

**inter.noise 2000**

*The 29th International Congress and Exhibition on Noise Control Engineering  
27-30 August 2000, Nice, FRANCE*

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I-INCE Classification: 6.6

## **NOISE MAPPING IN GREECE AND THE PSYCHOSOCIAL PARAMETERS OF MEDITERRANEAN COUNTRIES**

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**Keywords:**

VOGIATZIS, NOISEMAPS, GREECE, PSYCHOSOCIAL

**ABSTRACT**

The improvement of the acoustic environment, not only depends on the reduction of vehicle noise emissions, but on the organization of transport, on urban characteristics, on climatic conditions and on the way of life. In Greek and other South European cities the annoyance of urban noise does not uniquely depend on the level of received acoustic energy, but also on population characteristics (notably cultural aspects) and on the acoustic environment (topographic, urban and climatic conditions). Under this perspective, it is essential to act on the city dynamic and hence on the actual rhythms of modality; to act on the norms of individual and collective behavior with the help of performance tools, as the mapping of urban noise, which has allowed a more complete description of information in a direct visual expression, and the implementation of psychosocial methods and analyses, in order to formulate the best policy regarding the rehabilitation and the management of the urban acoustical landscape.

### **1 - THE NORTH AND SOUTH OF EUROPE**

In the Mediterranean countries of the South Europe, the open space is dominated by urban environmental noise corresponding to the "rhythm" of the diurnal, and primarily nocturnal, life & recreation activities of urban centers. It is the principal cause of resident dissatisfaction as far as the environment and quality of life are concerned. This lifestyle characteristic of the inhabitants of Mediterranean countries invades the vast majority of open spaces and private spaces, thus causing a significant annoyance. Consequently, the struggle against urban noise necessitates a different approach from the one that has already been employed these last years in other European countries. The causes of urban noise are firmly linked to the structure and operation of the city and the consideration of noise as an urban planning parameter in order to introduce an "ecological" way of interventions to the city dynamics.

Under this perspective, the assertion of an elected city official who stresses the importance of the struggle against noise and, at the same time, the danger of creating a "necropolis", could be the defining course. To reach this goal, it is necessary to act on the dynamic of the city and hence on the actual rhythms of modality; to act on the quality and quantity of transportation whilst introducing non-polluting means of transport; to act on the norms of individual and collective behavior with the help of the above stated performance tools.

In Greece and other South European cities, where the way of life and the acoustic scenarios are pure products of culture, of climate and of the history itself of the Mediterranean peoples, we realize that public space is primarily occupied by the pedestrian. He frequents the streets of the city center, but also the vast spaces in the perimeter of the city. The occupancy of the street, as well as the opening of balconies and windows encourages the multiplication of annoyance scenarios in everyday life. This is why the technical solutions aiming at the insulation of openings and the structure of lodgings remain insufficient. In the cities of the South, everyday life is led well outside the private space.

### **2 - THE GREEK EXPERIENCE**

In Greece, urban noise problems are primarily the responsibility of the Ministry of the Environment, Physical Planning and Public Works. Up to now, the Noise Control Department of the Ministry of the Environment after the creation of the first noise map of the Athens city center (*intra muros*) in 1977

(followed by noise maps of 1987 & 1997) [1], has continued its efforts and has already completed noise maps of over 35 Greek towns. The management of the urban acoustic environment in Greek cities is oriented towards conception, comparative examination and analysis of different operational tools and more particularly:

- different variables that characterize the urban tissues and those that act as limiting elements to the system of urban function,
- the current "deficiency" of urban planning,
- projects initiated by the elected who consider urban noise as being at the same time the basic element of "urban ecology", of quality of life and as a factor of a "new model" of urban planning,
- urban noise maps, notably those integrating the system of ground transports,
- the role of noise in the planning of cities with regard to climatological particularities and to social and cultural characteristics of the acoustic environment, as well as the evaluation or de-evaluation of the urban environment,
- methods of preparation of relevant documents, which integrate the psychosocial dimension of noise of the urban environment.

Therefore Greek authorities have realized that it is essential to:

- evaluate and examine the cartography of urban noise which as a primary tool aiming the collection of a large quantity of information in a visual representation, bearing in mind that the treatment of this information has to be improved in the operational plan, and
- introduce the psychosocial analyses that is an important factor for the determination of the public opinion on the topic of urban noise effects and which can lead to the definition of an operational policy of management of the urban acoustic environment.

The creation of a noise map is linked to the urbanization, transportation and socioeconomic characteristics of the urban site which is to be analyzed which regulates the retained methodology, the manner of result presentation and the recommendations which are to be proposed. The main project objectives for noise mapping in Greece in order to provide the necessary elements in order to decide on future planning are the following:

- to establish a general state of urban noise levels
- to predict the acoustic effect of new proposed activities (infrastructure, industry and others), and to evaluate the distribution of acoustic levels in time and space,
- to collect and analyze the facts so as to allow the eventual modification of the legislation concerning urban noise,
- to correlate quantity data with integrate the psychosocial dimension of noise of the urban environment. (reactions in different population layers, "day & night life rhythm" of cities, land uses, annoyance due to various forms of transport noise, to entertainment etc., special regulations etc.), and therefore
- to evaluate the necessary action plan introducing the appropriate acoustic zoning, taking into account the different types of noise sources,

In figures 1 and 2 above the road traffic map of Athens (1997) is presented along with relevant data from the simultaneous psychosocial analysis (by questionnaires) which was proved as a very important factor for the determination of the public opinion regarding noise annoyance in different noise zones. Fig. 3 presents the noise exposure of the population for 24 Greek cities as evaluated through noise mapping projects.

### **3 - TOWARDS A EUROPEAN POLICY FOR NOISE MAP PREPARATION – PERSPECTIVES**

The applied methodology in European cities is currently varied: a normalized model of acoustic cartography does not exist yet. This tool must be considered as one of the most important ones in urban



**Figure 1:** Road traffic noise map of Athens (GR).

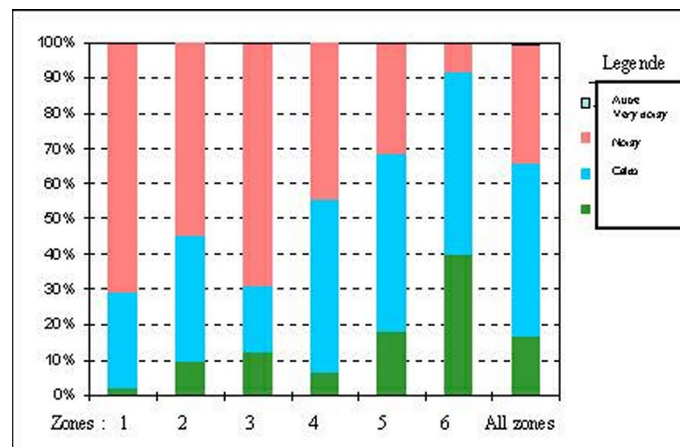
planning: it constitutes a very useful diagnostic tool for delivering an "x-ray" of urban noise. Within the framework of the GEUS I program of the French Ministry of the Environment [2], a first comparison of noise maps prepared for four south-European cities was realized with a great deal of coordination difficulty. Nevertheless, this comparison allowed the demonstration of certain largely diverging elements between the tested approaches. In the framework of the GEUS 2 program [3], the different established methodologies and metrologies, even at a national level, have allowed the project team to analyze and use the gathered information for informing and sensitizing/raising the awareness of the residents. Furthermore, the use of the analysis of psychosocial research has marked the importance of this tool which is complementary to noise maps, in the manner of decision making and raising awareness, the municipality of Rhodes.

The primary objective of urban noise cartography is to transmit in graph form information which is more explicit than that which can be presented in text or table form. Several European cities have more or less used this principle in this framework:

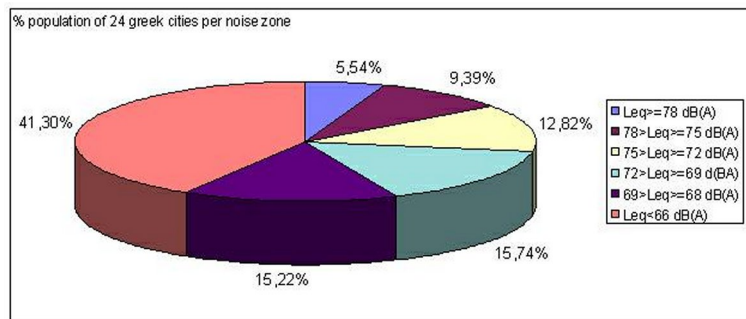
- either a superimposition on the geographic map, which allows the recognition of a "third dimension" representative of a noise quantity for a given time,
- or in linear form, based on the road network of the city.

The noise maps can be used in general to inform and sensitize the population, to manage urban noise problems and to coordinate public services in the framework of the struggle against noise. That is to say that noise maps represent an objective state of acoustic levels at a given time and therefore allow:

- raising population awareness: being accessible to all (large organizations, concerned parties and consulted by the public notably in town halls),
- the management of noise problems: made available to public and private decision makers, the map permits the formulation of strategies on the struggle against acoustic annoyances, preventive or remedying, on the topic of urbanization and habitat aiming to:
- direct the circulation plans: while preserving to the extent that is possible the calmest zones,



**Figure 2:** Responses of Athenian population regarding noise annoyance in different noise zones (zone 1 noisiest – zone 6 calmest).



**Figure 3:** Noise exposure in 24 Greek cities.

- take into account the acoustic factor in the instruction of all demand of construction permits: resulting in the delivering of recommendations dealing with: the placement and orientation of buildings relative to noise sources, the interior arrangement (bedrooms, classrooms, study rooms etc.), the acoustic protection of exposed facades and the choice of layout of sectors of new noisy activities.

Under this perspective, a noise map constitutes a factor of reinforcement of the necessary coordination of public services; the desired outcome being that every administration, in its specific ability, bears in mind the actions taken by its partners. Therefore, urban noise maps can be a good tool of analysis, decision making and sensibilisation, and have multiple uses, from a particular study of a restricted zone (in the case of an impact study of a new noise source), to a presentation of an existing situation at the scale of an entire city, or even of an agglomeration.

Human nature has been adapted during the last decades to the life space which makes up the city. The consideration of problems linked to urban noise and to European planning is manifested in the facts. Hence,:

- the protection against noise and the evaluation of the acoustic space contributes as an important parameter in urban management,
- new residence projects in European cities situated within noise zones necessitate adequate solutions which impose the consideration of the "noise" parameter,
- measures aiming at the protection of the acoustic environment and at the rehabilitation of urban space must be within the framework of a global and multidisciplinary effort, bearing in mind the cultural and physical particularities of each site,
- the diversity of the administrative and legislative context of each European country, or even city, necessitates a reorganization at a European level, while ensuring the psychosocial characteristics and the way of life of varied European people.

Up to now, the European Union has only regulated noise emitted by certain fixed sources. Noise from our environment has not yet been the subject of particular laws, since it is so difficult to legislate on a topic linked to such an extent to the city life itself (urban structure, economic model, cultural and climatic elements, citizen perception etc.). In the forthcoming EU Directive for noise [4] is stated that each member state shall take the necessary measures to provide that no later than 3 years after the date of entry into force of this Directive noise maps on the situation in the preceding calendar year have been made and approved by the competent authorities, for all agglomerations with more than 250,000 inhabitants and for all major roads, major railways and major airports within their territory. The noise maps will be presented as graphical plots, numerical data in tables and numerical data in electronic form, ensuring the presentation of data on one of the following aspects:

- an existing, a previous or a predicted noise situation in terms of a noise indicator;
- the exceeding of a limit value ("conflict map");
- the number of people that is affected (annoyed, sleep disturbed or otherwise) in a certain area;
- cost-benefit ratios or other economic data on mitigation measures or scenarios.

In general and for the information of the citizen according to article 9 of the Directive and for the development of action plans according to article 8 of this Directive, additional and more detailed information is required such as conflict maps; difference maps, with comparison with options for future situations; and maps in which the value of a noise indicator in front of individual dwellings (at different heights) is presented.

The inclusion of noise mapping and action plans for major roads, railways and airports is a very practical way to include rural areas at one hand and to include major noise emitting systems at the other hand. It is also providing the possibility to exclude the smaller agglomerations, which may not have the proper staff and experience to develop noise maps and action plans. However the diversification of the urban characteristics of the European cities requires a more in depth analysis of the currently operational tools used in different types of applications. The sensitive social and cultural differences between the reactions to noise by inhabitants of the North and by those of the South is a fact that underlines the necessity of the introduction of urban ecology, according to which the acoustic environment is taken into account in the framework of the reorganization of the urban environment. Furthermore, the connection with action plans for the noisiest areas (i.e. the city centers and the areas near major roads, major railways and major airports), not only on a "quantity" level but also on the annoyance expressed, makes the noise mapping much more cost-effective tool and is stimulating noise climate improvements.

Introducing simultaneous methods of psychosocial analysis in order to analyze with precision the effects of noise in the population, the degree of annoyance by noise source type permitting to describe with clarity public opinion and evaluating day & night annoyance and sleep disturbance is crucial to noise abatement, or better, to the management and rehabilitation of the urban acoustic environment and the preservation of the typical "acoustic landscape" especially in the Southern European cities. The structure and life rhythm of each European city, are very important factors effecting the city's dynamics, and with the behavior of people living in the city and the climatic conditions, requires an objective approach of the existing acoustic environment introducing the noise factor as a psycho-social and design parameter of urban planning.

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