



8º SYMPOSIUM FASE'89

«ACUSTICA AMBIENTAL»

Zaragoza, Abril 1989

ACOUSTIC MAP OF ZARAGOZA

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INTRODUCTION

With the intention of having an actual knowledge of the environmental noise levels present in the area of the city of Zaragoza, the Department of the Environment of the Municipality is conducting a study that includes an ample campaign of measurements of these noise levels.

The objectives of the study are:

To make a general diagnosis of the environmental noise, covering the existing different situations.

To produce a zoning of the municipal area in relation to the environmental noise levels.

To evaluate the distribution of the sound levels in the area and its evolution with time along the day, the week and the year.

CAMPAIN OF MEASUREMENTS

The measurements of environmental noise levels are being carried on along the twelve months, in periods that coincide with the seasons of the year.

A reticle of flexible dimensions has been defined, covering the whole area of interest, and with the possibility of multiplying the number of points of measurement in zones with special characteristics and maintaining a minimum number of measurement points in other areas, allowing to know the noise levels in a representative manner.

Applying this criterion, in urban areas the dimensions of the reticle are 200 times 200 square metres; in rural and non urban (in the future) areas, the distance between the vertices of the reticle can be either 500 or 1000 metres.

The points of measurement are made to be coincident with the vertices of the reticle, or, at least, are the nearest accesible ones, with equivalent characteristics.

Points with special acoustic characteristics have been also chosen, such as in the vicinity of hospital, university buildings, leisure areas, etc.

In all the points of measurement a time sampling technique has been used, that is to say, the 24 hours of the day have been split up in time periods that coincide with the variations of the human activities: night rest, working periods, lunch and dinner hours, local activities, etc.; a sampling of the environmental noise levels is made for each of these periods.

The duration of the sampling varies between five and ten minutes for measurement points situated in urban areas with dense traffic, and between fifteen and twenty minutes for points in rural areas.

They have been taken measurements also in points considered as being representative of the different environmental situations, measuring the sound levels along the days of the week, including Saturdays and Sundays.

The percentiles L1, L5, L10, L50, L90, L95 and L99, as well as the equivalent continuous sound level L_{eq} , all expressed in dBA, have been chosen as descriptors of the environmental noise for the measurement periods. Also, the mean equivalent continuous sound levels for day time, night time and 24 hours, have been calculated for each point of measurement (see Table I and Fig. 1).

Given the extension of the area to be covered in the study, and with the intention of normalizing as much as possible the environmental conditions in all points, several systems of multiple and simultaneous data acquisition have been used.

The measuring equipments of direct analysis in situ consist in Statistical Analyzers CEL 162 AND Larson Davis 700.

For recording of the data, portable magnetic tape recorders Kudelski Nogra IV and Uher 4200, connected to Bruel & Kjaer sound level meters types 2203 and 2209, are used. The magnetic recordings are later on analyzed in the laboratory by means of a HP computer and analyzer Nortronics 830.

All the systems are calibrated before and after the measurements; wind shields are used for the microphones, that are placed 1.5 m above the floor level and at a distance of three or four metres from any reflecting surface.

CRITERIA AND LIMITS

In Spain there exist not at this moment criteria or

limits for environmental noise at national level. They exist municipal regulations that limit the maximum levels of noise emission from industrial activities and of noise inmission inside the dwellings.

With this absence of criteria there have been established as a base criterion for this study the limits of 65 dBA and 55 dBA of equivalent continuous sound levels for day and night periods, respetively.

CONCLUSIONS

In this moment, the information and available data are being processed, and also the last phase of the measurements is being carried out. For these reasons, the conclusions mentioned below are to be considered as provisional, until the study is completed.

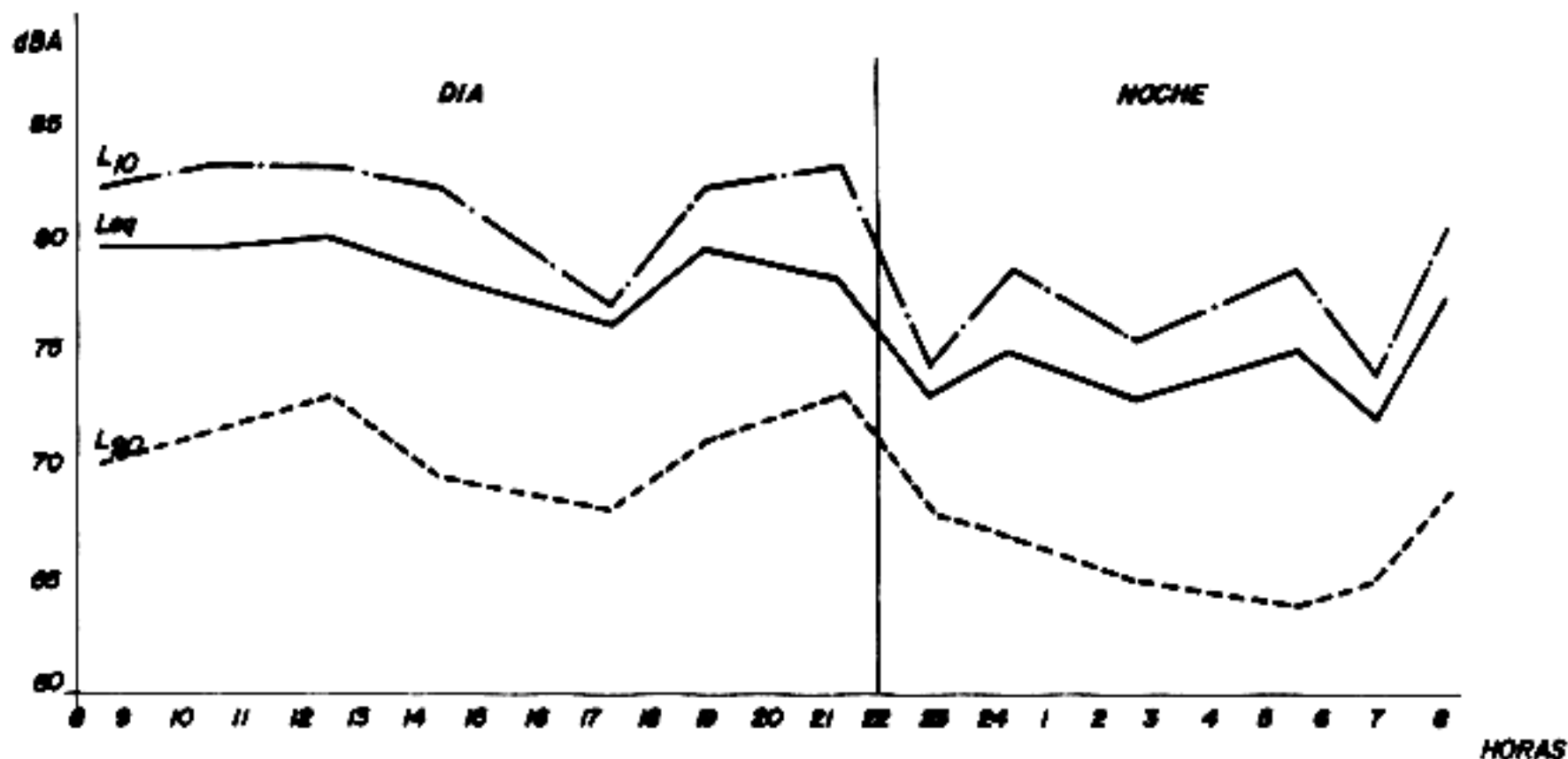
These conclusions are as follows:

The measured sound levels do not differ from those found in other Spanish towns.

In the 55% of the measured points the sound levels exceed the limit established for the day period.

In the 58% of the measured points the sound levels exceed the limit established for the night period.

Together with the traffic of vehicles, the sources of noise more important are: industry and activities, trains, acoustic sirens and building activities, during the day; for the night period, also the collection of rubbish.



COSO (C. MERCANTIL)

TABLE I

Project: P-478 MUNICIPAL AREA OF ZARAGOZA P.R.:P-40

Emplacement: COSO/Pza. ESPAÑA

Date: 09-12-1988

STATISTICAL SOUND LEVELS, dBA

HOUR	L99	L95	L90	L50	L10	L5	L1	LEQ
0,45	63,50	65,50	67,00	72,50	78,50	80,00	85,00	75,20
2,41	60,50	62,50	65,00	68,50	75,50	80,00	86,00	73,70
5,20	58,00	62,00	64,00	70,00	78,50	80,50	85,00	74,80
6,50	60,00	61,50	65,00	68,50	74,00	79,50	86,00	72,70
8,30	65,00	68,00	70,00	76,50	82,00	84,00	90,00	79,60
10,40	66,00	68,00	71,50	77,00	83,00	85,00	90,50	79,30
12,30	69,00	71,00	73,00	78,00	83,50	85,50	91,50	80,00
14,27	66,50	68,00	69,50	76,00	82,00	84,00	87,50	78,80
17,20	66,00	67,50	68,00	72,50	77,00	83,50	87,00	76,20
19,10	69,50	70,50	71,50	77,00	82,00	84,50	91,50	79,40
21,40	70,00	72,50	73,50	78,00	83,00	89,00	90,50	78,30
23,17	65,00	67,00	68,00	70,00	74,50	78,50	83,50	73,10
Day mean	67,43	69,36	71,00	76,43	81,79	85,07	89,79	78,80
Night mean	61,40	63,70	65,80	69,90	76,20	79,70	85,10	73,90
24 h mean	64,92	67,00	68,83	73,71	79,46	82,83	87,83	76,76

REMARKS: Traffic.-Day mean: 1500 v/h (12% heavies);
 Night mean: 70 v/h (2% heavies);
 Other.-Night public works