

ACOUSTIC SATISFACTION SURVEYS.

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ABSTRACT

In Spain, the DB HR (acoustic regulation) specifies the objective parameters and verification systems, whose compliance ensures the satisfaction of the basic requirements and the exceeding of the minimum quality levels of the Basic Requirement of Protection Against Noise.

In this study, made by ATEDY (Technical and Business Plaster Association), AFELMA (Manufacturers of Insulating Mineral Wool Association) and the Instituto de Ciencias de la Construcción Eduardo Torroja, in collaboration with other companies that have provided support, analyse the “Acoustic Satisfaction Surveys” for home users.

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1. EFFECTS OF NOISE ON HEALTH

In today's society, noise is one of the environmental problems that most concern, due to its involvement in the quality of life, of citizens. Acoustic comfort is sought to improve this quality of life and, as far as possible, limit the adverse health effects caused by noise.

Spain is the second noisiest country in the world after Japan (Sustainability Report in Spain of the Organization for Economic Cooperation and Development OCDE) and therefore about 9 million Spaniards support average noise levels above 65 dBA during the working day and in their residences, where almost a third of Spanish households declare to suffer discomfort due to noise generated outside their homes.

The greater the noise pollution, the greater the dissatisfaction with the house, the neighbours, the environment, etc. This causes the so-called "environmental stress" with physiological and psychological repercussions. The annoyance has to do with how noise is perceived and is affected by different aspects such as living conditions, attitudes towards the source of noise, time of day, personal and sociodemographic variables ... being the most vulnerable children and the elderly.

The main effects of noise on health detected in residential buildings are:

- Sleep disorder
- Disturbances and interference in the conversation
- Hearing impairment
- Effects on physiological functions (endocrine system, cardiovascular system ...)
- Effects on mental health
- Effects on performance
- Social and behavioral effects

To avoid these disorders, the World Health Organization published in 2000 the values from which there are evidences of health risks, which serve as reference recommendations for actions to control environmental noise.

2. ACOUSTIC COMFORT CRITERIA

The acoustic comfort in a residential building is an essential aspect of the quality of life of its users. Noisy environments are one of the biggest sources of annoyance.

One third of citizens are affected by noise and, therefore, do not get the necessary rest and relaxation essential for health. A significant percentage of the population declare having noise problems in their home. The acoustic comfort being increasingly demanded in today's society and a factor that should be improved not only in new buildings but in the existing building park.

2.1. What is acoustic comfort?

The acoustic comfort is in which the level of noise caused by human activities is adequate for rest, communication and health of people and allows him to perform their tasks comfortably and even perform activities that can produce noise without annoy other people; with three important concepts: privacy, concentration and intelligibility.

The acoustic comfort inside the home is an essential aspect of the quality of life of its users since it is in homes where users perceive noise as one of the most important annoyances.

In the survey conducted in this study, we will see the different types of noise and how it affectS the discomfort they cause, as well as the different perceptions of them. The

acoustic comfort has a subjective magnitude when valued by the perceptions of the user and that will be variable since they will depend on the people and the activities that they carry out. However, it is possible to delimit certain ranges or sound level patterns obtained from statistical studies that will be used in the survey.

The degree of acoustic comfort will depend on different parameters:

- Environmental: sound level, exposure time, frequency etc.
- Subjective: personal and socio-cultural factors
- Constructive: the acoustic quality of the building elements incorporated into the building to provide acoustic insulation and acoustic conditioning.

2.2. Sources of noise

The most relevant noise sources perceived in the interior of the house, and that will be analysed later in the surveys carried out, are the following:

- Noise disturbances in general
- Noise disturbances produced by neighbours
 - o Through the walls
 - o Through the roof / floor
 - o Bass music and subwoofer
 - o Noises of footsteps, vibrations and furniture clinking
 - o Own relatives heard inside the house
- Disturbances due to external noise
 - o Community stairs, access to common areas
 - o Water installations (plumbing, toilet, shower ...)
 - o Air conditioning installations (heaters, air conditioners, radiators and fans)
 - o Service facilities (elevators, washing rooms, central air conditioning)
 - o Locals (garages, shops, bars, restaurants ...)
 - o Road Traffic

3. SURVEY OF ACOUSTIC SATISFACTION IN RESIDENTIAL BUILDINGS

The phases of the study have been the following:

1. Survey design
2. Field work
3. Analysis of the results

3.1. Survey design

The survey was designed to perform in households with a battery of questions of classification and a block of questions of scale 0-10 on the discomfort caused by different types and sources of noise, being 0 "absolutely nothing" and 10 "extremely".

3.2. Field work

The surveys have been conducted in homes built as of 2011 with the CTE DB HR regulation already implemented.

The 1.000 interviews conducted have been distributed in 5 different cities as follows:

City	Survey number
Madrid	296
Barcelona	251
Valencia	151
Seville	152
Pamplona	150

3.3. Sample profile

The classification of the demographic sample on which the surveys have been conducted has been heterogeneous both in terms of gender, age and type of housing

3.4. Analysis of results: Satisfaction with housing

Scale used in the survey response

Numerical scale	Nominal scale
0 - 1	Absolutely nothing / Totally dissatisfied
2 - 4	Little / Dissatisfied
5 - 7	Very much / Satisfied
8 - 10	Extremely / Totally satisfied

With this structure the result of the surveys has been as follows:

Gráfico 1. Satisfacción general con la calidad de vida en su vivienda



Gráfico 2. Satisfacción con los siguientes factores de su vivienda

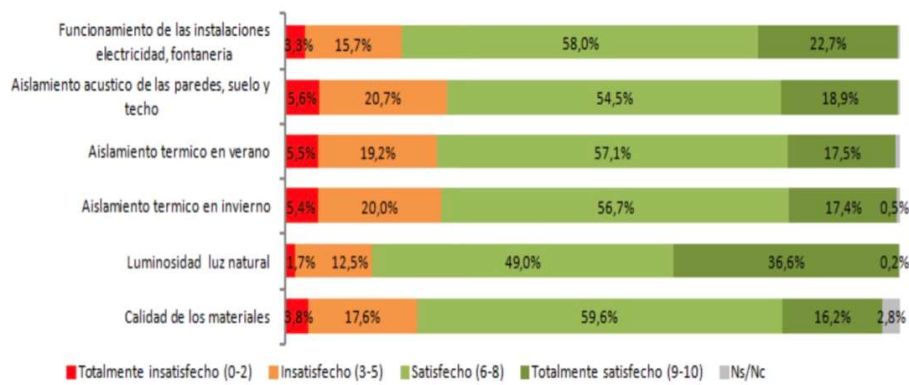


Gráfico 3. Cuánto le molesta o perturba el ruido producido en general



Gráfico 4. Cuánto le molesta o perturba el ruido producido por vecinos, instalaciones...

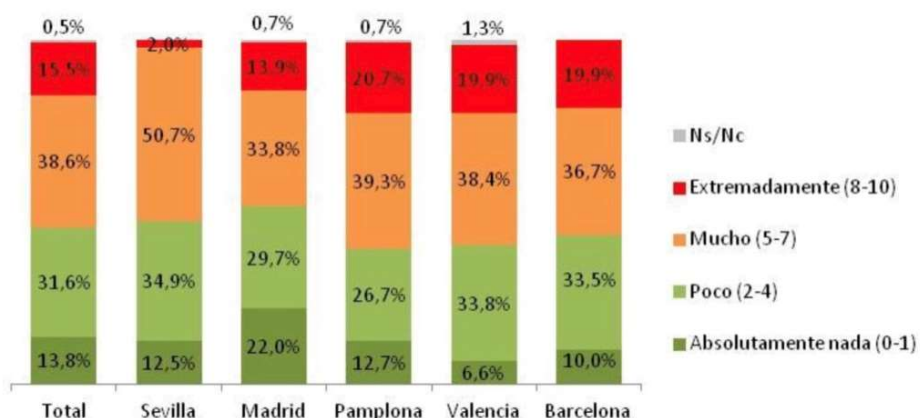


Gráfico 5. Cuanto le molesta o perturba el ruido producido por los siguientes factores:

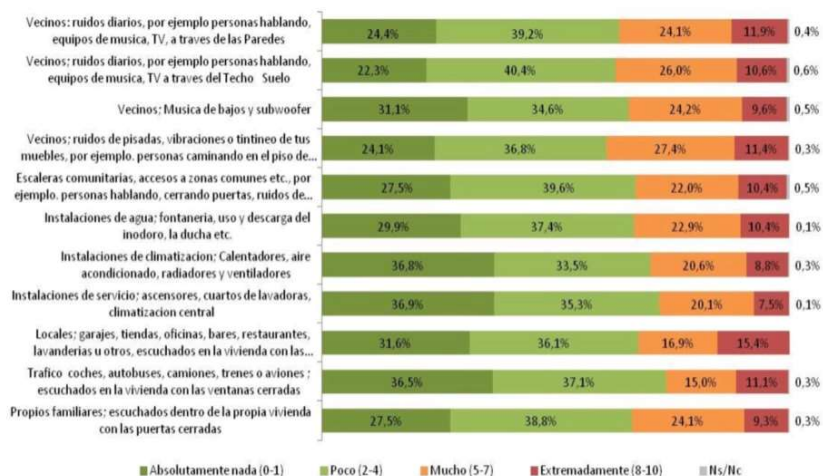


Gráfico 6. ¿El ruido le ha causado alguna afectación a su salud?



4. CONCLUSIONS

The results obtained in the study, with the sample of 1000 households, show a great consistency with the data break down by cities. This fact shows that the sample used in the fieldwork adequately captures the heterogeneity of the population and shows that noise is perceived in a similar way regardless of the place of residence.

From the analysis of the results of the survey, the following aspects can be highlighted:

- 84% of Spaniards feel satisfied in a general way with the quality of life in their home.
- However, when it is deepened and asked about specific aspects, it is where the problems that we find begin to appear, highlighting the isolation of houses in general and acoustic insulation in particular as the most worrisome aspect (26.3%) .
- In figure 3 we can see that almost half of the households state that they are very or extremely disturbed by the noise produced in general.
- Likewise, it can be seen that more than half of the households state that they are bothered a lot or extremely by the noise produced by neighbors, facilities ... (Graph 4)
- If we analyze noise according to its origin, we can see that those that cause the most discomfort (much or extremely) are those produced by neighbors in general, the one generated in community stairs or common accesses and water facilities. (Graph 5)
- All these noises supported generate some discomfort and affections both physically and psychologically, leading to stress (14.2%) or anxiety (10.3%) in people who suffer from it (Figure 6)

Despite the fact that the surveyed dwellings were built under the acoustic insulation requirements included in the Spanish regulation CTE DB HR (Document of Protection against Noise) that supposed 10 years ago a performance improvement with respect to the old norm of the year 1988 NBE CA 88, more than half of the households declares that it disturbs much or extremely the produced noise in general, causing affections in the people who suffer them, mainly sleep disturbances, lack of concentration, irascibility or stress.

With these results we can see that noise is a real problem in a large part of homes, regardless of their location, and isolation is one of the aspects that most concern citizens.

Society is increasingly sensitive to the problem of environmental noise, considering it as a negative aspect of their quality of life.

Spain is the second most noisy country in the world, being the noises that bother the Spaniards caused by traffic and works in the neighborhood, although there are other sources to take into account such as industrial, railway, air, noise, domestic activities...

The main adverse effects caused by noise are recognized by the World Health Organization. To counteract the noise pollution and limit the effects of noise on health, acoustic comfort is sought based on a better isolation of the enclosures.

Acoustic insulation in buildings has gradually developed during the last 100 years, with a special incidence in Spain since 2009 with the entry into force of the CTE DB HR, but, according to the results of the surveys, it is still not enough to achieve the desired acoustic comfort, being necessary an improvement of the acoustic requirements in residential buildings. The regulations demand minimum values of acoustic insulation but these only guarantee the satisfaction of 40% of the users in some cases.