

Assessment of Noise Emission Levels and Acoustic Pollution near Tirana International Airport "Mother Teresa", Albania

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Abstract

Air transportation is one of the most important sources of noise and acoustic pollution related with the life quality of population, especially in urban areas. The study was conducted during the period January-June 2018, in Qereka, the nearest village to the Tirana International Airport "Mother Teresa". There were measured noise levels ($L_{Aeq/Day}$, $L_{Aeq/Evening}$, and $L_{Aeq/Night}$) in three building clusters on different distances from the airport runway axis. Observed results showed that $L_{Aeq/Day}$ varied from 47.7 dB to 62.8 dB, and L_{Amax} varied from 77.8 dB to 97.9 dB, with 24 to 47 cases over 70 dB. $L_{Aeq/Evening}$ varied from 43 dB to 59.9 dB, while L_{Amax} varied from 80.8 dB to 89.7 dB, with 10 to 13 cases over 70 dB. $L_{Aeq/Night}$ varied from 40.3 dB to 55.9 dB, while L_{Amax} varied from 72.8 dB to 102.2 dB, with 3 to 10 cases over 70 dB. Results of the population interviews showed that the noise from air transport affects the quality of daily living activities of the residential area, mainly with sleep disturbances (87.1%), hearing problems (93%), communication interference (87.8%), irritability (64.8%), headache (56.9%), and signs of hypertension (32.1%). There was recommended reducing the noise impact in the residential areas and the neighborhoods of the Tirana International Airport "Mother Teresa", applying the recommended standards of WHO, EU, and Albanian standards for noise level in residential areas, regular monitoring of noise emission, compensation of noise impact, improvement of aircraft fleet, etc., in order to minimize the impact in the affected community.

Keywords

acoustic pollution, air transport, health problems, noise, TIA (Tirana International Airport)

1. Introduction

Noise is an important public health issue. It has negative impacts on human health and well-being and is a growing concern [1]. Environmental noise is defined as: "an unwanted and harmful external sound caused by human activities, including noise emitted by vehicles, road traffic, rail traffic, air traffic and industrial activities to which people are exposed "in particular in residential areas, public parks or other quiet enclosed areas, in quiet areas in open areas, near schools, hospitals and other noise-sensitive areas and buildings" [2]. It is the sound which causes any kind of negative effect of biological, social, psychological, behavioral and performance nature, on human health and well-being [3], which lead to a loss of productivity of workers, put a burden on health care systems and cause a substantial depreciation of real-estate value [4; 5]. The analysis of newer surveys (2000–2014) on annoyance due to traffic noise shows statistically significant correlations between noise levels and annoyance scores with moderate strength of the relationship [6]. WHO [7] at the "Night Noise Guidelines" noticed the relations between aircraft noise, sleep quality and health of human and animals. Rocha *et al.* [8] report that the outdoor nighttime aircraft noise around Atlanta International Airport was significantly

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associated with lower sleep quality, increased prevalence of being highly sleep disturbed and highly annoyed by aircraft noise. L_{night} was associated with several coping behaviors. Residents were more likely to report often or always closing their windows, consuming alcohol, watching TV and using music as sleep aids. The European Environment Agency [EEA] [9] reports that with the increase of $L_{\text{night, outside}}$ (aircraft) from 30-40 to 40-55, and >55 dB, the awakening increases from 2.5 to 25, 50, 75 and 97.75%. The long term noise exposure, either directly or indirectly, affects the autonomous nervous system, respiratory system and the endocrine system, changes in blood pressure and heart rate, arteriosclerosis, hypertension, Ischemic Heart Disease (IHD) (including myocardial infarction), and other diseases, which may be with chronic or acute effects.

According to the International Civil Aviation Organization [ICAO] [10], although aircraft being produced nowadays are 75% much quieter than those manufactured 50 years ago, aircraft noise remains the most significant cause of adverse community reaction related to the operation and expansion of airports worldwide. This outlook reviews the tremendous progress being made in aircraft noise technology and the projected trends of aircraft noise through the year 2036.

According to WHO Regional Office for Europe [11], critical health outcomes for exposure to high levels of noise produced by aircraft traffic (average/night time) for general population are related to cardiovascular disease, annoyance, cognitive impairment, hearing impairment and tinnitus, adverse birth outcomes, quality of life, well-being and mental health, metabolic outcomes, as well as effects on sleep for night noise exposure. It is estimated that around 3.2 million people were highly annoyed by aircraft noise, and 1.4 million suffered from high sleep disturbance in 2017 around the 47 major European airports [12]. Recent years have seen an increase in the strength of the evidence linking environmental noise exposure (road, rail, airport and industrial noise) to health [13].

2. Materials and Methods

The study was conducted during the period January-June 2018 in Qereka village, the nearest inhabited area of TIA. Three noise levels, such as $L_{\text{Aeq/Day}}$ (06:00-19:00), $L_{\text{Aeq/Evening}}$ (19:00-23:00), and $L_{\text{Aeq/Night}}$ (23:00-07:00), which are the most daily life and health concerns of the community due to noise emitted by the air transport, in three building clusters on different distances from the airport runway axis, such as: 300 m direct exposition (1), 300 m indirect exposition (2), and at the passengers' bus platform (3) were measured.

A Sound Level Meter (SLM) EXTECH 407764 RS232 / Data logger device, with a memory of 16 Kbit (16000 thousand measurements), and an error correction of ± 1.5 dB (A), and a calibrator OSHA Type GenRad 1562-A, were used for the noise level measurements. Measurements were made under normal climate conditions, such as lack of precipitation, fog and snow, and wind speed less than 5 m/s. The microphone was protected with anti-wind headphones. The apparatus was recorded to make 1 measurement in 6 seconds in order to catch the current value every 6 seconds, regularly for 24 hours. Estec SoundMeter - software that accompanies the device and reads and converts data for further use.

A questionnaire related to the information and public perception on acoustic pollution coming from the air transport was carried out with the population living on 75 families, 25 families for each cluster. Cluster 1: 25 families located 300 m with direct exposition (1); Cluster 2: 25 families located 300 m with indirect exposition (2), and Cluster 3: 25 families located over 300 m with direct and indirect exposition from the airport runway axis. Seventy-five questionnaires were completed.

Observed data were subject of the SPSS software processing [14] and the mean data were presented as a matrix and graphically (not shown).

3. Results and Discussion

Tirana International Airport "Mother Teresa" is the only operating airport used for civic transportation in Albania, since 1957. Airport Operator since April 23rd, 2005, is Tirana International Airport SHPK, and since December 18, 2020, Kastrati Group SHA is the only shareholder with 100% for BOOT-Concession (Build, Own, Operate, Transfer) until 2040 [15]. Data from the airport webpage show that, for the period 2005-2017, the mobility or traffic movements raised by 83.6% (from 15,400

to 28,270), while the passengers number was raised by 375%, or from 785000 (in 2005) to 3 338 147 (in 2019) (Table 1) [15].

Table 1

Facts and figures about the TIA “Mother Teresa”, modified by the authors

Traffic data	2005	2010	2015	2017	2018	2019
Passengers	785000	1536822	1977044	2630338	2947172	3338147
Aircraft movements	15400	20768	20876	24582	25426	28270
Cargo (in tons)	2000	2355	2229	2266	2249	2372
Airport employees	200	312	310	340	377	567
Employees of other companies at the airport	560	700	700	700	700	700

Since 2006, the Tirana International Airport “Mother Teresa” is publishing the Environmental and Social Bulletin [16-20], were, among others, starting from 2009, there are shown the noise levels measured during three periodical intervals [$L_{Aeq/Day}$ (06:00-19:00), $L_{Aeq/Evening}$ (19:00-23:00), and $L_{Aeq/Night}$ (23:00-07:00)], according to the EU Directives [21], WHO [7; 2018], and the Albanian legislation [22], etc. (Table 2).

Table 2

TIA noise-monitoring data of L_{Aeq} and L_{Amax} 2015-2019, modified by the authors

Instrument location	Time	2015		2016		2017		2018		2018	
		L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}
TIA North CR: 243/4	Day	58.3	89.7	63.1	92.2	63.7	94.6	58.3	89.7	63.8	110
	Evening	50.4	90.7	53.3	88.9	56.2	88.8	50.4	90.7	61.8	88.9
	Night	47.7	86.9	49.3	91.2	52.2	89.6	47.7	86.9	57.5	91.2
TIA North CR: 243/4	Day	59.4	93.5	88.9	91.8	63.1	91.3	59.4	93.5	88.9	113.1
	Evening	52.1	86.5	91.2	91.2	53.3	84.5	52.1	86.5	91.2	91.2
	Night	46.5	84.2	60.1	88.3	53.7	86.9	46.5	84.2	64.9	88.3

There were measured noise levels ($L_{Aeq/Day}$, $L_{Aeq/Evening}$, and $L_{Aeq/Night}$) in three building clusters on different distances, as was mentioned above. Observed results (mean values) showed that $L_{Aeq/Day}$ varied from 47.7 dB to 62.8 dB and L_{Amax} 77.8 dB to 97.9 dB, with 24 to 47 cases over 70 dB. $L_{Aeq/Evening}$ varied from 43 dB to 59.9 dB. L_{Amax} varied from 80.8 dB to 89.7 dB, with 10 to 13 cases over 70 dB. $L_{Aeq/Night}$ varied from 40.3 dB to 55.9 dB, L_{Amax} 72.8 dB to 102.2 dB, with 3 cases (on cluster 2 buildings) to 10 cases over 70 dB (Table 3).

Table 3

$L_{Aeq/Day}$, $L_{Aeq/Evening}$ and $L_{Aeq/Night}$ measured in three different clusters (mean values)

Instrument location	Time	L_{Aeq} (dB)	L_{Amax} (dB)	Cases >70 dB
Cluster 1	Day	48.7	87.4	47
	Evening	43	80.9	10
	Night	41.4	81.7	10
Cluster 2	Day	47.7	77.8	24
	Evening	43	80.8	10
	Night	40.3	72.8	3
Cluster 3	Day	62.8	97.9	25
	Evening	59.9	89.7	13
	Night	55.9	101.2	10

There were observed in total 152 cases over 70 dB. Although the obtained mean values of $L_{Aeq/Day}$ and $L_{Aeq/Evening}$ presented by TIA for the period 2015-2019 and several values of monitoring were found to be within or closed to the Albanian limits for industrial areas [22], based on WHO standards, these values are above the levels adopted in the EU [9], WHO Regional Office for Europe [1; 11] that cause problems in the psychosocial dimension and in the quality of life.

Related to the information and public perception on acoustic pollution coming from the air transport, seventy-five questionnaires were completed. The total population of 75 families under study was 443 individuals, from which 90 individuals or 20.3% of the population were children under 7. Forty-five families or 60% of the total had 1 to 3 children under 7 (32, 24, and 34 children, respectively), from which 56 children belong to cluster 1 and 2, directly or indirectly exposed to the aircraft noise. Results of the population interviews showed that the noise from air transport affects the quality of daily living activities of the residential area, mainly with sleep disturbances (87.1%), hearing problems (93%), communication interference (87.8%), irritability (60%), headache (46%), and signs of arterial hypertension (AH) (23%) (Table 4).

Table 4
Concerns in the dwelling and community as a result of aircraft noise

Cluster	No of population	Sleeping disturbance	Hearing problems	Communic. interference	Irritability	Headache	Signs of AH
1	123	117	123	121	115	112	79
2	144	132	138	137	97	87	37
3	176	137	151	131	75	56	26
Total	443	386	412	389	287	252	142
%	100	87.1	93	87.8	64.8	56.9	32.1

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5. References

- [1] WHO Regional Office for Europe (World Health Organization, Regional Office for Europe), Environmental Noise Guidelines for the European Region. Executive Summary (2018/a): https://www.euro.who.int/__data/assets/pdf_file/0009/383922/noise-guidelines-exec-sum-eng.pdf
- [2] PHI (Public Health Institute), Assessment of the prevalence of sleep disorders and population annoyance from urban traffic noise, in the main cities of Albania (2015/a): <http://www.ishp.gov.al/wp-content/uploads/2015/04/Raporti-i-vleresimit-te-crrregullimeve-te-gjumit-dhe-bezdisjes-sepopullates-nga-zhurma-e-trafikut-rrugor.pdf>
- [3] PHI (Public Health Institute), Urban Noise Monitoring, 2014. Final Report (2015/b): 3-4. <http://www.ishp.gov.al/wp-content/uploads/2015/04/Raporti-MONITORIMI-I-ZHURMAVE-URBANE-2014.pdf>.
- [4] EU (European Union) 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 (2002): <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0049&from=EN>
- [5] M. Basner, C. Clark, A. Hansell, J. I. Hileman, S. Janssen, K. Shepherd, V. Sparrow, Aviation Noise Impacts: State of the Science. *Noise & Health*, 2017 Mar-Apr, 19(87) (2017): 41–50 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5437751/#ref28>
- [6] R. Guski, D. Schreckenber, R. Schuemer, Review: WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance.

- International Journal of Environmental Research and Public Health, Dec. 2017, 14(12) (2017): 1539, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750957/pdf/ijerph-14-01539.pdf>
- [7] WHO Regional Office for Europe, Night noise guidelines for Europe. Copenhagen: World Health Organization (2009): www.euro.who.int/Document/E92845.pdf
- [8] S. Rocha, M. G. Smith, M. Witte, M. Basner, Survey Results of a Pilot Sleep Study Near Atlanta International Airport. *Int. J Environ Res Public Health*. 2019 Nov, 16(22) (2019): 4321, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6888482/pdf/ijerph-16-04321.pdf>
- [9] European Environment Agency (EEA), EEA Technical Report: Good practice guide on noise exposure and potential health effects. 36 pp. (2010) Pp: 6-16, 24, 32, 34. ISSN 1725-2237. <https://www.eea.europa.eu/publications/good-practice-guide-on-noise>
- [10] ICAO (International Civil Aviation Organization), Environmental Technical Manual, Volume I – Procedures for the Noise Certification of Aircraft. Doc 9501, AN/929. Order Number: 9501-1 (2018). https://www.icao.int/environmental-protection/Documents/SGAR_2018_ETM_Vol_I.pdf
- [11] WHO Regional Office for Europe, Environmental Noise Guidelines for the European Region. © World Health Organization (2018): Pp: 61-76. ISBN: 978-92-890-5356-3. https://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf?ua=1
- [12] EEA & EASA & Euro-Control (European Environmental Agency & European Union Aviation Safety Agency & Euro-Control), European Aviation Environmental Report 2019 (2020): Pp. 19-21. <https://ec.europa.eu/transport/sites/transport/files/2019-aviation-environmental-report.pdf>
- [13] C. Clark, Aircraft noise effects on health. Queen Mary University of London (2015): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/446311/noise-aircraft-noise-effects-on-health.pdf
- [14] P. Lekaj, B. Gjini, E. Ozuni, S. Mustafa, Microsoft Excel Computer Applications. Agricultural University of Tirana (2014): 212-218. ISBN 978-9928-07-296-2.
- [15] Tirana International Airport, Facts and Figures about Tirana International Airport Nënë Tereza (2021): <https://www.tirana-airport.com/l/7/53/company-information/facts-figures/>
- [16] TIA (Tirana International Airport), Fourteenth Environmental and Social Bulletin (2020): 12-13. https://www.tirana-airport.com/media/15948212866603Environment_Social_Bulletin_2020.pdf
- [17] TIA (Tirana International Airport), Thirteenth Environmental and Social Bulletin (2019): 12-13. https://www.tirana-airport.com/media/15759718685614Environment_Social_Bulletin_2019.pdf
- [18] TIA (Tirana International Airport), Twelfth Environmental and Social Bulletin (2018): 12-13. <https://www.tirana-airport.com/media/15426432557912EnvironmentSocialBulletin2018.pdf>
- [19] TIA (Tirana International Airport), Eleventh Environmental and Social Bulletin (2017). 13-14. <https://www.tirana-airport.com/media/15102388478311EnvironmentandSocialBuletin2017.pdf>
- [20] TIA (Tirana International Airport), Tenth Environmental and Social Bulletin (2016). 13-15. <https://www.tirana-airport.com/media/14756629791701EnvironmentandSocialBulletinYear2016.pdf>
- [21] EU (European Union), 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. (2002): <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0049&from=EN>.
- [22] MoEFWA & MoH (Minister of Environment, Forest and Water Administration & Minister of Health) Guideline No. 8, dated 27.11.2007, On noise limit levels in certain environments (2007): <http://extwprlegs1.fao.org/docs/pdf/alb89117.pdf>.