Noise pollution due to air and road traffic at Corfu’s international airport (Greece)

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Abstract

Corfu International Airport is located in the vicinity of the highly populated city of Corfu and next to the main national road of the island, which connects its northern with the southern part. Important environmental impacts, namely noise, have been observed at the surrounding area of this airport due to the airport operation and the road traffic; this especially applies for the summer periods, where both seasonal air traffic peaks and road traffic peaks are being recorded. Regarding air transport, in year 2000 approximately 1.9 million passengers (out of which 90% referred to international flights) were served. In year 2020 this number is expected to exceed the 3.0 million passengers. Major interventions and construction works are under way in this airport and in the surrounding areas, on the basis of its Master Plan design, which was recently completed [1]. In the context of this paper, the air and road traffic noise pollution impacts on the surrounding area of the Corfu airport and on the urban complex of Corfu city up to the design-year 2020 are estimated and assessed. The assessment as far as air noise pollution is concerned is based on noise recordings [2] and relative noise calculations, as produced by the Integrated Noise Model (INM) [1,3,4], a well-known and internationally widely used model. Special measures regarding operational procedures, road schemes and compatible land uses are proposed. The scope is to achieve a well – integrated and environmentally acceptable solution for the system: airport, airport road access, and urban areas, considered as a total.

1 Introduction

Corfu island is a traditional resort with nice weather and lots of natural beauties and beaches, that every year attract many tourists from several countries. The
island presents important hotel and entertainment infrastructure, that assures a pleasant staying to the visitors. According to recent statistics, approximately 370 hotels with 36,000 beds are distributed over several sites of the island. First class hotels share a 30% of total number of beds on the island. Regarding load factors of hotels and beds, these factors reach 90%-100% values in July and August, 80%-90% in June and in September, and 40%-60% in May and in October. Major hotel expansions are planned or under construction to further improve the hotel accommodation.

The main transport modes for the international tourism arrivals are sea- and air-modes, where the air mode shares a 80% of the total volume. This means that Corfu Airport is the main international entrance to the island. The international traffic is characterized by a clearly increasing trend.

Corfu International Airport is located at the vicinity of the densely populated city of Corfu and next to the main international road of the island. The latter connects the northern with the southern part of the island, and coincides with the periphery of the airport at a length of 1 km.

Important noise impacts have been observed at the surrounding area of this airport due to airport operation and road traffic. This especially applies for the (extended) summer period May to October, where both seasonal air and road traffic peaks have been recorded [1,7].

2 Environmental impacts

In the context of an Environmental Impact Assessment [2], an extensive environmental study was carried out at many locations in the surrounding area of Corfu Airport. This study included noise measurements during flight operations (landing, take-off, etc), as well as background noise measurements recorded in the absence of flight operations.

Also, road noise measurements were carried out in the absence of flight operations, for a comparative environmental analysis of the noise produced by airport operation and road traffic.

The above mentioned noise was recorded in time series of SPL (Sound Pressure Level), and in noise levels $L_n$ in A-weighted figures (dB(A)), for samples of 5 minutes duration.

The airport noise was calculated in NEF levels (Noise Exposure Forecast), and this in accordance to the Greek law 1178/1981. For comparison reasons, both the noise measurements and the general assessment of the acoustic environment have been recorded in dB(A) levels.

Based on the noise recording program of the above study, more than 130 acoustic measurements were carried out at 79 various geographical locations in the airport surrounding terrain. More specifically, the following areas had been examined:

- Corfu airport (apron, runway ends 35 and 17), airport road access, main national road, road to Agia Eleni, Katakali, Mamali, Akti Savoura, road to Kanoni, hotel area in Kanoni.

The examination of the noise measurements (Table 1) showed that the acoustical environmental noise in the urban area around the airport is considerably high.
during flight operations, as compared to the background noise. In some cases, levels $L(A)_{max}$ of more than 90 dB(A) were recorded. Especially in the areas of Kanoni and Akti Savoura (which connects suburban areas of Corfu city), the disturbance was high during the use of R/W 35 for landings and R/W 17 for take-off operations.

It was also found that the noise levels due to road traffic are high in the investigated area, so that the acoustical annoyance produced by flight operations is shown as reduced. It is mentioned, that there had been estimated a yearly mean daily traffic volume of about 7,000 cars on the main national road Corfu-Leikini and of 3,000 cars on the airport access road.

Table 1: Available noise measurements in the area around/ in Corfu airport, in context to the airport Environmental Impact Assessment study, 1993 [2].

<table>
<thead>
<tr>
<th>Region</th>
<th>Max noise levels during flight operations</th>
<th>Time duration of the air noise impact</th>
<th>Road traffic noise, $L_{max}$</th>
<th>Background noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Katakali (in the western part of Chalkiopoulou lake)</td>
<td>56-77 dB(A)</td>
<td>20’’ and 1’30’’ by the usage of R/W 35</td>
<td>81 dB(A)</td>
<td></td>
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<tr>
<td>Mamali region (in the northwestern part of the main runway)</td>
<td>62-100 dB(A)</td>
<td>&gt;1’50’’ by the usage of R/W 35</td>
<td>83-89 dB(A)</td>
<td>50-54 dB(A)</td>
</tr>
<tr>
<td>Road to Corfu city next to R/W17.</td>
<td>71-98 dB(A)</td>
<td>36’’-1,10’’</td>
<td>81-88 dB(A)</td>
<td>61-63 dB(A)</td>
</tr>
<tr>
<td>Corfu city (in the northern part of R/W 17)</td>
<td>75-90 dB(A)</td>
<td>26’’-34’’</td>
<td></td>
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</tr>
<tr>
<td>Across the Corfu-Kanoni road (eastern of R/W)</td>
<td>68-87 dB(A)</td>
<td></td>
<td>42-54 dB(A)</td>
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<tr>
<td>Kanoni (in the eastern part of R/W 35)</td>
<td>86-105 dB(A)</td>
<td>&gt;1’’</td>
<td>81 dB(A)</td>
<td></td>
</tr>
<tr>
<td>Akti Savoura. Pontikonisi (in the southern part of R/W)</td>
<td>70-108 dB(A)</td>
<td></td>
<td>71-87 dB(A)</td>
<td>50 dB(A)</td>
</tr>
<tr>
<td>Corfu airport (internal area)</td>
<td>78-106 dB(A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airport road access</td>
<td></td>
<td></td>
<td>80-105 dB(A)</td>
<td>64-71 dB(A)</td>
</tr>
</tbody>
</table>

By application of the INM model, the $L_{Amax}$ noise level distribution in the surrounding area of Corfu airport, as produced by aircraft types of B757 (Figure
1), and B737-400 and B767 was recorded, during take-off operation from R/W 17. A significant correlation was found between the calculated $L_{A_{\text{max}}}$ noise levels and the relative measurements—the latter had been made at specific locations during corresponding flight operations.

Figure 1 shows that the $L_{A_{\text{max}}}$ 80 curve remains almost within the airport boundaries; there is only a restricted extension outside of these boundaries at the northern and southern parts of the airport.

3 Noise pollution in years 2000 and 2020

By further applying the Integrated Noise Model, the noise curves $L_{A_{\text{max}}}$ 70, 80 and 90 around Corfu Airport and within the city's urban complex were made available, for years 2000 and 2020 (Figure 2). This index has been chosen for a better examination/correlation of the impacts produced by air and road traffic noise.

It should be noted that the number of aircraft movements in year 2000 was approximately 15,000; in year 2020 this is expected to double. The annual air traffic in 2000 was 1.9 million passengers, in 2020 these are expected to be more than 3.0 million passengers. Finally, in year 2000 we had 123 aircraft movements in the typical peak day; in year 2020 there are expected about 176 movements [1].

According to the results, it is observed that the areas included in the $L_{A_{\text{max}}}$ 90 noise curve are within the boundaries of the airport terrain for the year 2000. In year 2020, the situation remains the same. However, the noise curve $L_{A_{\text{max}}}$ 80 will be extended towards the eastern direction (Corfu city), as well as towards the southern direction (the later one falls within the sea area). Therefore, a slight airport noise increase is expected in Corfu city and measure must be taken to reduce these expected to be affected noise sensitive areas.

Finally, the $L_{A_{\text{max}}}$ 70 curve between years 2000 and 2020 is extended towards the northern and southern directions. The relevant areas fall within the sea. Furthermore, this curve is also slightly extended towards the eastern and western directions.

4 Conclusions

The Corfu airport is located next to a highly populated residential area, which is highly affected by road traffic and airport operations noise impacts [2]. The noise assessment was carried out in $L_{A_{\text{max}}}$ levels, because this index allows the quantitative comparison of the impacts produced by these different transport modes in urban areas [3,4].

According to various researches and investigators [3,4], the $L_{A_{\text{max}}}$ 90 level should be the limit, which cannot be exceeded outdoors in any residential area; the $L_{A_{\text{max}}}$ 80 level and less, are generally compatible for residential areas. For $L_{A_{\text{max}}}$ values among these levels, building improvements are proposed.

In the context of this paper, the correlation of the $L_{A_{\text{max}}}$ levels calculated by application of the INM model, to the airport actual noise levels measured at
specific locations in the surrounding area, for relative flight operations, was shown to be significant. According to these measurements and the relative noise calculations, the noise distribution in the surrounding area was found. Furthermore, for a decisive noise control at the affected surrounding area, it is proposed to undertake an effective noise abatement strategy. This will incorporate the following measures:

- Definition of flight paths, runway ends use distribution, flight operations and procedures of reduced noise impacts on noise sensitive areas, for the high air traffic season.
- Restrictions to the extension of any further urban and residential activities and house constructions in the zone included in the noise curve LA_{max} 80.
- Definition of specific activities and land uses to be developed in the area included in the LA_{max} 80 curve, which will be compatible to the seasonal character of the airport operations.
- Construction of noise barriers in proper sites.

References

Figure 1: LAmax noise curves at Corfu airport produced by a B757 take-off operation.
Figure 2: LAmx noise curves for 2000 and 2020 for Corfu airport.