

Aircraft Noise Perception in Brazil: The Sao Paulo International Airport Case-Study

This research aims to evaluate the aircraft noise perception in the vicinity of the Sao Paulo International Airport – AISP/GRU (the biggest airport of South America). The relationship between aircraft noise perception and social class levels, are specifically studied. This relationship is expected to be positive. Since noise perception is an intangible variable, this study chose as a proxy the value losses of residential properties, caused by aeronautical noise. The social class variable had been measured utilizing average per capita income of the population who live nearby the airport.

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The most relevant result obtained by this study is that all social classes are very susceptible to aircraft noise annoyance, even considering that the sample comes from a developing country. In fact, the magnitude of the noise perception proxy -the residential value loss- was found to be comparable to levels encountered in developed countries. Therefore, it can be foreseen that the social change leads to internalization of environmental problems, with the expected increase of air transport sector costs.

Aeronautical noise has been considered one of the most serious environmental problems of aviation, in accordance with the Report The Full Cost of Intercity Transportation (University of Berkeley, 1996). Noise generated by aircraft operation affects negatively the quality of life of people living nearby airports. The quality of life is a very subjective experience (Janic, 1999). In fact, the evaluation of noise discomfort is a subjective measure. It depends on individual noise perception, which is related to both tangible factors, such as numbers of landing and take-off aircraft operations, flight schedules, climatic conditions, and intangible factors, such as environmental awareness, welfare and quality of life standards, education and income levels (Janic, 1999; Garcia et al., 1993). In this context, the main objective of this paper is to contribute to the understanding of

this important environmental problem for the Brazilian air transport sector. Specifically, it focuses on evaluating aircraft noise perception, as a measure of social preferences for noise free environment. Under these circumstances, it can be foreseen that social change leads to internalization of environmental cost, which means that it must have taken into account by the generator, with the expected increase in the air transport sector costs.

Aircraft Noise Perception

It is important to point out that García et al. (1993) found out that noise perception depends upon social

classes. It can be expected that people could be classified into higher classes have higher quality of life standards and being less willing to accept aviation noise annoyance. Conversely, the lower class people would be less susceptible to noise, even when both classes are submitted to similar levels of noise. This situation is confirmed in the research developed in Finland by Heinonen-Guzejev et al. (2000). In this context, it is interesting to study the subjective factors that determine aircraft noise perception, in order to provide subsidies for mitigating and controlling their environmental impacts.



Aerial Photo of Sao Paulo International Airport Guarulhos

Aircraft Noise Perception at the AISP/GRU

Aircraft noise perception is a localized experience. In fact, the socio-economic characteristics of the region surrounding the airport are factors that are expected to affect the perception of aviation noise discomfort.

Guarulhos is a city located in Sao Paulo State, in the Brazil's southeast region. It has 1,100,000 inhabitants and it has the 3rd budget of the State. Despite this favorable position in the public finance context, a study developed by Brazilian Institute of Geography and Statistics (IBGE), points out that 22 % of the population of Guarulhos can be classified under the poverty income line with no access to sufficient conditions of sheltering and food. The Guarulhos's average income is R\$ 500,00 (five hundred reais) per month or about US\$ 170 (at the exchange rate of R\$ 2,95/US\$1, in April 2004), while the Brazilian average per capita Gross Domestic Product - GDP is about R\$ 420,00 per month (IBGE, 2000).

separated 375m from each other. The airport passenger's throughput (embarked plus disembarked) was 13,000,000 in round figures during the year 2003. The average airport daily traffic is about 500 operations, 90 percent occurring in runways 09L and 09R. Most of aircraft fleet is classified in the Chapter 3 of ICAO Annex 16 (IAC, 1998).

To complicate this scenario, there is no integration between the occupation rules of Brazilian civil aviation authorities, considering the noise contours (Plano de Zoneamento de Ruído) and the ones made by the County's urban specialists (Plano de Zoneamento Municipal).

Aircraft Noise Perception and social Classes at the AISP/GRU

Trying to find a variable that expresses noise perception in a quantifiable way, Eller (2000) developed a study on the AISP/GRU vicinity that considered the losses of value of the residential properties, caused by aeronautical noise as a measure of the perceived noise discomfort.

problems and 40 were properly answered.

Results Analysis

The results obtained by Eller (2000) were separated for region and for property's value losses intensity. Afterwards, the average per capita income for each real estate business region was identified, enabling to associate value losses intensity with social classes, as shown in Figure 2. In this Figure it can be observed that all social classes had losses of value estimated to be above 11 % of the market value of a similar residential property located in a noise-free area. Most of the region had value losses greater than 20 percent. In fact, for income levels above R\$1,000, around 67 percent of the sample declared residential value losses greater than 20 percent.

On the other hand, for the subsequent intermediate noise perception level, it was observed that the proportion of the sample that reports losses between 21 % and 30 % declines as income increases. However, as expected, for the higher noise perception level, the proportion of people affected, in each social class, increases as income increases.

It is necessary to pay attention to one of the intermediate levels that do not follow the expected pattern. However, observing results for social classes that earn more than R\$1,000 and comparing both, the more susceptible group, and the lower intermediate level, a positive relationship between noise perception and income class can be

clearly perceived.

The comparison of both, the lowest and the highest social class suggests that the relationship between social class and noise perception is positive in the AISP region. However, since this relationship was not positive for one of the intermediate noise perception levels, it is recommended to proceed with this study.

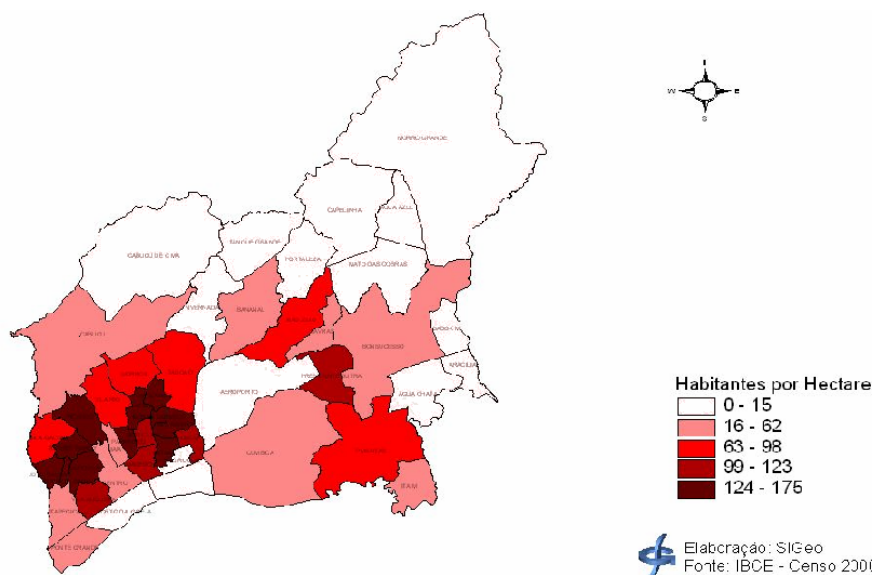


Figure 1: The urban demography of Sao Paulo Metropolitan Area and the AISP Region

Figure 1 depicts visually the urban demographic growing vector that comes from São Paulo City to the Airport region, where the demographic density of the airport western borders increases substantially. This situation is environmentally relevant, as that region is right below the most occupied airport runway flight tracks. The AISP/GRU has two parallel runways with its centerlines

This research was based on Non Personal interviews made by means of questionnaires sheets that were sent by postal shipment to the real estate developers who worked in the Guarulhos city area. All the region's real estate developers were identified, as well as, their postal addresses: 161 questionnaires were mailed, 14 returned due to addressing

Average per Capita Income (Reais-R\$)	Responses percentage			
	Below 10	Between 11 and 20	Between 21 and 30	Higher than 30
500-1000	0	50	50	0
1000-2000	0	33	35	32
2000-3000	0	33	25	42
>3000	6	30	23	41

Figure 2 - Properties market losses due to aircraft noise related to the average per capita income

Conclusions

During the last years, a new approach toward the environmental problems has resulted in social pressures to develop regulation and to implement measures designed to control environmental damages on social and economic welfare, caused by economics activities. Moreover, it is expected that airport authorities develop a systemic view of the relationships between airport and society.

This work contributes to show that Brazilian preferences support the reduction of environmental negative impacts, caused by aircraft noise. Hence, the most relevant result obtained by this study is that all social classes are very susceptible to aircraft noise annoyance, even considering that we are talking about a developing country. In fact, the magnitude of the noise perception proxy for all social classes -the residential value losses- was found to be comparable to levels encountered in developed countries. It demonstrates that there is a social demand for better quality of life.

Therefore, it can be foreseen that the social change leads to internalization of environmental problems, with the expected increase in the air transport sector costs.

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