Case Study - Iasi Airport

This case study provides an overview of the previous, current and proposed practices of Iasi Airport, as a part of their Noise Management Strategies.

The structure of the case study is constructed such that the actions and interventions accomplished by Iasi Airport, are presented in a descriptive and detailed manner with the purpose of emphasising lesson learning and good practices.

All information used for the development of this case study was gathered from the airport, interviews with relevant stakeholders and online sources. Interviews included airport representatives, ANSPs (Air Navigation Service Providers), the CAA (Civil Aviation Authority) and relevant National Ministries (Environment, Transport). The interview findings were correlated with all other available information and included within the case study. Most of the topics of the interviews were formulated around the knowledge, understanding and application of ICAO Balanced Approach, together with further actions designed to reduce and mitigate noise and its effects.

The target audience of the case study includes airport operators and several other relevant stakeholders such as Air Navigation Service Providers, Civil Aviation Authorities, aircraft operators, environmental and government organisations and other interested parties.

Background information

Overview of the Romanian air traffic on all Romanian Airports

According to the latest statistics developed for the interval 1 January 2017 – 30 September 2018, passenger air transport in Romania increased from 154 14,9 thousands of passengers to 166 22 thousands of passengers. It is an 7.8% increase. Cargo, including mail, increased by 11.5%, from 32267 tons to 35986 tones.

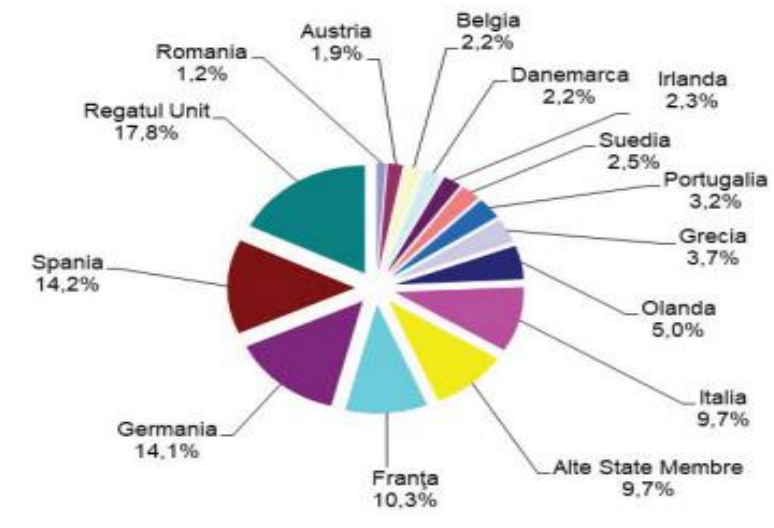

Figure 3.1 - Passenger air transport in Member States during 1 January 2017 – 30 September 2018 [1]

Four macroregions have been developed for the analysis of air traffic on all Romanian Airports by taking into account the regions of development and the counties where the airports are located. Therefore, the following four categories have been formulated:

- The first macroregion: Bihor, Cluj, Satu Mare (North-West); Mures, Sibiu (Centre);
- The second macroregion: Bacau, Iasi, Suceava (North-East); Constanta, Tulcea (South-East);
- The third macroregion: Ilfov (Bucharest-Ilfov);
- The fourth macroregion: Dolj (South-West Oltenia); Arad, Timis (West).

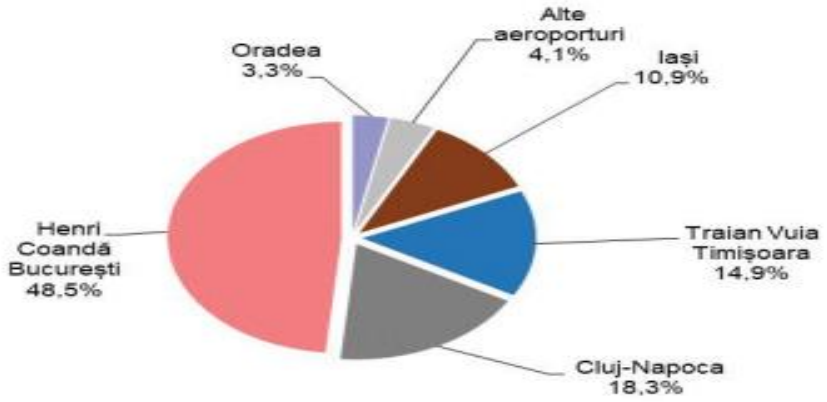

Figure 3.2 - The structure of embarked passengers within domestic transport in the interval 01 Jan. 2017 – 30 Sept. 2018 [1]

Iasi Airport background information

Iasi Airport is located in the North East of Romania (121 m altitude), on a hill of approximately 180 m height and at 8 km from the centre of Iasi city, on its North East side. Since 1905, the area was used for aeronautic activities, supported by the Royal House, thus it is one of the oldest certified Romanian Airports.

Immediate surroundings include the Ciric forest, together with Aroneanu, Dorobant and Valea Lunga villages. The overall North-Eastern Region, including Bacau, Botosani, Neamt, Suceava and Vaslui Counties, has an approximate number of 3.8 million residents.

Iasi Airport had the highest percentual increase from all Romanian regional airports in 2018. Air traffic growth is accelerated, as it increases from a number of approximately 200,000 passengers in 2012, to one million passengers in 2017. Initial forecasts estimated one million passengers to be reached five years after the new runway was put in use, yet the number was achieved two years earlier. Predictions for 2019 estimate an approximate number of 150,000 passengers in each summer month, having at least 100,000 passengers in the rest of the year.

The estimated number of passengers for 2019 is around one and a half million passengers. In line with this forecast, terminal T1 was re-opened in order to manage some of the external traffic handled by the terminal T3. This is only a temporary solution until the new major airport development plan will be implemented. Forecasts for the next 4-5 years estimate reaching the number of two million passengers.

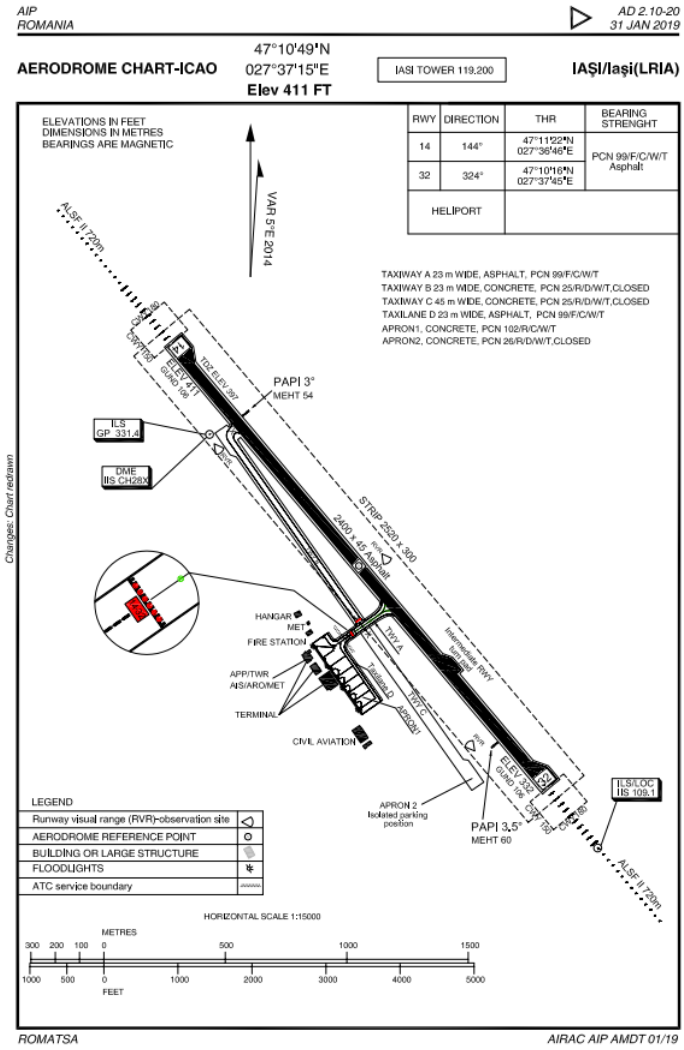

Figure 3.3 – Aerodrome Chart – ICAO [2]

Table 3.1 - General Airport Information [2]

Name of the company	R.A. AEROPORTUL IASI
Aerodrome location indicator and name	LRIA – IASI/ Iasi
Aerodrome geographical and administrative data	
Direction and distance from the city	3.48 km East from Iasi city; 8 km NE from the centre of Iasi city
Elevation	Approx. 400 FT (411 FT according to AIP)
Reference temperature	28.7° C
AD Administration	R.A. Aeroportul Iasi
Types of traffic permitted (IFR/VFR)	IFR/VFR

Passenger facilities	
Transportation	Buses, taxis and rent-a-car on the airport.
Radio navigation and landing aids	
Type	LOC 15 (ILS CAT II) GP 15, DME 15 NDB, MKR, LM

Table 3.2 – General Airport and Air Traffic Information [3]

Total number of passengers	1,256,640 in 2018 (10% increase from 2017; 43% increase from 2016)
Total number of aircraft movements	12,749 in 2018 (8% increase from 2017)
Flight connections (countries)	12 countries
Flight connections (destinations)	23 destinations

Table 3.3 – Traffic figures in the period 2012-2018 [4][19][20][24]

Year	Number of Passengers
2012	173,248
2013	231,933
2014	273,046
2015	376,858
2016	881,000
2017	1,146,086
2018	1,256,640

New routes have been introduced in 2018, including domestic direct flights to Cluj-Napoca and Timisoara and external flights to over ten European destinations. Further charter flights were introduced during the high season towards Antalya, Rhodos, Corfu and Heraklion. The frequency of flights to Munich, Milan and Turin also increased.

Table 3.4 - Runway Physical Characteristics [2]

RWY Designator	Direction	RWY Dimensions [m]	THR elevation [ft]
14	144°	2400 x 45	THR 411
32	324°	2400 x 45	THR 332

2. Applicable Noise Regulations

The **Environmental Noise Directive (END)** [5] was transposed into the National Legislation in 2005 (**H.G. 321/2005**) [6]. Further updated and modified versions were published through the years, together with the necessary framework for the implementation and evaluation of its provisions. As a main result, the development of Strategic Noise Maps and Action Plans is mandatory for major airports. Romania has only one Major Airport, that being Bucharest Henri Coanda International Airport.

Its alignment to **END** is furthered in 2007 (**H.G. no. 674/2007** [7]), 2012 (**H.G. no.1.260/2012** [8]) and 2016 (**H.G. no. 944/2016** [9]) through modifications and completions done under the provisions of the **Law no. 52/2003** [10] regarding the decisional transparency of the public administration.

A new **Noise Law** [11] was initiated in 2018, transposing the updated version of the **Environmental Noise Directive**, i.e. together with the **Annex of the EU Directive 996/2015** [12] establishing the common methods of noise evaluation at the EU level. The implementation of the **Noise Law** will repeal the previous transposition of the **Environmental Noise Directive**, together with all its subsequent legislation.

Regarding **ICAO Balanced Approach** [13], recent legislative changes include the transposition of the **Regulation (EU) no. 598/2014 of the European Parliament and Council of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC** (August, 2018) [14].

A detailed description of the Romanian Legislative Framework regarding Aviation Noise can be found in Annex (A). Responsible Authorities for aviation noise are detailed in Annex (B).

3. The approach to ICAO Balanced Approach and Noise Management

Iasi Airport does not fulfil the condition of having more than 50,000 movements per year in order to be classified as a Major Airport. Even so, according to the National legislation, it is considered an Urban Airport, thus having the responsibility of developing Strategic Noise Maps and Action Plans.

General Overview

According to the Romanian Aeronautical Information Publication (AIP) [2], **Noise Abatement Procedures** have been introduced since the 31 January 2019 as a mandatory requirement for Iasi Airport. The provisions are formulated both on departure and on the ground. The provisions for departure have not been published yet. For the ground operations, the provisions state that the use of GPU and APU must be limited; the use of reverse thrust should be avoided (especially in the 2300-0600 LT interval) as possible as safe; ATC will approve engine ground operations only at idle speed; engine ground testing permitted only between 0600-2300 LT and only with ATC approval; the Safety Officer on duty decides the location and timing of engine ground testing, for safety reasons.

Land-use planning and management is currently being developed within the Romanian legislative framework on noise.

Operating restrictions [14] have been transposed, compliant to a balanced approach, within the National legislation. At the moment, only Major Airports must apply these

provisions [14], therefore Iasi Airport is not required to become compliant with noise operating restrictions.

Review of Noise Action Plans and previous BA interventions

R.A. AEROPORTUL IASI is the economic operator responsible for the development of noise maps, Strategic Noise Maps and Action Plans.

The development of acoustic maps and, respectively, the evaluation of acoustic pollution, serves, among others, to public informing. After the acoustic mapping, it is necessary to develop action plans through which problems and negative effects generated by sound pollution are to be solved, and if necessary, to reduce the level of ambient noise. The strategic mapping and the reports for the Action Plan construction are meant to support the beneficiary in fulfilling the obligations according to the National legislation (**HG 321/2005** [6]), EC requirements and public informing. Global and individual Strategic Noise Maps were developed for airport activities. No previous noise reduction programmes were developed before 2014.

From the analysis of noise maps, no areas have been identified as potential quiet areas.

Methods used for calculus or measurement

The mapped area is on a calculated distance according to point 21 *"Date privind suprafata care va fi cartata in vederea realizarii hartii de zgomot"* (English: Data regarding the surface that will be mapped for the development of noise maps) from Chapter 3.2 of *"Ghidul privind metodele interimare de calcul a indicatorilor de zgomot pentru zgomotul produs de activitatile din zonele industrial, de traficul rutier, feroviar si aerian din vecinatatea aeroporturilor"* (English: the Guide regarding the interim calculus methods of the noise indicators for noise produced by activities in industrial areas, road, rail and air traffic in the vicinity of airports, approved by *"Ordinul ministrului mediului si gospodaririi apelor, al ministrului transporturilor, constructiilor si turismului, al ministrului sanatatii publice si al ministrului administratiei si internelor, nr. 678/1344/915/1397/2006"* [15] (English: the Order of the Minister of Environment and Water Management, of the Minister of Transport, Construction and Tourism, of the Minister of Public Health and of the Minister of Administration and Internal Affairs, no. 678/1344/915/1397/2006)).

Calculus Methods: According to **HG 321/2005** for the evaluation and management on ambient noise, acoustic pollution of the ambient environment has to be determined and respectively presented through acoustic maps, as a result of acoustic mapping. The method for calculus used is **ECAC.CEAC Doc. 29** [16] *"Report on Standard Method of Computing Noise Contours around Civil Airports"*, 1997, regarding the calculus of noise indicators for noise produced by air traffic around civil airports. From the different approaches of modelling flight paths, it is used the technique of segmentation mentioned in the section 7.5 of **ECAC.CEAC Doc. 29** [16].

This method of computing is implemented in the program CADNA A, produced by DATAKUSTIK GmbH and used by the society ACCON Environmental Consultants S.R.L. in developing Strategic Noise Maps.

According to **ECAC** [16], ground manoeuvres are not taken into consideration as aircraft movements, therefore only take-offs and landings are used.

Therefore, according to [15] Cap 2.3, noise emitted by airport activities (other than the noise produced strictly by aircraft take-off and landing – aircraft movements) inside urban agglomerations and that have under 50,000 aircraft movements/year, are treated as industrial areas when the public administration authorities develop Strategic Noise Maps and the noise emitted by all activities of take-off and landing (aircraft movements) of these

airports are considered separately in the development of Strategic Noise Maps, therefore their mapping will be done separately. Airport activities that can be considered as industrial activities are aircraft engine testing, the use of the main and auxiliary energy generators and motor vehicles used for parking and aircraft fuelling.

Measuring methods: For noise produced by aircraft, **ECAC.CEAC Doc. 29** [16] is used. From the different approaches of modelling flight paths, it is used the technique of segmentation mentioned in the section 7.5 of **ECAC.CEAC Doc. 29** [16].

The methodology used for obtaining the number of residencies and residents exposed to noise is the use of CadnaA v.4.3. ("land-use" module), through which the population was distributed on buildings. The mapping software and its version used is CadnaA4.0 made by DATAKUSTIK.

The distribution of residencies and residents in residential buildings

Starting from the total population of Iasi Agglomeration, it was firstly made a division of it on habitable areas. After these areas were obtained, the buildings with residential character were selected and the non-residential ones were separated (i.e. industrial warehouse, commercial buildings, administrative buildings). Out of these, it was obtained the number of existing residential buildings in each of the defined population areas.

By using the program CadnaA v4.3 (using the object type area "land-use"), the population was distributed on buildings (through the use of Instrument 2 from point no. 18 from [17]).

The total number of the population of Iasi Municipality and of Aroneanu Village was obtained from the website of the National Statistics Institute [18] and it was referring to the census from 2011.

Table 3.5

Instrument 2 [17]: There is no data regarding the number of residents having the residency inside the mapped area (or of any part of this surface) [19]

Method	Complexity	Accuracy	Cost
The number of the total people inside each building within the mapped surface is determined	x	x	x
• An estimation regarding the mean average of the number of people that have the residency within different types of buildings within the mapped zone is done • A limited research of the different types of buildings within the mapped zone and a list of them is developed, and an estimation of the people having the residency within the mapped area is developed afterwards.	x	x	x

The estimation of the number of people exposed to noise for L_{den} and L_{night}

The estimation of the number of people exposed to urban ambient noise is made through the distribution in bands of variation of the values of noise indicators according to **Annex 7 point 1.5 of HG 321/2005** [6], performed separately for different noise sources and also cumulated.

This chapter is completed after obtaining acoustic maps and it contains the evaluations necessary to be transmitted to the European Commission, in compliance with the requirements of **Annex 7, from HG 321/2005** [6].

According to the aforementioned Annex, it is needed to determine the number of residents living in the interior of some noise contours defined by ambient noise. The width of these contours is of 5 dB(A). For the L_{den} indicator for the inferior class, the interval is 55-59 dB(A). For the indicator during the nighttime L_{night} inferior class, is 50-54 dB(A).

For the estimation of the height of buildings, all these data were corroborated with the indications of [17] Cap 3.2 point 22, Instruments 1 and 2, i.e. *"The same height is used for all buildings"* scenario, as well as point 12 ("maps or aerial photographs exist" scenario) Instrument 2 corroborated with the method of considering 6 metres for buildings with one or two floors, 15 metres for buildings with more than two floors, combined with the method through which the height is calculated from the number of floors multiplied by 3 metres.

Table 3.6 - Maximum allowed values and target values for the maximum allowed values for the year 2012

The exposure of the population and of residencies/ building to noise from air traffic at values of L_{den} and L_{night} [19]

Category	No. of people
No. of people (near major airports) exposed to L_{den} 50-54/ 55-59/ 60-64/ 65-69/ 70-74/ >75	0
No. of people (near major airports) exposed to L_{night} 50-54/ 55-59/ 60-64/ 65-69/ >70	0
No. of people (living in residencies with special insulation) exposed to L_{den} 55-59/ 60-64/ 65-69/ 70-74/ >75	0
No. of people (living in residencies with special insulation) exposed to L_{night} 55-59/ 60-64/ 65-69/ >70	0
No. of people (on a quiet façade) exposed to L_{den} 55-59/ 60-64/ 65-69/ 70-74/ >75	0
No. of people (on a quiet façade) exposed to L_{night} 55-59/ 60-64/ 65-69/ >70	0
No. of people (living in residencies with special insulation, noise being from major sources) exposed to L_{den} 55-59/ 60-64/ 65-69/ 70-74/ >75	0
No. of people (living in residencies with special insulation, noise being from major sources) exposed to L_{night} 55-59/ 60-64/ 65-69/ >70	0
No. of people (living in residencies with a quiet façade, noise being from major sources) exposed to L_{den} 55-59/ 60-64/ 65-69/ 70-74/ >75	0

No. of people (living in residencies with a quiet façade, noise being from major sources) exposed to L_{night} 55-59/ 60-64/ 65-69/ >70	0

Apart from the number of residents, it is requested to also determine the number of residencies exposed to noise levels in the previously mentioned noise intervals. The estimated number of residencies affected by ambient noise results from the number of affected residents.

Table 3.7

The estimated number (approximated in hundreds) of residencies, as well as schools and hospitals exposed to ambient noise generated from airport activities. Data from 2014 [19]

Lzsn(Lden) dB(A)		Exposure to ambient noise generated by airport activities, estimated in hundreds						The total surface (in km^2) exposed to the values of the indicator	
		Residencies		Schools, Education		Hospitals, Clinics, Sanatoriums			
Above	Up to	Lzsn	Ln	Lzsn	Ln	Lzsn	Ln	Lzsn	Ln
45.0	49.0	0	0	0	0	0	0	0.9	0.33
50.0	54.0	0	0	0	0	0	0	0.39	0.08
55.0	59.0	0	0	0	0	0	0	0.12	0
60.0	64.0	0	0	0	0	0	0	0	0
65.0	69.0	0	0	0	0	0	0	0 0.1218 (2016)	0
70.0	74.0	0	0	0	0	0	0	0	0
75.0		0	0	0	0	0	0	0	0

Table 3.8 - The estimation of the number of people, residencies and surfaces exposed to values of L_{den} greater than 55, 65 and 75 dB [19]

Category	No. of people
No. of people (living in residencies and surfaces) exposed to Lzsn(L_{den}) 55-59	0
No. of people (living in residencies and surfaces) exposed to Lzsn(L_{den}) 60-64	0
No. of people (living in residencies and surfaces) exposed to Lzsn(L_{den}) 65-69	0
No. of people (living in residencies and surfaces) exposed to Lzsn(L_{den}) 70-74	0
No. of people (living in residencies and surfaces) exposed to Lzsn(L_{den}) >75	0

Data processing

Data used for the development of Strategic Noise Maps and Action Plans include airport coordinates [2]; runway dimensions and physical characteristics [2]; airport plan [2]; air traffic data (airport); data regarding the flight paths and flight profiles [2]; data regarding the number of population, number of residencies and statistical distribution of population; data about the noise level intervals contours; the map with cities; building types and heights. Data regarding the flight paths and flight profiles [2] include the Aerodrome Obstacle Chart, Precision Approach Terrain Chart, Standard Departure Charts and Instrument Approach Charts. All the aforementioned are further processed through the use of BaseOPS (v 7.363) software pack (calculus and prediction) for noise mapping. In addition, NoiseMap – Washmer Consulting (v 4.969) is the software pack used for editing and visualising airport GIS data.

Table 3.9 – Air Traffic Data [20]

Year	Total No. of Movements	No. of Movements (smaller or military aircraft)
2016	10,269	346
2017	11,781	380

Additional input data regarding air traffic that was taken into account during the process of noise mapping refers to the distance between the airport reference point and the runway reference point, the distance between the landing point and the runway reference point, the distance between the take-off point and the runway reference point, the runway length and direction, the ID code for each runway (i.e. RWY14 and RWY32) and the description of the flight path, split in sections, starting with the runway reference point, separated for take-off and landing.

Data with respect to the degree of use of the flight paths was taken into account because the directions used for take-off/landing have a direct influence on the areas affected by noise generated by airport activities.

Table 3.10 - Statistical data with respect to the degree of use of flight paths [20]

RWY	Operation type	2014	2015	2016	2017
RWY14	*Landing*	70.12%	69.34%	68.23%	73.95%
	Take-off	51.40%	53.12%	52.21%	57.37%
RWY32	*Landing*	29.88%	30.66%	31.77%	26.05%
	Take-off	48.60%	46.88%	47.79%	42.63%

Total number of aircraft movements	1.124	6.057	10.269	11.781

Information about aircraft movements was classified according to international aircraft categories defined by **ICAO** [21]. The **distribution of aircraft movements on flight paths** has been provided by the airport and will be presented in the following tables, together with the **distribution of aircraft movements on time intervals** (day, evening, night).

Table 3.11 - The description of airport traffic [19]	
Reference time interval	(366 days = 8748 hours) (the days for the beginning and end of the interval will be mentioned, with the according dates)
Day time	0700-1900 = 12 hours
Evening time	1900-2300 = 4 hours
Nighttime	2300-0700 = 8 hours

Table 3.12 - Emission data for aircraft movements – local time [19]
The number of movements according to the aircraft type

	RWY15			**RWY33**		
Aircraft Type	**Day 07-19**	**Evening 19-23**	**Night 23-07**	**Day 07-19**	**Evening 19-23**	**Night 23-07**
AT45	52	8	6	68	9	0
AT75	12	17	6	19	19	19
DH8D	27	0	0	23	0	0
B733	33	15	2	53	15	4
F70	1	0	0	1	0	0

This data was processed and introduced in the calculi program [15], Cap.2.3.

Noise Maps Description

Acoustic maps were computed with a raster, spatial grid of 10m, at a height of imission of 4m above ground. The reflections from the buildings, acoustic obstacles and the effects of the terrain on noise propagation were taken into consideration.

For the determination of the number of citizens exposed to a certain level of noise, the computation points were placed on the facades of the buildings. For this case, it is not taken into consideration the last reflection on the façade of the building, on which the computing point is situated. Calculi regarding the affected people are done, as well for a height of 4m above ground (see **HG 321/2005** [6]).

Next, Strategic Noise Maps at a scale of 1:10000 will be presented. The colour code for the representation of noise level contours are included in the Action Plans.

Table 3.13 - Aircraft Movements (2016) [20]		
Direction	Movement type	Number of aircraft movements on flight paths
RWY14	ARR	3501
	DEP	2683
RWY32	ARR	1630
	DEP	2455

Table 3.14 - Percentage distribution of aircraft movements on LRIA, according to the type of movement and time interval (2016) [20]			
Movement type	Day time (0700-1900)	Evening (1900-2300)	Nighttime (2300-0700)
Landing	64.40%	27.53%	8.07%
Take-off	66.29%	18.12%	15.59%

Previous programmes for noise reduction and current measures against noise

Iasi International Airport has been preoccupied with noise control as an outcome of airport operations. In this line, Strategic Noise Maps and Action Plans were developed in 2014.

From the measures proposed in the first Action Plan (2014) [19], the first solution was implemented, i.e. the development and use of a new runway having a different orientation so that it avoids overflying communities as much as possible. Its orientation modified the flight paths and reduced overflying surrounding communities in a significant manner. The new runway started to be completely used since October 2014. The estimated reduction was between 3 an 18 dB(A). This solution was assessed to have high cost, with a negative impact on air traffic growth. This scenario implied overflying the Eastern part of Iasi Municipality (mostly industrial areas) and the Western part of Aroneanu Village, leading to a decrease in the number of exposed people.

The second solution (2014) [19], i.e. increasing the use of the Northern direction for take-offs and landings, was partially implemented to reduce the generated noise levels in residential areas. Most landings during the night-time (more than 90%) are from the Northern direction (RWY14 direction), since on this direction is available the equipment for assisted landing in low visibility conditions. The estimated reduction of the noise level was between 3 and 14 dB(A), implying medium costs for implementation. Further implications include a higher fuel consumption and a higher noise burden in the Northern area, i.e. an increase of 10 dB in the Northern area and a decrease to almost no exposure in the Southern area.

Aircraft not compliant with **ICAO Annex 16 Volume I ("Aircraft Noise") Chapter 2** [22] **or FAA FAR Part 36 Chapter 2** [23] are not allowed to operate on Iasi Airport since April 2002. Moreover, a significant amount (74% from the total number of aircraft in 2017)

of aircraft that operate on Iasi Airport are compliant with the noise standards from ICAO Annex 16 Volume I 3rd Edition, 7th Amendment, Chapter 4. All take-off and landing operations are made in compliance with standard flight profiles.

An additional measure with respect to the organisation of the operation program is that the number of take-offs/landings is reduced as much as possible during the night at/from this airport.

Data was obtained from either official sources or through vectorisation by the method of production and the methodology used for obtaining the input data is detailed in Annex (C).

Public Consultations (according to Law no. 52/2013 [10] regarding the decisional transparency in the public administration, with further modifications and updates)

In order to ensure transparency in decision-making, suggestions, recommendations and proposals can be sent to an e-mail address, by specifying the articles from the Action Plan that are referred to, which is available on the website of the airport at the same time when the announcement is made. The announcement for the official meeting has been published on the website and also in local newspapers.

The participation in the public consultation requires an a priori registration which can be done online or at the airport.

All proposals and observations discussed during the public consultation are included in the official minutes and further analysed in order to establish what can be included in the Action Plan.

The minutes of the public consultation, the recorded recommendations, an updated version and the final version of the Action Plan and other relevant documents are published and available on the website of the airport, respectively at the airport.

The Agency for Environmental Protection Iasi, the Iasi County Council, the City Hall of Aroneanu Village and the City Hall of Holboca Village attended previous public consultations (2014) [19].

Long-term strategy

The long-term strategy for noise reduction takes into account the analysis of sustainable measures that are focused more on the prevention of noise. Key objectives that are taken into consideration are the promotion and support of legislative changes for land-use planning in the conflict areas such as the reduction of the number of exposed population and the development of both residential and airport activities. Additional measures include maintaining an optimal number of flights during the nighttime.

Estimations regarding the reduction of the number of exposed people (annoyance, sleep disturbance etc.)

The importance of informing the population of Iasi City about the noise levels that can be bearable by the human body, together with the dangers they are exposed to through long-term exposure to noise with high-intensity is highlighted in the Action Plan. The effects of noise are described in detail, including annoyance, communication interferences, attention and focus problems, sleep disturbances, hearing damage and stress with further implications and consequences. In addition, socio-economic effects are communicated.

Table 3.15 - Total no. of people living outside agglomerations in residencies exposed to L_{den}/L_{night} values, at 4 m above the ground, for the most exposed façade [20]		
Interval (dB)	No. of exposed people to L_{den}	No. of exposed people to L_{night}
45-49	N/A	124 (2016)
50-54	N/A	154 (2016)
55-59	159 (2016)	122 (2016)
60-64	0 (2016)	0 (2016)
65-69	0 (2016)	0 (2016)
70-74	0 (2016)	0 (2016)
>75	0 (2016)	0 (2016)

Table 3.16 - Total surface (km^2) outside agglomerations exposed to the values of L_{den}/L_{night} greater than 55, 65 and 75 dB [20]		
Indicator value (dB)	Total surface for L_{den}	Total surface for L_{night}
>55	N/A	2.9956 (Aroneanu Village) (2016)
>65	0.1218 (2016)	0.0049 (2016)
>75	0 (2016)	0 (2016)

Table 3.17 - Total surface (km^2) exposed to the values of L_{den}/L_{night} greater than 55, 65 and 75 dB [20]		
Indicator value (dB)	Total surface for L_{den}	Total surface for L_{night}
>55	5.4321 (2016)	N/A
>65	0.1218 (2016)	N/A
>75	0 (2016)	N/A

Table 3.18 - The number of residencies exposed to the values of L_{den}/L_{night} greater than 55, 65 and 75 dB [20]		
Indicator value (dB)	Number of residencies for L_{den}	Number of residencies for L_{night}
>55	92 (2016)	N/A
>65	0 (2016)	N/A
>75	0 (2016)	N/A

Table 3.19 - The number of people exposed to the values of L_{den}/L_{night} greater than 55, 65 and 75 dB (including agglomerations) [20]		
Indicator value (dB)	Number of people for L_{den}	Number of people for L_{night}
>55	244 (2016)	N/A
>65	0 (2016)	N/A
>75	0 (2016)	N/A

Table 3.20 – Data regarding the number of exposed people [20]			
Indicator value (dB)	Total number of exposed people	No. of people exposed, living outside agglomerations	No. of people exposed, living inside agglomerations
The total number of people living in residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{den}>70 dB(A)****, according to Strategic Noise Mapping for 2016* [20]			
>70	0	0	0
The total number of people living in residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{den}>65 dB(A)*** *–* ***The target for the long-term target value****, according to Strategic Noise Mapping for 2016*			
>65	0	0	0
The total number of people living in residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{night}>60 dB(A)****, according to Strategic Noise Mapping for 2016* [20]			
>60	0	0	0

The total number of people living in residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{night}>50 dB(A)*** *–* ***The target for the maximum allowed value****, according to Strategic Noise Mapping for 2016* [20]			
>50	approx. 300	276	0

Table 21 – Data regarding the number of exposed residencies [20]			
Indicator value (dB)	Total number of exposed residencies	No. of exposed residencies outside agglomerations	No. of exposed residencies inside agglomerations
The total number of residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{den}>70 dB(A)****, according to Strategic Noise Mapping for 2016* [20]			
>70	0	0	0
The total number of residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{den}>65 dB(A)*** *–* ***The target for the long-term maximum allowed value****, according to Strategic Noise Mapping for 2016* [20]			
>65	0	0	0
The total number of residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{night}>60 dB(A)****, according to Strategic Noise Mapping for 2016* [20]			
>60	0	0	0
The total number of residencies (at 4 m above the ground and for the most exposed façade) exposed to ***L_{night}>50 dB(A)****, according to Strategic Noise Mapping for 2016* [20]			
>50	103	103	0

Table 22 – Data regarding the number of exposed surfaces [20]	
Indicator value (dB)	Total surface (km^2)
Total surface (km^2) exposed to values of ***L_{den}>70 dB*** [20]	
>70	0.00

Total surface (km2) exposed to values of ***L_{den}>65dB – The long-term target for the maximum allowed value*** [20]	
>65	0.1218
Total surface (km^2) exposed to values of ***L_{night}>60 dB*** [20]	
>60	0.5847
Total surface (km^2) exposed to values of ***L_{night}>50 dB*** [20]	
>50	10.338

Trends, overarching processes and internal systems that underpin the implementation of ICAO Balanced Approach

The airport had one concrete runway (2014) [19] used for take-off and landing of 1800 m length and 30 m width, with two paved verge areas of 7.5 m and a running path having 135 m length and 15 m width and an additional platform with four parking slots. According to these dimensional restrictions, only small types of commercial aircraft could be operated at that time. An extension was planned through the construction of a new take-off and landing runway, which was later developed.

In 2014 [19], no line of the public transport network was reaching the airport. A new line was planned by the local public transportation network to operate from the centre of the city (i.e. Piata Eminescu) to the airport, having four stops. One route segment was planned to last for around 30 minutes. Depending on its post-implementation evaluation, the route could be further extended to connect the train station with the airport. Currently, the plan was implemented, including the extension segment that links the train station with the airport.

Flight Procedures: Low Visibility Procedures (LVP) are available. Runway 14 is approved for CAT II operations. Both RWY14 and RWY32 are approved for LVTO. Standard Instrument Departure (SID) is available on both RWY14 and RWY32. [2]

The SPICE Project [24]

The European Project SPICE (Synchronised PBN Implementation – Cohesion Europe) is a part of the implementation phase (2014-2024) of SESAR that seeks the increase of Air Traffic Management (ATM) efficiency and of Air Navigation Services (ANS) through decreasing the fragmentation level of the European airspace. Through its nature, this initiative is Pan-European. Predicted advantages through the application of Single European Sky (SES) estimate a triple increase in airspace capacity, a 50% reduction in ATM costs, a 10% safety increase and a 10% impact reduction of aviation on the environment.

SPICE involves the implementation of a navigation system based on PBN performance, exploiting RNAV (Area Navigation Systems) advantages of modern aircraft in order to support an efficient design of the airspace and the systematisation of air traffic routes, in pursuit of optimising the available airspace.

The implementation period of the project is from 2016 to 2020 and is coordinated by EUROCONTROL. Partners range from air carriers (Aegean, Blue Air, Regional Air Service,

SATA, Tap Portugal), to Air Navigation Service Providers (DCAC, HCAA, LPS SR, NAV Portugal and ROMATSA), including also the Romanian Civil Aviation Authority (AACR) and the Romanian Airports' Association (AAR).

At the level of Romania, the project implies a series of activities to design, approve and operate RNAV SID/STAR systems and procedures (RNP APCH LNAV, LNAV/VNAV, LP and minimum LPV) through the use of the GNSS signal (EGNOS). The tasks of the project include data collection through the development of obstacle studies for all participant airports, as well as the design, encoding and authorisation of the equipment for PBN implementation. The application of the project activities will assist the progress of controlling operations inside the Romanian airspace through PBN, thus facilitating safer and more efficient trajectories, altogether with reducing the rate of missed approach and redirection.

In the first phase of the project (*Design and Implementation Activity*), all airports that are members of AAR had to collect data regarding obstacles, followed by the design of RNAV SID/STAR procedures for international airports only. The specific order for the second requirement is the following: Sibiu, Baia Mare, Bacau, Tulcea, Suceava, Timisoara, Craiova, Arad and Constanta (first stage); Iasi and Oradea (second stage); Bucuresti Baneasa, Satu Mare and Targu Mures (third stage); Cluj-Napoca and Bucuresti Henri Coanda (fourth stage).

Airport Obstacles

Table 23 - Aerodrome Obstacles for the Approach and Take-off Area/ in Circling Area and at the Airport [2]

RWY/ Affected Area	Obstacle Type	Elevation [m]	
		[m]	[ft]
RWY14 Approach *RWY32 Take-off* *(Approach/Take-off Area)*	Church		
	LM Antenna		
	Building		
	Tree		
	Antenna		
	Antenna		
	Building		
	Mast		
	Mast		
	Antenna		
	Building		
	Mast		
	Building		
	Building		
	Mast		

	High Power Mast		
RWY14 Approach *RWY32 Take-off* *(Circling Area and at the Airport)*	High Power Pylon		
	Hill		
	Antenna		
	Cross		
	High Power Pylon		
	Forest		
	Hill		
	High Power Pylon		
	Building		
	Tree		
	Mast		
	Antenna Mast		
RWY32 Approach *RWY14 Take-off* *(Approach/Take-off Area)*	Antenna		
	High Power Pylon		
	Hill		
	Cross		
	Hill		
	High Power Pylon		
	High Power Pylon		
	Forest		
	Hill		
	Hill		
	Antenna		
	Antenna mast		

Further relevant airport information

On the Western part of the airport is the Ciric forest, "Eternitatea" cemetery and Iasi Municipality. On the Northern side is Aroneanu city, on the Eastern side is Valea Lunga city and in the Southern part is UM 01175 (Military Facility) and Aviation district (with residencies).

The terrains from the immediate vicinity are mainly used for agricultural purposes, therefore no industrial sources or traffic sources to general a high level of noise exist.

Table 24 – Land-use in the proximity of Iasi Airport [19][20]	
Direction from the airport	Activity
Northern	Agricultural fields and Aroneanu Village
Southern	Agricultural fields; UM 01175 (Military Facility); Aviation District (from Iasi City)
Eastern	Agricultural fields; Valea Lunga Village (approx. 2 km from the runway threshold)
Western	Ciric forest and Iasi City

Table 25 - Number of aircraft operating on LRIA and type of aircraft (2016) [20]	
Aircraft type	Aircraft Number
A318/320	1495
ATR42/75	2757
B737	5103
DH8D=ATR	478
F80/100/ERJ	90
Others	346

It can be observed from this table that an approximative of 4% (3.7%) of the total number of aircraft used in 2016 are of non-commercial type.

Table 26 - Statistical data (2011) regarding the population, number of residencies and statistical distribution of population [19]			
Establishment name	Iasi Municipality	Aroneanu Locality/ Aroneanu Village	Dancu Locality/ Holboca Village
Establishment type	Agglomeration	Village	Village
No. of inhabitants	290,422.00	3402.00	11,971.00
No. of residencies	13,138.00 residential buildings/	546.00 residential buildings/ 662.00 residencies	2215.00 residential buildings/ 2472.00 residencies

	114,181.00 residencies		
Average no. of household residents	2.52 people	2.94 people	2.94 people
Population density	3109 inhabitants per square metre	92.2 inhabitants per square metre	258.9 inhabitants per square metre
Distance from LRIA	8 km W from LRIA	3 km N-NW from LRIA	4 km SE from LRIA

THE CASE STUDY

Introduction

Through the years, the Romanian legislation on noise (HG 321/2005 [6]) suffered several modifications, putting in charge of developing Strategic Noise Maps and Action Plans other airports having less than 50,000 movements per year. The criteria for selecting additional airports was defined by the number of residents inside agglomerations close to an airport, i.e. airports near or inside agglomerations having more than 100,000 inhabitants. Currently, ten airports [Annex(A)] with less than 50,000 movements per year are defined as Urban Airports, having the responsibility of developing Strategic Noise Maps and Action Plans similar to END [5] provisions for Major Airports. The Urban Airports are Bucharest (Baneasa) - Aurel Vlaicu International Airport, Avram Iancu (Cluj) International Airport, Iasi International Airport, Craiova International Airport, Oradea International Airport, Sibiu International Airport, Transilvania (Targu Mures) International Airport, Maramures (Baia Mare) International Airport and George Enescu (Bacau) International Airport. Since 2016, Satu Mare International Airport was included as an Urban Airport as well [26].

Identification of environmental needs

In this context, the construction of a new runway was selected as a measure within the first Action Plan [19] developed by Iasi Airport in order to modify the direction of flight so that surrounding communities will become less overflown. The project started in the same year with the Action Plan and the new runway RWY14/32 (DEP and ARR) was put in use by the end of the year. Until then, RWY 13/33 was in use, which was situated South from the new runway.

In 2015, Iasi Airport was also engaged in the developed of annoyance case studies, being the first Romanian Airport involved in this area of research. Results from the study and the expected development of residential areas around the airport showed that noise exposure and impact for the next years risked increasing, in spite of the efforts of the airport to avoid overflying communities through building a new runway one year before. [27]

Selected options in response to environmental needs

For Iasi Airport, studying the extent of implementation of ICAO Balanced Approach pillars [13] started when it decided to engage with all relevant stakeholders (CAA, ANSP, airlines) and various other potential stakeholders (Ministries, local authorities, regional authorities) in order to research all available options to both prevent airport expansion limitations and reduce community noise exposure and impact.

Conclusions drawn on practices available and applicable for Romanian Airports were formulated around the necessity of a properly defined policy on land-use planning, which was unavailable at that moment.

Implementation processes

Territorial planning was defined as the responsibility of City Halls and Regional Counties, i.e. local and regional authorities, with further implications to the Ministry of Development and Public Administration. Airports had no involvement whatsoever with respect to noise in the development of Urbanism Plans.

In this context, Iasi Airport, initiated discussions and meetings on noise management at Romanian Airports, with the support of all other Romanian Airports and the CAA.

Dialogue was initiated between local and regional authorities and Iasi Airport on understanding the noise impact on communities around the airport and finding solutions together on reducing impact and preventing similar exposure situations. Various criteria were evaluated, e.g. economic and social impact of noise management measures, concluding that land-use planning was needed as the best solution, yet a legislative context was still unavailable. At the time Iasi Airport entered the ANIMA EU Project (2017), the context was still the same.

Further experiences and research of Iasi Airport on land-use planning implementation in other European Airports within the ANIMA Project led to conclude that collaboration between relevant stakeholders is key to applying efficient noise management measures, as well as communication with other European Airports to learn from their challenges and best practices discovered or resulted from interventions. This approach was later applied to the need of a land-use planning policy for noise management.

During 2018, various meetings were initiated by Iasi Airport, gathering all potential stakeholders, from Ministries of Environment, Health, Transport, representatives from local and regional authorities, representatives of all Romanian Airports, CAA, ANSP and airlines, as well as research experts. Discussions were specifically formulated around aviation noise management, particularly land-use planning needs, together with the urgency of collaboration between all relevant stakeholders, including the communities. Data from all official meetings was disseminated through local media, in order to ensure transparency and to inform the public about current efforts of airports towards reducing noise exposure and impact. [28]

Evaluation of results, post-implementation changes, mitigation actions

Immediately after one official meeting, a new legislative change was proposed, empowering the status of the previous transposition of END [5] from Governmental Decision [6] to Law [11]. This change was determined by the need to ensure a better understanding of noise management and to highlight the importance of collaboration between all relevant stakeholders during noise mitigation. Various other stakeholders became officially responsible for airport noise management, compared to the previous situation, when only the airport was in charge. According to these provisions, quiet areas will be determined by local authorities in compliance with Strategic Noise Maps.

Further legislative changes occurred, e.g. the transposition of **Regulation (EU) no. 598/2014** [14], regarding ICAO BA operational restrictions, which provisioned further involvement of stakeholders in aviation noise. For example, the CAA has to support the official authority for environmental protection (central public administration authority for environmental protection) during the process of evaluating aircraft noise on airports and to offer assistance for conflict management between safety requirements and

environmental protection requirements, while the ANSP has to provide necessary information for compliance with noise operating restrictions [29].

A new version of the "Air Code" was proposed for adoption. Provisions include the requirement for Noise Maps to be considered within Airport Development Plans during their development. In addition, recommendations were formulated for considering Noise Maps in local/regional Urbanism Plans by local and regional authorities responsible for land-use planning. The definition of acoustic zoning is proposed as a responsibility of the Ministry of Environment.

Additional changes were included in December in a rule issued by the CAA for the requirements for the design and approval of instrumental flight procedures [30]. Noise alleviation procedures are included as a provision when necessary and all relevant stakeholders have to reach a common agreement on the requirements needed for the design of new procedures or modification of the current ones, taking into account noise exposure.

Methods and tools, interdependencies, other relevant information

Iasi Airport is the first Romanian Airport that conducted an annoyance case study, in order to determine the reaction of the surrounding communities to aircraft noise. [27]

Further developments on LRIA [25]

Future developments include the construction of an additional taxiway in order to be able to operate aircraft bi-directionally, as well as the enlargement of the processing capacity for the aircraft parking platform with 4-6 new parking spots. The estimated time of implementation is 12 months, having an estimated cost of approx. 14,000€. Such developments are necessary, as the current income from airport activities is lower than maintenance costs.

Due to the fact that the platform for boarding and disembarking has a limited number of parking spots, difficulties are faced in satisfying the requirements of air carriers for flight scheduling, especially during peak hours. In this respect, an extension of the platform is planned in the Southern area for a distance of 270 m. The width of this extension is similar to the width of the existing platform.

Conclusions

As it can be easily observed from the Review of Noise Action Plans, the increase in the number of total movements is approximately of 14.7% from 2016 to 2017. The overall situation of air traffic growth shows a constant increase. In this respect, the land-use planning and management pillar of ICAO Balanced Approach was considered by the airport as being the best option to ensure the necessary protection from noise for all communities surrounding the airport. From the position of being a public airport, i.e. owned by the state and functioning under the local and regional authorities, Iasi Airport, as well as almost all Romanian Airports, have little decision-making competence in land-use. Therefore, communication and engagement with the relevant stakeholders and the communities were crucial in taking the first steps into including provisions of land-use planning and management within the National legislative framework.

Recommendations and lessons learnt

More specific trainings on both awareness and understanding of the noise issue are needed, especially for airport representatives, as well as for all relevant stakeholders,

including communities. In this respect, guidance is needed for the introduction of noise management within the overall management such that environmental benefits can be obtained proportional to the increase in the performance of daily operations.

A legislative change to include and efficiently support land-use planning and management is considered highly important by all relevant stakeholders. Even if some provisions have been introduced within the National legislative framework, a specific policy on land-use planning and management is still necessary. In addition, guidance for ensuring a proper understanding and application of land-use planning and management is needed for all relevant stakeholders, as well as for community awareness.

Constant focus should be placed on effective communication and collaboration between all relevant stakeholders in aviation noise, in order to understand and discuss the noise situation at a National level, as well as to find solutions to reduce noise impact and noise effects in a timely manner. As a result, the communication and engagement with communities can be established and/or supported by either stakeholder, depending on its competence in aviation noise. In this respect, guidance is needed for ensuring effective communication on noise management between stakeholders relevant to aviation noise.

All measures have to be detailed in a more universal manner so that they take into account and overcome limitations, for example the differences between major airports and airports having less than 50,000 movements per year, the differences between the national legislative frameworks of different Member States and others.

A policy on noise complaint management is needed in order to establish the Competent Authorities responsible for the collection and storage, analysis and assessment of complaints on noise, together with ensuring the provision of the necessary feedback, mitigation and oversight of changes.

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