

Characterization of Zone Acoustic Saturated (SAZ) in the city of Leon (Spain)

Eduardo García^a, Jesús Cepeda^b, Marcos Fuentes^c, Berta Melcón^d, David Fernández^e, Mercedes de Barrios^f

^{a, b, c, d, f} Laboratory of Acoustics, Physics Department, University of León, Vegazana Campus, León, Spain. Tel. +34 987 291 777 - <http://www3.unileon.es/lab/acustica/>

^eEnvironment Office, Leon City Council, Leon, Spain

^{a, b, c, d, f} acustica.lab@unileon.es; ^e ambiente.ruido@aytoleon.com

Summary: With date June 25 2003, the Council of León (Spain) law for protection of the Environment against the emission of noises and vibrations was published in the Official Gazette of the Leon Regional Government. This law ordered, for the first time, the study of the possibilities of implanting Saturated Acoustic Zones in the city of Leon. The results of the preliminary studies corresponding to the possible implantation of Saturated Acoustic Zones (SAZ) in the city of Leon have implied the obtaining of high data of measurements of level of sonorous pressure in diverse points of a defined affluent zone of this city, for later to confront them with the exigencies that the existing city council legal norm indicates. The values obtained for different L10, L50, L90, Leq and Lmax, are of special relevance in the nocturnal period, in days of weekend. The conclusions will fundamentally talk about the Leq, like significant parameter. In this paper the Acoustics Laboratory (University of Leon) displays the results of the preliminary studies corresponding to the possible implantation of SAZ.

1. INTRODUCTION

The possibility of implantation of Zones Acoustic Saturated in the city of Leon (Spain) is contemplated for the first time in June of year 2003, with the take effect of the Local Law of the City Council of Leon, on protection of the Environment against the emission of noises and vibrations.

Many spanish City Councils gather also this possibility in their respective laws, and in the most of the occasions as a result of the accumulation in certain zones of the cities of activities that originate annoyances of consideration in the residents by noise levels. It is almost always forced to talk about activities of nocturnal leisure and entertainment, bound to a high density

of discos, pubs and clubs in areas more or less reduced of the city. The City Council of Leon has ordered to the Acoustics Laboratory of the University of Leon the accomplishment of a previous study to verify the viability of the declaration of SAZ in a defined zone of the city, well-known like "Barrio Húmedo". The reiterated request of the associations of neighbors has decisively contributed to motivate the accomplishment of this study to take measures, improving its acoustic comfort, that, of course, they consider very deficient.

2. METHODOLOGY

Starting points. Local before mentioned forces to fulfill series of exigencies and procedures to be able to approve implantation of SAZ in this city, requirements of special importance.

The implantation of SAZ in our city implies series of performances, procedures and requirements legal to fulfill, given the important repercussions that it can suppose in the territorial scope of the affected district.

The law indicates:

"It is possible to declare Zones Acoustic Saturated (SAZ) those districts in which, even though each activity individually fulfills the levels regulated in this Law, the levels are exceeded in more of 20 dBA twice per week, during two weeks consecutive, the limits of disturbance by noises in the outer atmosphere established in article 7 of this Title".

"The index to consider will be LAeq during any hour of the nocturnal period (10 pm to 8 am) or LAeq14h for all the diurnal period (8 am to 22.pm)".

Parameters to consider and extension of the Zone. As it were already mentioned, the Zone is limited the denominated "Barrio Húmedo", where a high concentration of pubs exists, musical discothecs, coffees, bars and other similar establishments; be enough to mention that, as a whole, they develop to his activities approximately 140 establishments of the mentioned characteristics. Altogether, this zone will be certain in the present study by 19 different streets, that they are formed as representative of the zone to consider.

We have the data collected in the Acoustic Map of Leon, finished in year 2002, and also made by this Acoustics Laboratory, reason why we will leave from the results of the same one for its comparison with the demanded study for the SAZ declaration.

The local law indicates to the effect that the maximum levels to outside do not have to surpass the following values:

Max. levels (dBA) according to type of urban zone	Day	Night
Zones of houses, tertiary offices and noncommercial services or nonsanitary equipment	55	45

The requirement to surpass in more than 20 dBA the considered levels of noise is evidently very demanding, but to it we will have to talk about for the study to develop. Considering that the activity of the zone at issue is developed primarily in the nights of weekend, it was adopted as comparison criterion the Leq corresponding to each hour section of the nocturnal period, on Friday and Saturday. Therefore, the representative values of Leq of the zone will have to surpass the 65 dBA for the considered period.

Representativeness and Randomness of the data. In order to guarantee the validity of the data corresponding to the zone of study a series of criteria was adopted. Of this form, in the first place, representative points in each one of the streets were chosen; thus, if the street, in function of its dimensions, only needed a point, this one would be located in its center, and always considering the possible sources of noise. However, if several points needed, they would be had distance at intervals regular; in this case, the acoustic conditions of the street at issue would be determined by the average of the values corresponding to the different points.

On the other hand, the measurements were at night carried out of Fridays and Saturdays, from 10 pm to 8 am, dividing this schedule, with the object of measurement, in the following ones períodos:

- 1st period: 10 pm-24 pm, subdivided in two hour sections.
- 2nd period: 0 am-6 am, subdivided in six hour sections.
- 3rd period: 6 am-8 am, subdivided in two hour sections.

Each one of the measures took place during a time of 5 minutes of uninterrupted manner, for each one of the indicated hour sections. Therefore, like result of the exposed planning, each point was measured during 50 minutes.

In addition, in order to obtain the greater representativeness, they were marked, among others, the following conditioners:

Any point in the same day of work was not measured twice.

Points of a same street in the same day, but always in different hour sections could be measured.

Parameters of Measurement. Each one of the measurement points is determined by the Level of Equivalent Noise (Leq), as well as by the levels L10, L50 and L90, and by the Lmax, all of them expressed in dBA.

Measuring equipment:

- Precision integrating sound level meter Brüel&Kjaer mod. BK 2231, with the corresponding modules, provided with tripod.
- Pistophone Brüel&Kjaer, BK 4230.
- Precision integrating sound level meter CEL, mod. 393, provided with tripod.
- Pistophone Cel, mod. 177.
- Precision integrating sound level meter Rion mod. NL-18, provided with tripod.
- Pistophone 01 dB mod. CAL 01, for the previous sound level meter.
- Anemometer Silva.

The necessary precautions for this type of measures were taken, as far as distance, meteorological adverse incidences height of the tripod and other that supposed important alterations in the measurements. Also, all the apparatuses were calibrated before and after each measurement.

3. ACOUSTIC LEVELS IN THE ZONE.

As much acoustic maps of the zone have been made, like the corresponding tables with the obtained graphs. At the end of the present communication the resulting planes for the Leq and Lmax are offered, as well as a leaf with the most excellent data Leq and Lmax of each one of the measured points.

A summary of the results, as far as the values of Leq, would offer to us:

- Period between 22 and 24 hours: 11 points surpass the level of 65 dBA.
- Period between 24 and 06 hours: 18 points surpass the level of 65 dBA.
- Period between 06 and 08 hours: 8 points surpass the level of 65 dBA.
- In the average for the total at night, 11 points present/display levels superior to limit
- In some concrete hour period, for example, between the 02 and 03 hours, they are the 20 points in which it reaches the number of reference
- *Final, like more excellent data, must be indicated that in 24 points (96 % of the total) the Leq surpasses the level of 65 dBA.*

On the other hand, in which it makes reference to the numbers of Lmax, in 23 points (92 %) the 75 dBA are surpassed for the average of all the night, and even in 13 of them (52 %) the 80 dBA.

It is forced to review some questions of interest:

- The source of predominant noise constitutes the own people, who in general excel over the generated one by the establishments in himself.
- The schedules of closing of the premises are located very over the authorized thing legally.
- It is essential to indicate that all the zone at issue is a pedestrians street.

4. DECLARATION OF SAZ AND CONSEQUENCES.

The procedure to follow for the SAZ declaration, from the results of this study, will be the following one:

- Accomplishment of sonometric study for updated and definitive justification of which the sonorous level surpasses the value or indicated.
- Preparation of planes of the Zone that delimit it of precise and clear form, as well as, in its case, a Zone of Respect.
- Report that establishes the type and characteristics of the establishments or activities that, as a whole, generate saturation.
- Proposal of general and/or individual measures to adopt.

The measures anticipated in the municipal norm, for the case of SAZ declaration, will be, among others, the following ones:

- Limitation of schedules for the playful activities.
- Prohibition to place tables and chairs in the public thoroughfare and temporary retirement of licenses to the effect.
- Establishment of limits of sonorous emission more restrictive than those of general character.
- Prohibition to install, to modify or to extend the activities that specifically determine, and that they can be origin of acoustic saturation.
- Prohibition of commercial or advertising activities in the street.

5. CONCLUSIONS.

Although one is carried out prior to the measurements, the conversion of the zone in pedestrians street, the results of present study establish clearly the importance of the existing problem in the zone considered, with high levels of noise in nocturnal period during the days of weekend.

The criteria indicated by the Municipal Ordinance of Leon for the implantation of a SAZ are highly demanding. Nevertheless, in most of the studied points, the obtained values surpass the level of 65 dBA of Leq, being highly showy some hour period, with levels even over 70 dBA in several cases. Let us remember that in 96 % of the considered points the level is surpassed in some hour section limit.

It must conclude of definitive way that is forced the accomplishment of a complete study, in agreement with the norm of application, for the definitive declaration of Zone Acoustic Saturated. This declaration would allow to make to the City council excellent performances to try to diminish the annoyances caused to the residents and to improve its quality of life.

6. ACKNOWLEDGEMENTS

The financing of the City council of Leon, and in special to the support offered by its Council of Environment, has made the accomplishment possible of this study.

Table 1: Acoustic Map – Leon Old Zone – Values of Leq (dBA)

id	PLA	GUT	SER	PLE	BER1	BER2	BER3	CER1	CER2	MAY1	MAY2	CRU1
22-23	64,6	66,6	65,8	59,7	63,6	64,6	57,0	71,4	65,6	62,5	65,6	62,1
23-00	66,6	68,6	62,7	62,6	65,1	62,2	58,7	70,2	64,1	64,0	66,9	64,7
av 22/00	65,6	67,6	64,3	61,2	64,4	63,4	57,9	70,8	64,9	63,3	66,3	63,4
00-01	68,3	65,4	64,7	68,4	67,4	61,9	60,9	63,9	69,9	71,1	70,1	60,7
01-02	70,5	71,5	66,0	72,2	65,8	60,1	65,7	64,6	62,9	71,5	72,7	65,5
02-03	72,9	73,4	62,7	71,1	67,9	68,5	68,8	66,2	60,0	71,0	76,2	70,8
03-04	78,0	66,4	62,3	71,8	70,3	66,7	71,1	60,8	56,2	75,8	75,1	69,0
04-05	70,9	65,9	58,9	71,3	73,8	69,4	73,4	50,2	52,0	64,5	73,9	69,8
05-06	66,0	64,2	58,1	65,9	74,6	74,4	69,1	51,2	54,8	61,7	70,7	68,6
av 00/06	71,1	67,8	62,1	70,1	70,0	66,8	68,2	59,5	59,3	69,3	73,1	67,4
06-07	65,1	61,0	56,5	59,9	75,8	78,5	68,8	47,0	55,6	59,5	64,7	70,3
07-08	63,0	58,3	54,8	57,5	76,1	76,1	67,6	44,3	53,9	57,6	63,3	67,8
av 06/08	64,1	59,7	55,7	58,7	76,0	77,3	68,2	45,7	54,8	58,6	64,0	69,1
night	66,9	65,0	60,7	63,3	70,1	69,2	64,7	58,6	59,6	63,7	67,8	66,6

Table 2: Acoustic Map – Leon Old Zone – Values of Leq (dBA)

id	CRU2	ANC1	ANC2	MIS	MAT	JUA	GRA	CAÑ	PAL	VAR	RIA	MAR	CAS
22-23	65,8	64,4	62,6	68,1	74,0	62,1	55,9	54,1	66,3	68,1	60,3	75,6	64,2
23-00	65,9	62,3	60,6	70,2	70,3	66,0	60,5	54,4	64,8	66,3	62,9	72,8	68,0
av 22/00	65,9	63,4	61,6	69,2	72,2	64,1	58,2	54,3	65,6	67,2	61,6	74,2	66,1
00-01	66,8	69,5	67,3	73,3	76,2	67,7	53,5	54,2	64,6	64,8	62,6	69,8	67,2
01-02	66,5	62,3	56,5	75,0	82,8	77,3	55,8	57,5	70,7	69,1	68,5	76,0	66,5
02-03	74,5	63,2	68,4	71,8	77,7	78,2	60,7	53,6	66,3	74,3	68,6	76,6	69,4
03-04	80,0	62,9	50,2	75,5	81,8	77,7	54,5	61,2	75,9	74,4	67,8	79,5	67,2
04-05	68,4	57,7	54,4	67,6	81,9	76,2	47,8	65,4	75,9	76,1	76,9	69,8	62,5
05-06	67,5	56,8	58,5	62,0	66,3	64,0	47,0	50,6	76,0	72,5	65,3	70,8	57,9
av 00/06	70,6	62,1	59,2	70,9	77,8	73,5	53,2	57,1	71,6	71,9	68,3	73,8	65,1
06-07	70,3	56,1	69,2	53,2	57,5	58,6	46,8	53,1	72,1	66,8	63,9	57,4	53,2
07-08	68,5	52,1	65,9	48,3	53,0	43,5	46,4	49,0	70,2	66,3	59,0	58,8	50,2
av 06/08	69,4	54,1	67,6	50,8	55,3	51,1	46,6	51,1	71,2	66,6	61,5	58,1	51,7
night	68,6	59,8	62,8	63,6	68,4	62,9	52,7	54,1	69,4	68,5	63,8	68,7	61,0

Table 3: Acoustic Map – Leon Old Zone – Values of Lmax (dBA)

id	PLA	GUT	SER	PLE	BER1	BER2	BER3	CER1	CER2	MAY1	MAY2	CRU1
22-23	79,0	79,9	76,6	68,8	82,1	79,1	71,2	90,9	80,3	78,3	73,3	75,6
23-00	76,5	83,4	77,7	73,0	85,4	74,3	72,4	89,8	77,0	77,2	75,8	84,2
av 22/00	77,8	81,7	77,2	70,9	83,8	76,7	71,8	90,4	78,7	77,8	74,6	79,9
00-01	85,3	81,0	74,3	80,4	81,8	90,8	76,7	77,5	91,2	82,3	84,9	71,7
01-02	91,0	86,3	86,5	88,1	77,7	72,7	79,1	84,7	74,6	82,8	82,1	77,4
02-03	90,9	85,9	74,3	89,1	83,3	81,7	81,7	84,5	75,4	84,1	88,3	81,8
03-04	87,4	85,4	81,9	85,6	84,4	82,6	82,3	80,4	71,7	95,4	86,7	85,0
04-05	86,5	87,1	70,1	90,3	84,5	84,3	83,2	74,0	63,8	82,6	85,0	90,7
05-06	81,6	84,1	81,8	89,3	87,1	92,2	80,5	73,3	71,1	77,2	84,0	85,1
av 00/06	87,1	85,0	78,2	87,1	83,1	84,1	80,6	79,1	74,6	84,1	85,2	82,0
06-07	82,0	81,3	75,0	73,1	88,1	91,0	84,9	68,5	75,4	79,1	84,7	86,8
07-08	80,5	79,4	75,5	66,6	88,8	93,4	84,0	65,6	72,2	75,5	84,0	83,3
av 06/08	81,3	80,4	75,3	69,9	88,5	92,2	84,5	67,1	73,8	77,3	84,4	85,1
night	82,0	82,3	76,9	76,0	85,1	84,3	78,9	78,8	75,7	79,7	81,4	82,3

Table 4: Acoustic Map – Leon Old Zone – Values of Lmax (dBA)

id	CRU2	ANC1	ANC2	MIS	MAT	JUA	GRA	CAÑ	PAL	VAR	RIA	MAR	CAS
22-23	80,5	78,1	76,3	84,2	85,9	79,7	70,5	65,0	81,9	82,5	78,2	97,8	79,2
23-00	81,3	76,0	74,8	86,9	84,6	81,3	71,3	68,1	83,2	85,6	74,4	95,7	84,9
av 22/00	80,9	77,1	75,6	85,6	85,3	80,5	70,9	66,6	82,6	84,1	76,3	96,8	82,1
00-01	79,7	86,1	76,8	87,5	84,0	82,5	68,4	76,8	76,8	84,8	80,4	79,5	81,0
01-02	82,9	70,2	74,2	91,4	96,5	90,5	65,5	72,8	87,5	80,6	81,5	89,7	84,9
02-03	92,3	80,8	82,1	85,9	93,3	93,8	74,0	67,7	80,5	90,9	89,8	88,9	85,1
03-04	95,4	76,4	68,1	89,7	95,6	89,5	70,2	75,5	88,7	87,0	80,3	91,1	81,1
04-05	86,8	71,9	68,2	85,7	97,2	91,9	63,6	79,5	89,0	91,0	95,6	89,0	77,6
05-06	84,1	72,0	77,4	82,2	79,0	82,0	67,1	65,8	91,7	92,7	83,9	84,9	73,4
av 00/06	86,9	76,2	74,5	87,1	90,9	88,4	68,1	73,0	85,7	87,8	85,3	87,2	80,5
06-07	83,0	73,9	85,7	78,0	83,7	75,3	64,9	68,5	86,2	82,2	81,2	75,5	78,0
07-08	81,1	70,2	82,2	73,0	75,6	60,9	58,6	62,4	84,8	78,7	76,7	72,0	75,6
av 06/08	82,1	72,1	84,0	75,5	79,7	68,1	61,8	65,5	85,5	80,5	79,0	73,8	76,8
night	83,3	75,1	78,0	82,7	85,3	79,0	66,9	68,3	84,6	84,1	80,2	85,9	79,8

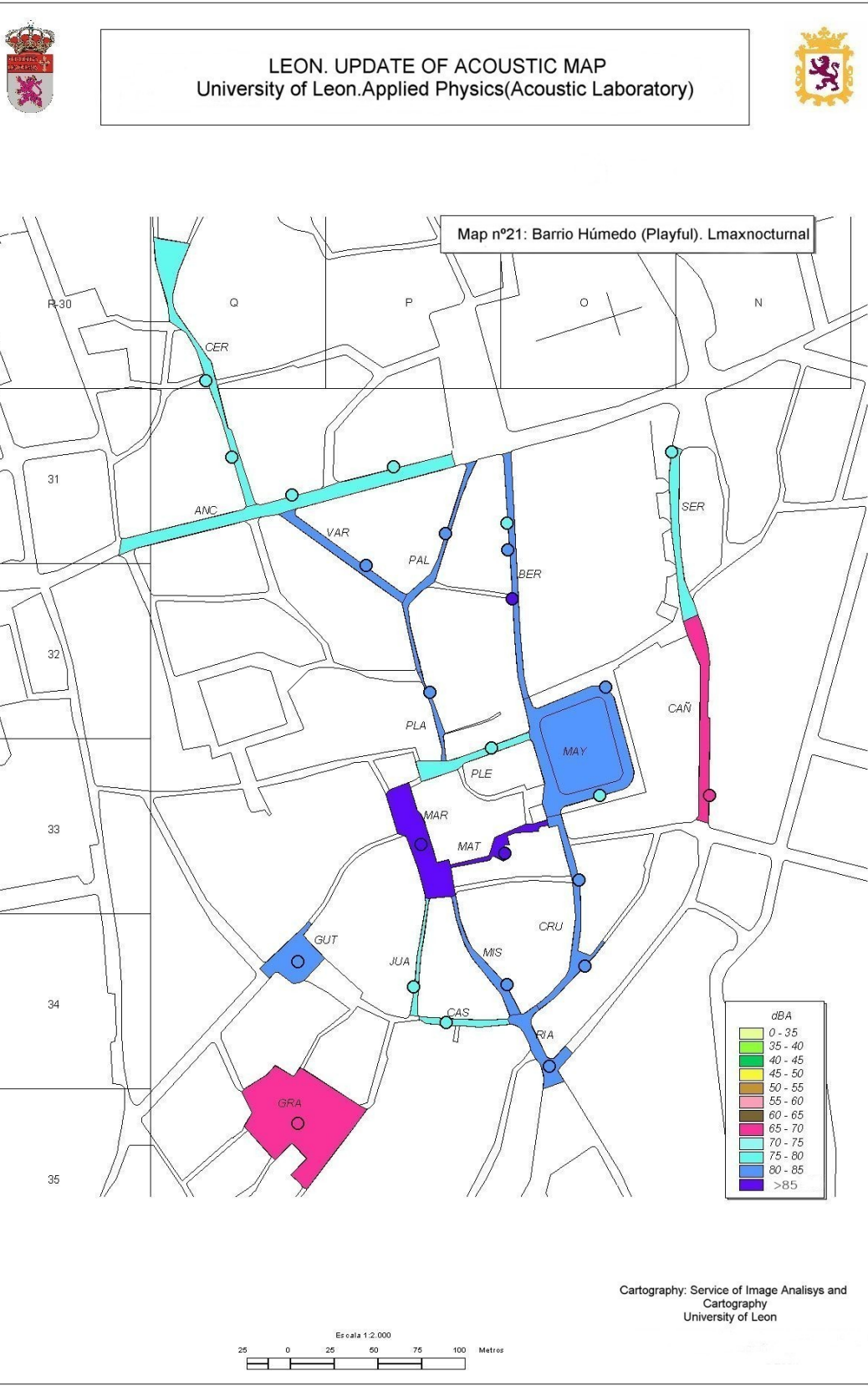


Figure 1: Acoustic Map – Leon Zone” Barrio Húmedo” – Values of Lmaxnocturnal (dBA)

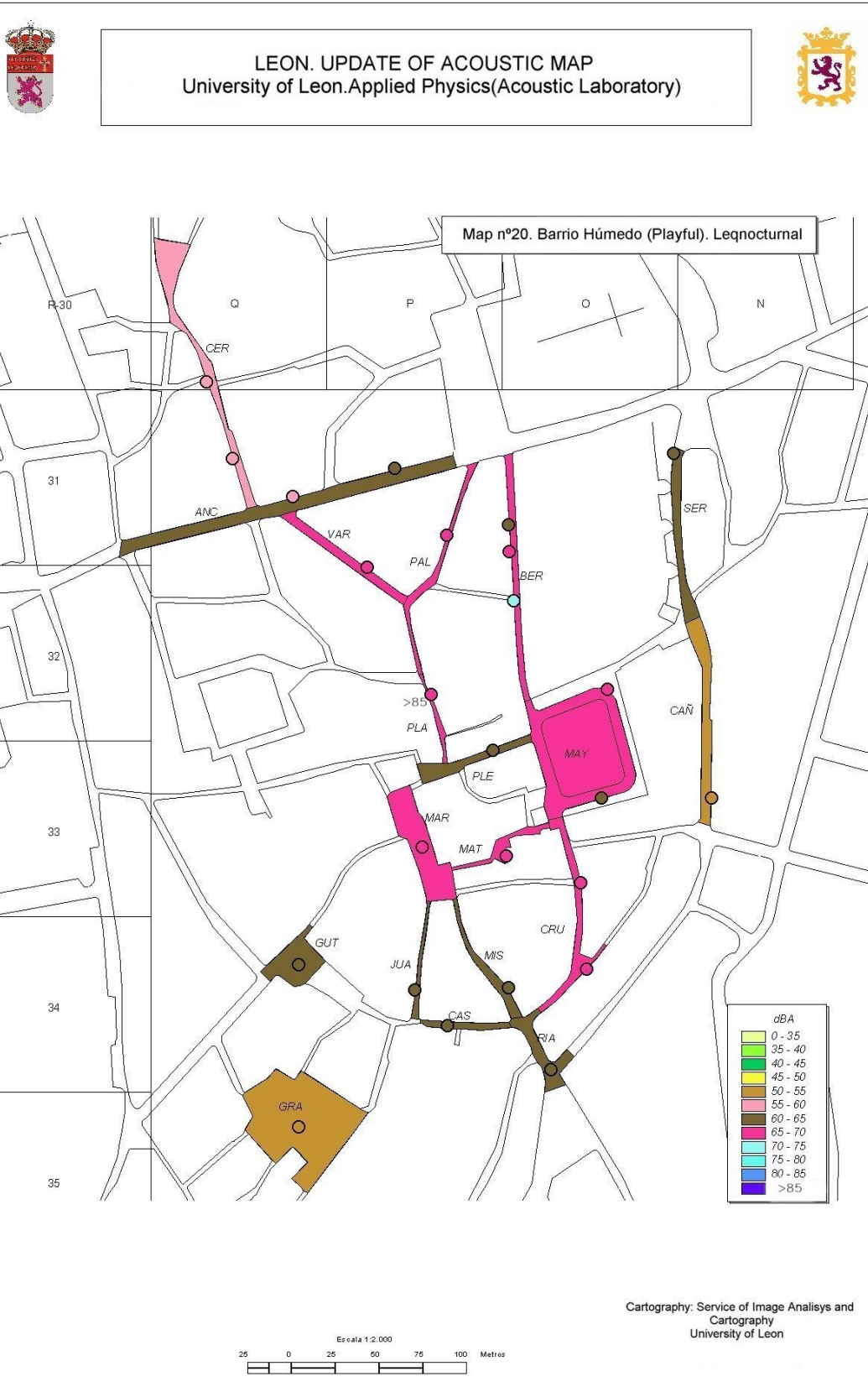


Figure 2: Acoustic Map – Leon Zone” Barrio Húmedo” – Values of Leqnocturnal (dBA)