goleniów is approximately 5 km, while from Szczecin it is 24 km as the crow flies (approximately 40 km by public road).

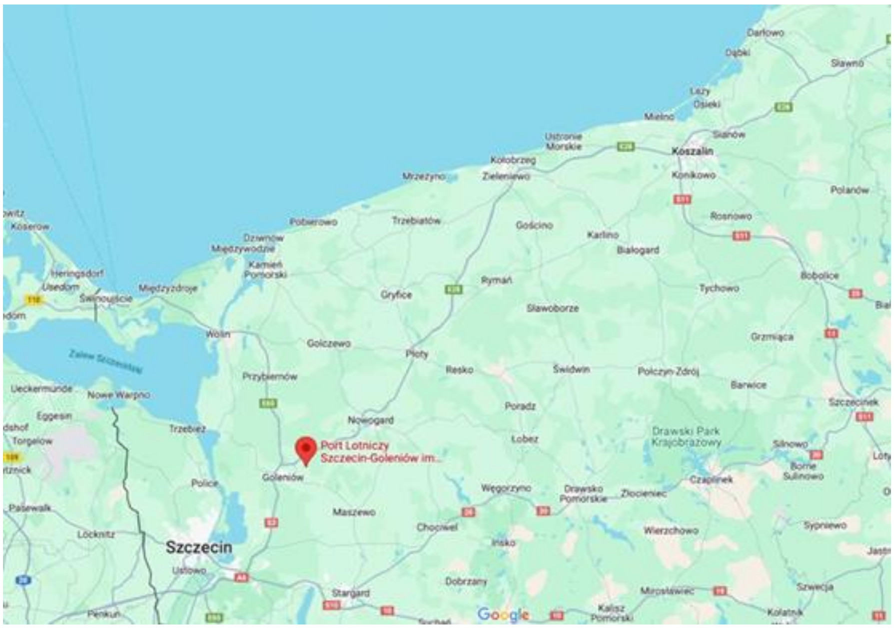

Figure 1. Location of Szczecin-Goleniów Airport

According to the Civil Aviation Authority, Polish airports handled a total of 59.2 million passengers in 2024, an increase of 13.3% on the previous year. Szczecin-Goleniów Airport handled 479,119 passengers during this period, representing approximately 1% of the nationwide passenger traffic and an increase of 0.3% on the previous year [ULC]. The dominant segment of traffic at Goleniów Airport remains that of low-cost carriers ('low-cost'). The tables below show the flight schedule of the Szczecin-Goleniów Airport as at 10.03.2026.

Must be listed at the end of the paper. Indicate references by (Van der Geer, Hanraads, & Lupton, 2000) or (Strunk & White, 1979) in the text. All tables should be numbered with Arabic numerals. Every table should have a caption. Headings should be placed above tables, left justified. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded into the text and not supplied separately. Below is an example which the authors may find useful.

Table 1. Arrivals as at 10.03

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8:15 Warsaw	8:15 Warsaw	8:15 Warsaw	8:15 Warsaw	8:15 Warsaw	8:15 Warsaw	10:20 Oslo Gardermoen
9:50 London Stansted	14:35 Warsaw	14:15 Warsaw	14:35 Warsaw	10:20 Oslo Gardermoen	14:25 Dublin	11:30 Dublin
10:20 Oslo Gardermoen	20:30 Warsaw	16:40 London Stansted	17:25 London Stansted	14:15 Warsaw	14:35 Warsaw	14:15 Warsaw
14:15 Warsaw		20:30 Warsaw	20:30 Warsaw	17:20 London Stansted	15:50 Liverpool	15:20 London Stansted
20:30 Warsaw			22:10 Dublin	20:30 Warsaw	22:15 London Stansted	20:30 Warsaw
21:10 Liverpool				22:30 Liverpool		

It can be seen that the network of connections varies considerably from one day of the week to the next. Arrival and departure times for the same connections also change. The days with the highest traffic are Monday and Friday, while the fewest flights take place on Tuesdays.

Table 2. Departures as at 10.03

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8:55 Warsaw	8:55 Warsaw	8:55 Warsaw	8:55 Warsaw	8:55 Warsaw	8:55 Warsaw	10:55 Oslo Gardermoen
10:15 London Stansted	15:15 Warsaw	14:55 Warsaw	15:15 Warsaw	10:55 Oslo Gardermoen	14:50 Dublin	11:55 Dublin
10:55 Oslo Gardermoen	21:10 Warsaw	17:05 London Stansted	17:50 London Stansted	14:55 Warsaw	15:15 Warsaw	14:55 Warsaw
14:55 Warsaw		21:10 Warsaw	21:10 Warsaw	17:45 London Stansted	16:15 Liverpool	15:45 London Stansted
21:10 Warsaw			22:35 Dublin	21:10 Warsaw	22:40 London Stansted	21:10 Warsaw
21:35 Liverpool					22:55 Liverpool	

3.2 Measurement Tools

In order to realise the objective of the study, the AS - 200 sound meter was used. The meter is primarily intended for the measurement of noise generated by motor vehicles at standstill and in motion. It can also be used to assess the loudness of other sound signals (S&K Servive..., 2026).

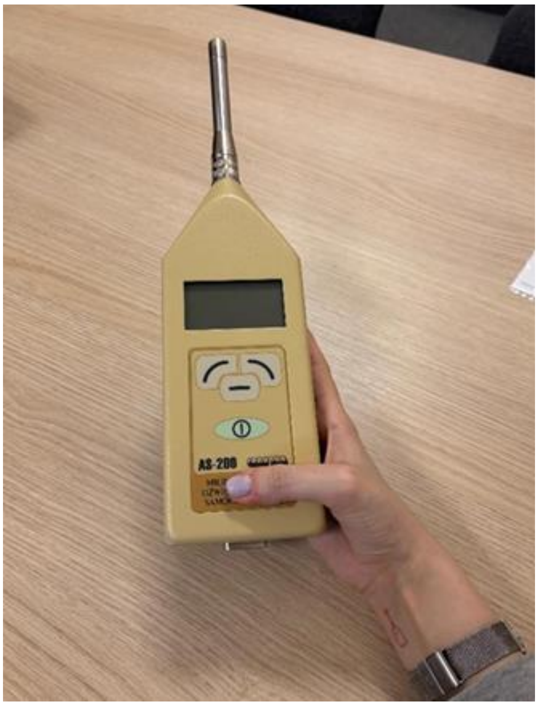

Figure 2. AS - 200 sound meter

3.3 Research Period

Measurements using the AS 200 detector were conducted continuously for over an hour, from 2:20 p.m. to 3:40 p.m. on March 10, 2026. The measurement period was selected to collect data covering all airport operations during aircraft arrivals and departures, which made it possible to determine noise intensity peaks and the contribution of individual sound categories. The measurement period covered flight connections Warsaw-Szczecin and Szczecin-Warsaw operated by Embraer 175 aircraft, a narrow-body, twin-engine aircraft with a range of up to 3,300 km, able to take 82 passengers on board in a 2+2 seating configuration. According to the carrier's declaration, the aircraft meets current noise standards (PLL Lot).

3.4 Limitations

The research methodology used is subject to the limitations of the requstry introduced by the Ministry of Environment on the permissible levels of noise in the environment caused by aircraft take-offs, landings and overflights (Table 3).

Table 3. Permissible noise levels

Lp.	Terrain type	Reference period equal to all days of the year	Night reference period
1.	(a) 'A' spa protection zone (b) Hospital, nursing home area (c) Areas of buildings relating to the permanent or temporary residence of children and young people	55	45
2.	a) Areas for single- and multi-family residential buildings, farm buildings and collective residential buildings b) Recreational and leisure areas c) Residential and service areas d) Areas in the inner city zone of cities with more than 100,000 inhabitants	60	50

Therefore, noise intensity data can be analysed through the prism of restrictions introduced by the Ministry of the Environment.

4 Research results

The first measurements started when no transport processes were taking place at the airport and no means of air transport was identified. The noise emission level was then 50.20 dB. The highest noise recorded was when the engine of an aircraft was started and preparing for departure. Detailed measurements of all processes are shown in Table 4.

Table 4. Schedule of noise measurements at Szczecin-Goleniów Airport

Time	Situation description	Noise level (dB)
14:20	No aircraft at the airport	50,20
14:32	Aircraft arrival - landing proces	59,10
14.38	Aircraft arrival - taxiing	67,60
15:05	Commencement of preparatory work for take-off - starting of aircraft engine	83,70
15:25	Aircraft departure - taxiing	63,80
15:30	Aircraft departure - climbing in air	61,00
15:30	Aircraft departure - distance approx. 5 km from airport	54,50

The aim of the study was to determine the impact of air transport on acceptable noise levels in urban agglomerations. Based on the analysis of data on the degree of noise levels identified in a logarithmic manner, the energy average of noise levels can be determined based on the formula:

$$L_{avg} = 10 \log_{10}\left(\frac{1}{n}\sum_{i=1}^{n} 10^{\frac{Li}{10}}\right) \quad (1)$$

Where:
L_{avg} – average equivalent sound level (dB),
L_i – sound level of the i-th measurement,
n – number of all measurements.
In summary, the measurement result of the study is: Lavg≈ 74.3 dB. Although most of the measured values were identified in the 50 - 65 dB range, the recorded value of 83.7 significantly raises the average.

Another important issue considering the operation of Airports is the analysis of the extremes, where in the presented research it can be assumed that the minimum is 50.2 dB (acoustic background), while the maximum is 83.7 dB (engine start-up). Thus, according to the formula, the difference is:

$$\Delta L = 33{,}5 \mathrm{dB} \tag{2}$$

This means more than two thousand times more acoustic energy by the prism of the logarithmic scale.
A significant decrease in noise was also observed associated with the distance of the air vehicle from the Port. On take-off, the measurement showed noise in the 61 dB range. When the aircraft moved 5 km away from the airport, the measurement dropped by 6.5 dB (it was then 54.5 dB). Another important aspect of the study was the observation of noise nuisance exceedances in line with mobility policy and criteria set by state organisations. Assuming the thresholds of the beginning of noise annoyance - 55 dB and of high annoyance - 60 dB, it can be assumed that as much as 57% of the measured values have a clearly annoying character for the inhabitants of urban agglomerations.
Noise level measurements carried out at the airport indicate significant differentiation of sound intensity depending on the phase of flight operations. The recorded values range from 50.2 dB, corresponding to the background sound level, to 83.7 dB in the case of aircraft engine start-up. The calculated average equivalent sound level of approximately 74.3 dB confirms the significant impact of high-intensity events on the overall acoustic balance of the environment. A characteristic feature of the situation analysed is the occurrence of impulsive noise associated with single aircraft operations such as take-off, landing and engine start-up. This type of noise is particularly troublesome for humans, as it causes sudden changes in sound intensity that are more perceptible than noise with a constant level. The analysis showed that, in most cases, the noise level exceeds the threshold of perceived annoyance (55 dB) and, in some observations, reaches values considered high (65 dB).
In addition, the observed decrease in noise levels with increasing distance from the source, of around 6.5 dB over a distance of several kilometres, confirms compliance with theoretical acoustic wave propagation models. At the same time, this indicates that the impact of the airport is not only limited to its immediate surroundings, but also covers significant areas of adjacent urbanised areas.
In the context of functioning urban agglomerations, the presence of an airport is an important factor shaping the spatial structure and living conditions of the inhabitants. High noise levels lead to restrictions in spatial development, particularly with regard to the location of residential buildings, and necessitate the use of solutions that minimise acoustic impact, such as isolating buildings or designating restricted-use zones. The results obtained indicate that short-lasting but intense acoustic events, which determine to the greatest extent the human perception of the sound environment, are of key importance for the assessment of air noise nuisance.

5 Conclusion

The analysis of the noise surveys and measurements confirms that air transport generates significant acoustic impacts in urban areas, including high levels of short-term impulsive noise. This is associated with take-off, landing and engine start-up operations. The calculated average equivalent noise level and frequent exceedances of nuisance thresholds indicate that the impact of the airport extends beyond its immediate surroundings, covering a significant part of the urban agglomeration and potentially affecting the living comfort of residents.

Literature results and field measurements suggest that public acceptance of airport operations is strongly related to the intensity and frequency of nuisance acoustic events. Effective minimisation of the negative effects of air transport requires the implementation of technological (e.g. quieter engines, acoustic screening) and planning solutions (protection zones, appropriate location of buildings), as well as active participation of the local community in decision-making processes.
The results emphasise that a holistic approach combining environmental and social aspects is necessary for the sustainable development of air transport, which will enable both the functioning of the aviation infrastructure and the preservation of the quality of life of the inhabitants of cities and regions with heavy air traffic.

References

Andreana, G., Grampella, M., Martini, G., & Scotti, D. (2024). Airport noise assessment and mitigation: A simple and flexible methodology. Case Studies on Transport Policy, 17, 101240

Barczak, A. (2016). Wykorzystanie analizy harmonicznej w procesie prognozowania ruchu pasażerskiego w transporcie lotniczym na przykładzie Portu Lotniczego Szczecin-Goleniów. Folia Pomeranae Universitatis Technologiae Stetinensis. Oeconomica, 84

Batóg, J., Foryś, I., Gaca, R., Głuszak, M., & Konowalczuk, J. (2019). Investigating the Impact of Airport Noise and Land Use Restrictions on House Prices: Evidence from Selected Regional Airports in Poland. Sustainability, 11(2), 412

Behere, A., & Mavris, D. N. (2021). Optimization of Takeoff Departure Procedures for Airport Noise Mitigation. Transportation Research Record: Journal of the Transportation Research Board, 2675(9), pp. 81-92

Brown, A. L., & Van Kamp, I. (2017). WHO Environmental Noise Guidelines for the European Region: A Systematic Review of Transport Noise Interventions and Their Impacts on Health. International Journal of Environmental Research and Public Health, 14(8), 873

Cohen, J.P. and Coughlin, C.C. (2008). Spatial hedonic models of airport noise, proximity, and housing prices. Journal of Regional Science, 48, pp. 859-878

Dominoni, D. M., Greif, S., Nemeth, E., & Brumm, H. (2016). Airport noise predicts song timing of European birds. Ecology and Evolution, 6(17), pp. 6151-6159

Drop, N., & Bohdan, A. (2025). Application of the Holt–Winters Model in the Forecasting of Passenger Traffic at Szczecin–Goleniów Airport (Poland). Sustainability, 17(14), 6407

Faulkner, J. P., & Murphy, E. (2022). Estimating the harmful effects of environmental transport noise: An EU study. Science of The Total Environment, 811, 152313.

Heyes, G., Hooper, P., Raje, F., Flindell, I., Dimitriu, D., Galatioto, F., Burtea, N. E., Ohlenforst, B., & Konovalova, O. (2021). The Role of Communication and Engagement in Airport Noise Management. Sustainability, 13(11), 6088

Heyes, G., Hooper, P., Raje, F., & Sheppard, J. (2021). The case for a design-led, end user focused airport noise management process. Transportation Research Part D: Transport and Environment, 95, 102847

Huderek-Glapska, S. (2014). Koszty zewnętrzne transportu lotniczego. Logistyka, 2, pp. 97-105

Josimović, B., Krunić, N., & Nenković-Riznić, M. (2016). The impact of airport noise as part of a Strategic Environmental Assessment, case study: The Tivat (Montenegro) Airport expansion plan. Transportation research part D: transport and environment, 49, pp. 271-279

Koźlak, A. (2020). Mobility-as-a Service jako postęp w integracji transportu. Transport Geography Papers of Polish Geographical Society, 5, pp. 7-17

Kuciaba, E., Kwarciński, T., Milewski, D., & Załoga, E. (2013). Społeczne i ekonomiczne znaczenie transportu regionalnego. Problemy Transportu i Logistyki, 24, pp. 7-27

Kutnik, K., Klamerek, J. (2023). Ekonomia transportu intermodalnego: badanie korzyści ekonomicznych związanych z wykorzystaniem różnych trybów transportu w jednym łańcuchu dostaw. Zarządzanie Innowacyjne W Gospodarce I Biznesie, 2/37, pp. 181-187

Lawton, R. N., & Fujiwara, D. (2016). Living with aircraft noise: Airport proximity, aviation noise and subjective wellbeing in England. Transportation Research Part D: Transport and Environment, 42, pp. 104-118

Liu, J., Sun, S., Tang, K., Fan, X., Lv, J., Fu, Y., Feng, X., & Zeng, L. (2025). IoT Based Airport Noise Perception and Monitoring: Multi-Source Data Fusion, Spatial Distribution Modeling, and Analysis. Sensors, 25(8), 2347

Lotnisko Chopina Warszawa https://www.lotnisko-chopina.pl/pl/aktualnosci-i wydarzenia/0/757/szczegoly.html [dostęp: 20.03.2026]

Netjasov, F. (2012). Contemporary measures for noise reduction in airport surroundings. Applied Acoustics, 73(10), pp. 1076-1085

Ozkurt, N., Hamamci, S. F., & Sari, D. (2015). Estimation of airport noise impacts on public health. A case study of Izmir Adnan Menderes Airport. Transportation Research Part D: Transport and Environment, 36, pp. 152-159

Polskie Linie Lotnicze LOT https://www.lot.com/pl/pl/odkrywaj/o-lot/flota/embraer 175 [dostęp: 10.03.2026]

Port Lotniczy Szczecin-Goleniów im. NSZZ Solidarność https://airport.com.pl/loty/rozklad-przylotow-odlotow/ [dostęp 10.03.2026]

Püschel, R., & Evangelinos, C. (2012). Evaluating noise annoyance cost recovery at Düsseldorf International Airport. Transportation Research Part D: Transport and Environment, 17(8), pp. 598-604

Rynek Lotniczy https://www.rynek-lotniczy.pl/wiadomosci/lot-reaguje-na-problemy anulacje-wybranych-polaczen-nocnych-14909.html [dostęp: 20.03.2026]

Schreckenberg, D., Meis, M., Kahl, C., Peschel, C., & Eikmann, T. (2010). Aircraft Noise and Quality of Life around Frankfurt Airport. International Journal of Environmental Research and Public Health, 7(9), pp. 3382-3405

Sørensen, M., Münzel, T., Brink, M., Roswall, N., Wunderli, J. M., & Foraster, M. (2020). Transport, noise, and health. In Advances in transportation and health, pp. 105 131

S&K Service. Wyposażenie stacji kontroli pokazdów. https://www.skservice.pl/pl/as 200/162/ [dostęp 22.03.2026]

Stoeck, T., & Gołębiewski, W. (2016). Ocena preferencji i zachowań komunikacyjnych pasażerów dojeżdżających do Portu Lotniczego Szczecin-Goleniów. Przegląd Komunikacyjny, (6), 20-24.

Urząd Lotnictwa Cywilnego https://ulc.gov.pl/_download/wg_portow_lotniczych_4kw2024_v2.pdf 20.03.2026]

Wang, W., Gao, H., Li, C., Deng, Y., Zhou, D., Li, Y., Zhou, W., Luo, B., Liang, H., Liu, W., Wu, P., Jing, W., & Feng, J. (2022). Airport noise disturbs foraging behavior of Japanese pipistrelle bats. Ecology and Evolution, 12, 8976

Xie, J., Zhu, L., & Lee, H. M. (2023). Aircraft Noise Reduction Strategies and Analysis of the Effects. International Journal of Environmental Research and Public Health, 20(2), 1352

Yang, J., Wei, L., Xia, Y., Wang, J., Bai, Y., & Xia, Y. (2025). Effects of Long-Term Airport Noise Exposure on Inflammation and Intestinal Flora and Their Metabolites in Mice. Metabolites, 15(4), 251

Zagożdżon, B. (2013). Europejska polityka transportowa a koszty zewnętrzne transportu. Autobusy: technika, eksploatacja, systemy transportowe, 14(6), pp. 12-16

Zheng, X., Peng, W., & Hu, M. (2020). Airport noise and house prices: A quasi experimental design study. Land Use Policy, 90, 104287