

Acoustical Post-Evaluation applied to the neighborhoods of a small airport

Marta Ribeiro V. Macedo¹, Jules G. Slama², Mário César Vidal³

¹COPPE/UFRJ - FIOCRUZ, Fundação Oswaldo Cruz, DIRAC, Av. Brasil n° 4365, Rio de Janeiro, BRASIL.
Email: mribeiro@fiocruz.br

²PROARQ COPPE/UFRJ, Centro de Tecnologia, Sala G210, Cidade Universitária CEP 21945-970 Rio de Janeiro. BRASIL, Email: jules@rionet.com.br

³COPPE/UFRJ, Centro de Tecnologia, Sala G207, Cidade Universitária CEP 21945-970 Rio de Janeiro. BRASIL, Email: vidal@pep.ufrj.br

Introduction

During the year 2001, ICAO, the International Civil Aviation Organization has proposed the A33/7 resolution where the multi-disciplinary concept of balanced approach is presented.

Then it become important to develop new tools to be used for a general analysis of the environmental noise impact produced on airport surrounding populations.

The Acoustical Post-occupation Evaluation (Acoustics POE) applied to the airports surroundings constitutes an appropriate tool which can be used to understand the interrelation between the many factors that constitute this complex matter.

The post-occupancy evaluation is composed of a set of actions destined to study a urban or architectural situation. In Acoustical POE, four approaches, technical-constructive, technical-physical, technical-functional and technical-behavioral, are considered, from which it is possible to study the many elements that constitute the sonorous environmental impact in an airport surroundings.

This work, presents a case study for Jacarepaguá Airport, a small airport which is situated in the city of Rio de Janeiro and in which an increasing demand of small airplanes and helicopters flights exists. In addition, it is being studied the possibility of increasing its track from 900m to 1200 m.

The POE and the Acoustical POE

Acoustical post-occupancy Evaluation [1] is an evaluation of the acoustical performance that, beyond the technical aspects, considers the opinion of people who use and live in the sonorous environment, recognizing particular characteristics in their day-to-day life which cannot be described by noise measurements or simulations.

When applied in the field of the environmental acoustics, around airports, the studied urban area becomes very large and heterogeneous.

Thus, in order to reduce costs, time and to simplify the work, it is important to define the criteria to be followed and to identify the more exposed construction groups to the aeronautical noise, in order to select a trustworthy sample to be evaluated.

It is considered that not all the types of activities and use of constructions situated in the studied area will be equally exposed to the aircraft noise, since the bother varies as a function of the type of developed activity, the proximity between the receiver and the noise source, of the propagation path, as well as of several other factors that will be able to intervene with the sonorous perception.

In this matter, in the sample selection, the constructions in which noise sensible activities are developed must be prioritized (residences, hospitals and schools), as well as those situated in more exposed locations. In this direction, it is up to the evaluation team, through usual techniques of data collection in APO and tools used in several countries when it is desired to diagnosis the sonorous environment in airport adjacent areas, such as the noise curves tracing, to select the constructions that will have to be part of a deeper boarding.

One evidences that the presence of the work team in the location, aiming to know the peculiarities of the environment, to observe details and to talk with users is very important for the accomplishment of an adequate diagnostic of the sonorous environment.

An acoustical POE is basically summarized in four stages: Technical-behavioral evaluation, technical-functional evaluation, technical-physical evaluation and technical-constructive evaluation [2].

Initially, the Acoustical APO goes through a preliminary data-collection phase, in which useful maps, laws, norms and other important documents to the development of the work are obtained. After this phase, interviews are carried through with keypeople which can guide the evaluation process, as it was proceeded in the surrounding area to the Airport of Jacarepaguá.

The Acoustical APO

Jacarepaguá's Airport (SBJR) Characterization

The SBJR is a local domestic airport, characterized by the exclusive operation of general and military aviation [3], constituted basically by aircraft and helicopters, the latter representing about 63 % of the airport movements .

Technical-Comportamental Evaluation

Considering the importance of knowing deeper the area object of study, so that a complete diagnosis of the situation can be traced, the evaluation team carried through visits to

the area of study and interviewed key people, such as members of the board of directors of a public school situated next to the airport's runway end 02, administrators of residential buildings situated in the direction of the aircrafts landing and take-off pathways, the responsible doctor for the center of studies of a county hospital, also situated next the airport, as well as professionals that work in the control tower of the Jacarepaguá's Airport, professionals responsible for the approval of projects among with the Department of Licensing and Fiscalization of Rio de Janeiro's City hall and professionals of the Secretary of Environment. This procedure guided the definition of the areas that could be more impacted by the airport noise, in which questionnaires and sound level measurements should be applied. The constructions situated in the area delimited by the LDN=55 dB(A) curve in the runway direction towards runway end 02 were selected, where it was observed that the bother should be more accentuated, since the aircraft which are in training make the turn of return to the airport above them, flying at low heights.

67 questionnaires were applied to multifamily residential constructions, 200 in a public school and 66 in the Arruda Câmara Park.

In the residences, it was observed that the noise emitted by small airplanes provokes accentuated bother (very and excessively) in about 84% of the interviewed population, as well as the noise emitted by helicopters provokes bother in 76%, provoking interference in the communication and the performance of activities that require concentration. An important fact is that 91% of the interviewed people consider that they will give great importance to the acoustics quality of the construction they may buy in the future.

In the Arruda Câmara Park the bother was considered high only by its employees (biologists and guards).

In the school, once the noise decurrent from internal activities is excessively high, they partially mask the external noise. Thus, the noise of airplanes was considered very bothering by only 17% of the sample and the noise generated by helicopters for 16%.

Technical-Functional Evaluation

In this evaluation the aircraft and helicopters routes (pathways) were considered and the types of constructions identified, verifying if the developed activities are sensible to the noise or not. It was also verified if the constructed buildings are compatible with the foreseen land use, if the direction of the dominant winds will be able to favor the sonorous propagation and how are the constructions implanted in relation to the sonorous sources (noise generated by road and aircraft traffic).

Technical-Physical Evaluation

This evaluation is based on measurements of sound level and simulation using predictive acoustics software, such as the Integrated Noise Model (INM - version 6.0) and Heliport Noise Model (version 2.2.), both of the Federal Aviation Administration (U.S. FAA).

The noise footprints were traced around the landing and take-off tracks, aiming to verify the inserted areas in the curve of noise traced for 55 LDN = dB(A) and to collate if the land use is adequate, considering the aeronautical legislation. It was also traced Laeq curves with the intention of comparing the sound levels defined by the curves with the Federal and municipal Legislation.

Moreover, measurements of noise in LAMax were carried through, in order to qualitatively evaluate the environmental noise and the aeronautical noise in four points.

Technical-Constructive Evaluation

In this stage, the acoustical quality of the constructions envelope and the external environment were evaluated. The evaluation was based on the observation *in loco* of the relative constructive characteristics of the selected areas as sample, such as external mass of walls and door and window frames, types of ventilation elements and prohibition, types of banisters, glasses thickness, quality of the windows and covering materials, quality of finishings and covering of the ground.

Conclusions

In extensive urban areas, such as an airport surrounding, the Post-Occupancy Evaluation requires a stratified selection of samples. Initially, it is necessary to analyze the problem in its totality. The realization of interviews with key-people and *in loco* observations are important for the definition of the sample. In this direction, the tracing of noise curves projected around the airport's runway is also important.

Through the APO Acoustics realized it can be evidenced that a small airport can cause accentuated bother to the local inhabitants.

References

- [1] PREISER, W. F.E.; RABINOWITZ ; H.Z. WHITE, E. T. Post Occupancy Evaluation. Van Nostrand Reinhold. New York, 1987.
- [2] MACEDO, M.R.V. Avaliação Pós-Ocupação Acústica de Habitações Populares. Dissertação de Mestrado. Rio de Janeiro: FAU/UFRJ, 1999.
- [3] Associação Brasileira de Aviação Geral. URL: <http://www.abag.org.br>.