



Assessment of noise pollution sourced from entertainment places in Antalya, Turkey

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ABSTRACT

Noise pollution with the increased entertainment facilities especially in the touristic cities, has been turned out to be one of the major problems that impact the quality of life all over the world. Antalya is the most prominent tourism center in Turkey with its historical places, beaches and crowded entertainment areas. Entertainment life in Antalya is more dynamic and versatile than an usual touristic city with beaches parties, hotel discos, wedding ceremonies and night clubs. Emphasis in this paper is placed on conducting computer simulation using the SoundPLAN 7.3 to assess the noise exposure levels sourced by above 600 entertainment facilities such as discos, bars and pubs etc. in the city center of Antalya. The levels of entertainment noise exposure in the city was calculated according to the European Noise Directive. Almost all of the entertainment places located at the sea side, therefore the most affected population from the entertainment noise live close to these regions. Our results show that nearly 29,000 households during daytime and 10,500 households at night-time were exposed to 50 dB(A) or higher entertainment noises in Antalya. In other words, 3% of the resident population is potentially threatened by high noise levels which may cause to several illness such as hypertension, sleep disturbances etc.

Keywords: Entertainment noise, Noise map, Exposure, Noise pollution

I-INCE Classification of Subjects Number(s): 68.3, 76.1, 12.9.3

1. INTRODUCTION

The rapid development of the tourism industry are increasing environmental problems, such as rising noise, declining air quality, increasing water pollution, and increasing biodiversity loss (1,2,3,4,5). The tourism activities can cause noise pollution over surrounding residential areas (6). In the touristic places noise pollution sourced from transportation (vehicles) and machinery. It is observed that a sound level beyond 50 dB(A) in the tourism area there can be regarded as noise (3). The soundscape helps to create a comfortable environment and a good tourist experience and it is one of the important components of the tourism environment. Noises from entertainment in tourism districts have a huge influence on local communities (7). Due to the spread of high-level musical entertainment venues, surrounding settlements generally have a negative impact in terms of noise. When they are active and if not taken the necessary control measures especially in the summer and evening-night hours in these areas, there are temporary and/or permanent physiological-psychological impression on local residents and leads to discomfort. Because of unplanned urbanization these places

are near to residential buildings (housing, schools, hospitals, etc.) and the noise led to the growth of many problems.

"The Environmental Noise Directive (END, 2002/49/EC)" and "Turkey's The Regulation on Assessment and Management of Environmental Noise for Environment" aim the people's health and quality of life will not affect the levels of continuous provision is intended. In line with the directive, most of the member countries of the European Union, the noise mapping studies were largely completed (8,9,10). According to Turkey's The Regulation on Assessment and Management of Environmental Noise for Environment in the noise maps; entertainment places, factories, industrial plants, workshops, factories, ports, along with industrial facilities are covered. Clubs, bars, discos, restaurants, cafes, outdoor cinemas, casinos, wedding halls, entertainment and recreation places, such as outdoor or semi-outdoor area are classified as entertainment noise sources.

Antalya is located at the south coast of Turkey and in the Mediterranean region with suitable climate and the opportunities presented by today has drawn the attention of local and foreign tourists. In 2012, domestic and foreign tourists visited Antalya was recorded 10,622,000 (11). Over 600 entertainment venues in terms of tourism are listed in Antalya. While they are improving the attractiveness of the city, can also brings many environmental problems including noise pollution. Antalya is the most prominent tourism center in Turkey with its historical places, beaches and crowded entertainment areas. Entertainment life in Antalya is more dynamic and versatile than an usual touristic city with beaches parties, hotel discos, wedding ceremonies and night clubs. Emphasis in this paper is placed on conducting computer simulation using the SoundPLAN 7.3 to assess the noise exposure levels sourced by above 600 entertainment facilities such as discos, bars and pubs etc. in the city center of Antalya. The levels of entertainment noise exposure in the city was calculated according to the European Noise Directive.

2. DATA AND METHODOLOGY

2.1 Study Area

Antalya is a city in the Mediterranean coast of southwestern Turkey and is surrounded by mountains situated on coastal cliffs. The city of Antalya is located between the longitudes 29° 14' E and 32° 27' E, and latitudes 36° 06' N and 37° 27' N, covering a total area of 138,000 hectares. The population of agglomeration in the city is more than 1 million (3,491 people per 1 km²). Antalya has a Mediterranean climate with hot-dry summers and mild-rainy winters. Antalya is one of the world's and the Mediterranean's leading tourism destinations with the location and hot climate especially for foreign tourists, since the early 1980s (12). Antalya contains attractive tourism elements such as sun-sea-sand tourism, sport tourism, cultural tourism and especially entertainment tourism. There are up to 600 entertainment places (bars, pubs, discos etc.) in the city center. The distribution of these places is given in Figure 1.

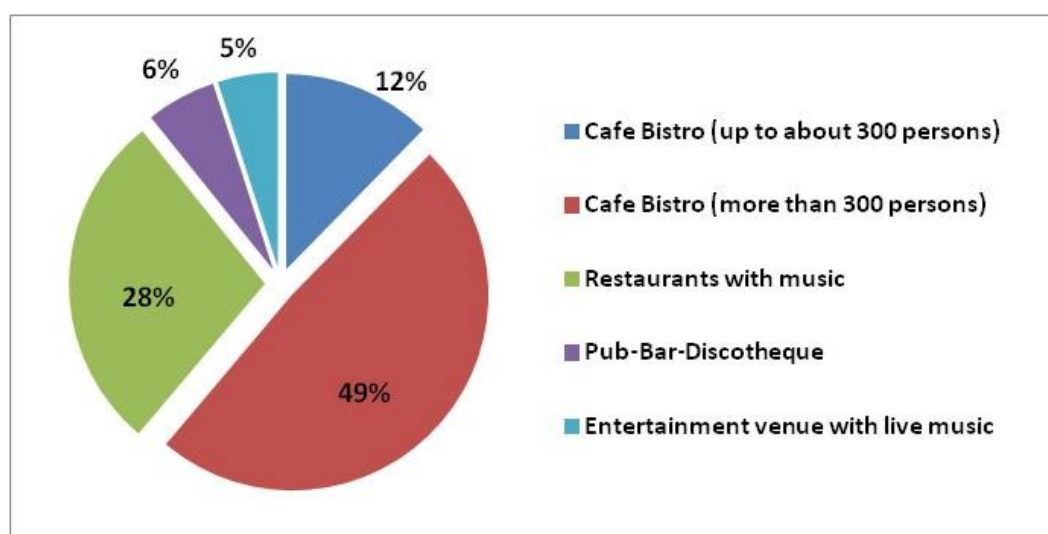


Figure 1 - The distribution of entertainment places in the city center of Antalya

2.2 Noise Maps

The models can be used to produce estimates of the noise exposure experienced in the cities. Noise modeling is used to evaluate current or future noise levels in agglomerations and to produce different noise maps. These maps, which show contours of equal noise, are a powerful tool for illustrating the impact of noise from a source like as entertainment places to surrounding communities (13).

This study is based on ISO 9613-2 Standard which is used in the SoundPLAN software package for the purpose of assessing noise exposure levels in Antalya sourced from entertainment places. The SoundPLAN is a graphics oriented noise prediction program which is used for noise planning, noise assessment and the development of noise mitigation measures. ISO 9613-2 Standard, which is an engineering method in calculating the attenuation of sound during propagation outdoor, was used for the computation of the entertainment noise. In ISO 9613-2, sound power levels of the sources, directivity correction and attenuation due to geometrical divergence, atmospheric absorption, the ground effect, screening structures with miscellaneous other effect are used to predict to sound pressure level at receivers.

Sound power levels of entertainment places are used as input for the model, based on measured or estimated data. According to Davis and his colleagues (2005), the noise levels are 65-70 dBA in the restaurants, 85-90 dBA in the bars playing music, and 105 dBA in the night clubs in UK (14). Fleming (1995) mentioned to the noise levels of discotheques as from 83 dBA to 98 dBA (15). Sometimes, noise can't be measured in the field due to environmental conditions, dominant background noise, and commercial concerns etc. for the entertainment places. So, the representative sound pressure levels can be used for noise sources. In this study sound pressure levels of entertainment places which are obtained from emission library of SoundPLAN used as 66 dBA for cafe bistro-beer garden (up to about 300 persons), 71 dBA for cafe bistro-beer garden (more than 300 persons), 80 dBA for restaurants with music, 90 dBA for pub-bar-discotheque and 105 dBA for entertainment venue with live music (16).

L_{den} (day-evening-night) and L_{night} as noise indicators for exposure suggested by EU Commission and Turkey's The Regulation on Assessment and Management of Environmental Noise for Environment, are to be determined by means of the assessment method described hereafter. The results of these simulations were exported to maps; then L_{den} and L_{night} noise layers were created at 10-m spatial resolution in raster data format using the bilinear interpolation algorithm.

3. RESULTS AND DISCUSSION

Noise mapping is acknowledged as one of the best tools to indicate the problems related to environmental noise (17). Noise maps is used for computing the affected area, the number of the critical building (house, hospital, school etc.), the number of citizens who are annoyed by noise (18). In this paper, the entertainment noise was calculated separately for daytime (07:00-19:00), evening time (19:00-23:00) and nighttime (23:00-07:00). The noise maps for L_{den} and L_{night} that show the equivalent noise levels were created on the basis of the calculated noise level in grid points were given in Figure 2.

Based on the noise model calculations undertaken within the scope of this work, the principal findings are summarized as follows:

1. The noise levels very high in shore sides of the city.
2. As shown in the enlarged map of Figure 2, "The Inner Bailey of Antalya" and "Lara Beach" are the most affected areas in the city from bars, discos and pubs.
3. Most of entertainment venues with live music, rammed bars and discos are located in "The Inner Bailey of Antalya". So this region can be defined as a hot spot for entertainment noise exposure.
4. The residential areas which is situated far from entertainment places are less affected than nearby.
5. Beach clubs and other outdoor live music venues caused to high noise levels up to long distances.

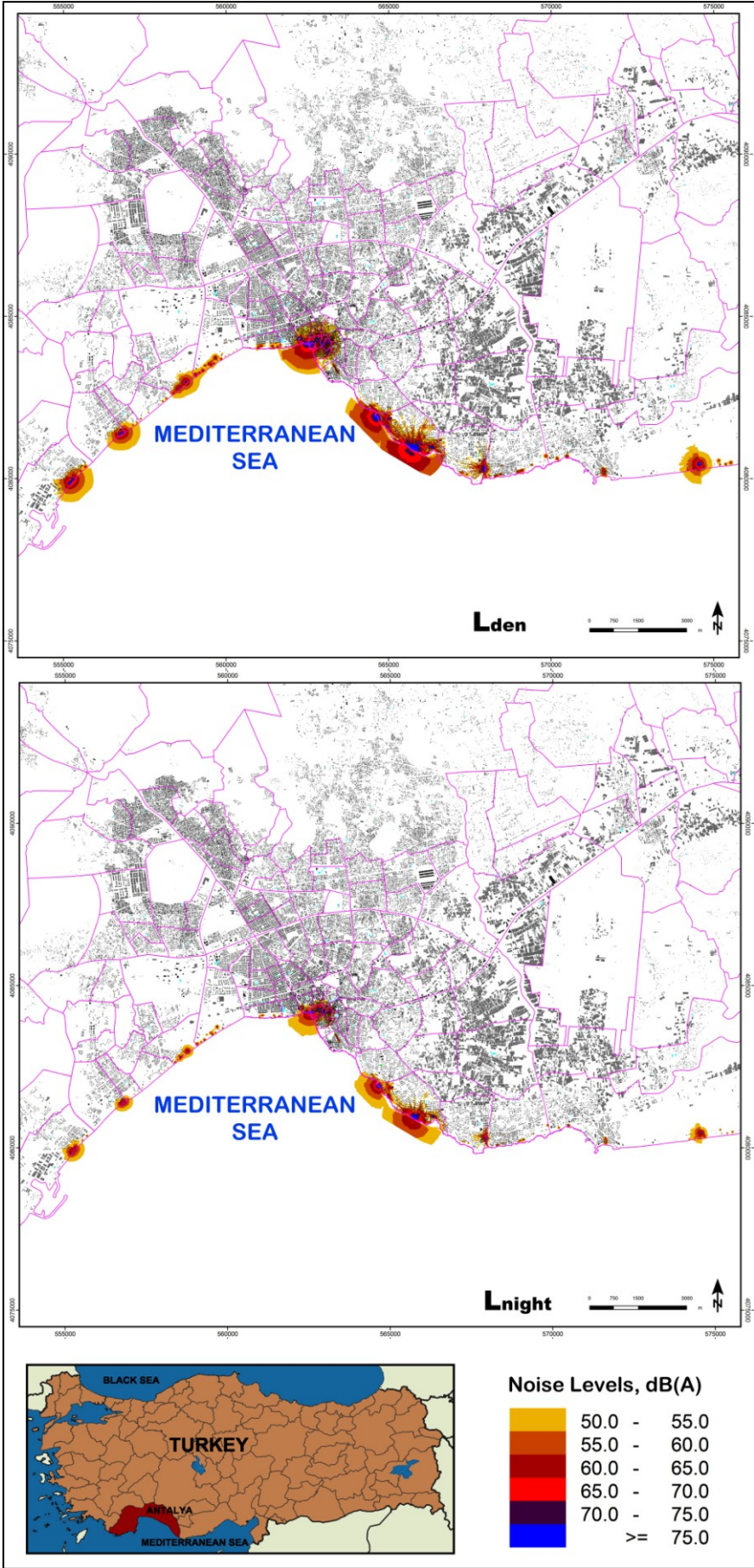


Figure 2 - Entertainment noise maps of Antalya for L_{den} and L_{night} noise indices

According to END, the estimated total number of people and households (in hundreds), schools and hospitals that are exposed to each of the following bands of values of daytime (L_{den}) and night-time (L_{night}) in dB 4 m above the ground on the most exposed façade: 50-54, 55-59, 60-64, 65-69, > 70, from entertainment places' activities were respectively given in Table 1.

Table 1 - Estimates of population and noise sensitive buildings for L_{den} and L_{night}

Period	Noise Levels, dB(A)	Area (km ²)	Households	Population	Schools	Hospitals
L_{den}	50-54	3.398	5,000	16,300	13	2
	55-59	2.595	2,200	6,700	4	0
	60-64	1.442	1,300	3,200	0	0
	65-69	0.731	700	1,500	0	0
	70-74	0.274	300	800	0	0
	>75	0.183	300	700	0	0
L_{night}	50-54	2.286	1,900	5,400	2	0
	55-59	1.200	1,100	2,600	0	0
	60-64	0.585	600	1,300	0	0
	65-69	0.182	200	600	0	0
	70-74	0.080	100	400	0	0
	>75	0.067	100	100	0	0

It was found that 5 km² of the land area of Antalya exceeded the threshold of 55 dB(A) during daytime. However, when the exceedance of threshold of 65 dB(A) was investigated, the affected area was found quite small (1 km²). Although according to the END, the exceedance map of threshold of 75 dB(A) was calculated, the results shown that the affected area was negligible (0,2 km²) during day-time. At night-time, noise levels drop significantly. About 2 km² area of the city had noise levels exceeding 55 dB(A) during night-time. But, according to calculation results were very small for both threshold of 65 dB(A) and 75 dB(A), the comparison to total city area was neglected.

Our results show that about 1% (12,800 households) of the resident population was exposed to 55 dB(A) or higher noises during daytime. When applying the second threshold criteria, nearly 0.4 % of the population (2,900 households) was exposed to noise levels greater than 65 dB(A). Similarly, when the exceedance of threshold of 75 dB(A) was investigated, the calculated population rate was found very small (0.1 %) and negligible. At nighttime, 0.5 % of the population (5,000 households) was exposed to 55 dB(A) or higher noise levels. In addition, nearly 1,100 households in the city had noise levels exceeding 65 dB(A) during nighttime from entertainment places. Since the affected area for the threshold of 75 dB(A) was relatively very small (100 households) at night-time, population calculation was neglected.

4. CONCLUSIONS

As Antalya is an agglomeration of nearly 1,000,000 citizens, the noise maps were generated for the year 2012, according to the European Noise Directive. The noise indicators presented in this article were calculated on the basis of the data acquired from entertainment place's inventory of Antalya Metropolitan Municipality. Our results show that significant numbers of people were potentially exposed to excessive noise levels. Maps of the spatial patterns of noise exposure reveal where to begin and/or focus noise abatement practices.

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