RESULTS FROM IMPLEMENTATION OF THE NEW PORTUGUESE ENVIRONMENTAL NOISE REGULATION

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ABSTRACT
Environmental noise is one of the main environmental problems in Portugal. In order to minimise it, new Portuguese environmental noise legislation was recently approved. In this study it was pretended to analyse and compare results of several environments noise evaluations according to the old and new legislation criteria. Although the new criteria appear to be more restrictive, the evaluation parameters have changed. It is therefore not quite clear that new legislation is in fact more restrictive. Analysis from 15 different cases shows that there are significant differences between the two criteria.

1. INTRODUCTION

Noise is one of the main environmental problems worldwide. There are no worldwide estimates of the impact and cost of environmental noise (Bruel&Kjaer, 2000). Although in an european context, a study from the European Commission (European Commission, 1996) seems to cover some of these aspects. This study, entitled European Union's Green Paper on Future Noise Policy, estimates that: (1) in terms of the number of people affected by noise, approximately 20% of the population are exposed to unacceptable noise levels. Additionally, 170 million Europeans live in areas where noise levels cause serious annoyance during the daytime; (2) in financial terms, environmental noise costs society an estimated 0,2 to 2% of the Gross Internal Product.

In contrast to many other environmental problems, noise pollution continues to grow and it is accompanied by an increasing number of complaints from people exposed to noise. The growth in noise pollution is unsustainable because it involves direct, as well as cumulative, adverse health effects. It also has socio-cultural, aesthetic and economic effects and can adversely affect future generations.

In order to avoid the worst scenario, in almost all european countries some efforts have been made to reduce environmental noise. However, these efforts are country specific, i.e., each country has carried out its own measures, developing specific methodologies, and its own legal requirements, since there is no European Directive concerning environmental noise.

Portugal, as other European countries, has specific legal requirements in what concerns to environmental noise. The first legal requirements related to noise are dated from 1987, when the Decreto-Lei no. 251/87, of 24th June, which approves the "Noise General Regulation" (NGR), was published. In 1989, some modifications on NGR were implemented through the Decreto-Lei 292/89, of 2nd September.

This last legislation was expected to be revised in a short period. However, only eleven years later, in 2000, a new legislation about environmental noise was published in Portugal. This legislation, the Decreto-Lei 292/200, of 14th November, was then designated "New Legal Regimen about Noise Pollution". Several modifications, implemented in this last legislation, will be later explained in more detail later.

This paper focuses a comparison, based on 22 cases of environmental noise evaluations, between new and old legislations, in order to verify if the new legislation is, as preconized by environmental portuguese entities, more restrictive.

2. METHODOLOGY

As mentioned previously, a new criteria has been implemented in Portugal. This new criteria, however, is not directly comparable with the old one because the evaluation parameters have changed. It is therefore, not immediately evident that the new legislation is in fact more restrictive (Carvalho, 2001). In order to test the differences between the application of the new and old legislation, a sample of 22 cases was used.

The study sample includes several economic activities (Table 1). These cases were not originally evaluated by the two criteria. In these 22 cases, some of them were evaluated before the new legislation. Only for this purpose, all cases were analysed using both criteria.

Activity Sector	Cases
Bars and Cafes	8
Stone and Marble Industries	4
Metal Industries	3
Textile Industries	3
Wood Industries	2
Night Clubs	1
Rubber Industries	1
Total:	22

Table 1. Distribution by activity sector of the 22 cases sample

The main difference between old and new legislation was, essentially, the evaluation criteria, since legislation do not specify the evaluation methodology. The evaluation methodology of noise annoyance is presented in Portuguese standards, namely, NP 1730:1,2 and 3 of 1996. However these standards, based in European standards, are oriented to geographical noise mapping and simulation. Thus, methodology for evaluation of noise annoyance in residences (indoor) is not completely clear.

Beyond these methodological issues, the new Portuguese legislation introduced new important insights. These include, the use of acoustical data for territory use planning, the need to establish city noise maps, the definition of neighbourhood noise, and the classification of all areas in two different areas according to noise levels.

However, the aim of this study was to evaluate the differences between annoyance criteria. These criteria had substantially changed. Both limits and parameters used were changed. Additionally, the reference periods have changed from 3 to only 2 periods.

2.1. Criteria from DL 292/89

In this legislation the annoyance criteria is defined as the difference between the Leq of the specific noise and the L_{95} of the residual noise. Specific noise is a component of the ambient noise and can be identified and associated with a specific source. Residual noise is the ambient noise without the specific noise, measured when the noise from the specific source is suppressed.

According to this criteria, noise annoyance is verified when the previous difference exceeds 10 dB(A). However, there are some corrections that must be applied. Tonal and impulsive corrections must be added to specific noise, if any of them are identified. None of these corrections are specified in legislation. The values and the way to identify them are only referred in previously mentioned standards.
The 3 reference periods used in this legislation were day period (7-20h), intermediate period (20-24h), and night period (0-7h).

In any case the criteria for a non-annoyance situation is:

$$L_{eq}(\text{specific noise}) - L_{95}(\text{residual noise}) \leq 10 \text{ dB(A)} \qquad \text{Equation 1.}$$

2.2. Criteria from DL 292/2000

This legislation has changed several aspects in evaluation criteria. Reference periods, as mentioned previously, change from 3 to 2, the day period (7-22h) and the night period (22-7h).

Noise annoyance is, in this case, identified if the difference observed between the ambient noise Leq and the residual noise Leq exceeds 5 and 3, in the day and night period respectively. However, like the old criteria, some corrections have to be made. In this new legislation, tonal and impulsive (k1 and k2 respectively) are well defined, as well as their quantification (3 dB if detected and 0 if not). If the evaluated noise levels meet any of the correction definitions, a value of 3 must be added to the ambient noise Leq. This corrected level is named evaluation level (L_{Ar}) and can be calculated according equation 2.

$$L_{Ar} = L_{eq}(\text{ambient noise}) + k1 + k2 \qquad \text{Equation 2.}$$

Thus, the criteria for a non-annoyance classification is:

$$L_{Ar}(\text{specific noise}) - L_{eq}(\text{residual noise}) \leq 5 \quad \text{in DAY period} \qquad \text{Equation 3.}$$

$$L_{Ar}(\text{specific noise}) - L_{eq}(\text{residual noise}) \leq 3 \quad \text{in NIGHT period} \qquad \text{Equation 4.}$$

To the previous values of 5 and 3 an increment (D) could be added. If the period of noise occurrence is less or equal to 8h, according to table 2. However, in the night period, beyond 24h, D remains 2 for T≤4h.

Cumulative duration of specific noise occurrence, T	D
$T \leq 1h$	4
$1h < T \leq 2h$	3
$2h < T \leq 4h$	2
$4h < T \leq 8h$	1
$T > 8h$	0

Table 2. Difference limits increments (D) according to cumulative duration of noise occurrence.

3. RESULTS

Applying the two mentioned criteria to the 22 cases sample, it was observed how this new criteria could change the evaluation result, in terms of annoyance or non-annoyance classification.

Tables 3 and 4 show the obtained results. In table 4, the changing orientation is specified, i.e., if the evaluated situation is below the limits in the old criteria but is above in the new, this is represented as a OK to KO changing, and as a KO to OK if it the contrary happens.

Legislation	No. Evaluated cases/points	No. of cases exceeding the legal limits	Percentage (%) of cases exceeding the legal limits
Old (DL 292/89)	22/190	13	59,1
New (DL 292/2000)	22/190	15	68,2

Table 3. Total results obtained by application of both criteria.

Results change	Cases	Percentage (%)	Evaluation Points	Percentage (%)
OK to KO	6	27,3	35	18,4
KO to OK	1	4,5	5	2,6

Table 4. Number of cases and evaluation points changed by application of both criteria

As can be seen in table 4, the application of the new criteria led to 7 result changing, 6 of them in a OK to KO orientation and only 1 in the KO to OK orientation.

The case in which the result, by application of the new legislation, changes from KO to OK, is due, essentially, to discrepancy observed between Leq and L_{95} of the background noise. In this case, background noise had a fluctuating tendency. Therefore, L_{95} was very low and Leq high. As mentioned previously, the new legislation only considers the Leq difference, thus these particular cases (great discrepancies between Leq and L_{95}) tend to accomplish the new legislation.

4. CONCLUSIONS

Analysis from 22 different cases shows that there are significant differences between the two criteria. From this study it is possible to conclude that the new criteria seems to be more restrictive, however, there are some cases where it can be more permissive.

In general, the new Portuguese legislation seems to have a large application, and a better contribute to territory administration and use planning. In spite of these advantages, some problems remain in this new legislation, some of them related to ambiguities presented in the legislation text (Patrício, 2001).

This new Portuguese noise regulation aims at minimizing environmental noise effects. However, noise is likely to continue as a major issue well into the next decade, both in developed and in developing countries. Therefore, strategic action is urgently required, including continued noise control at the source and in local areas. Joint efforts among countries are necessary at a system level, concerning the access and use of land, airspace and seawaters, and the various modes of transportation.

We must understand the different types of noise and how to measure it, where noise comes from and its effects on exposed populations. Furthermore, noise mitigation, including noise management, has to be actively introduced and policy implications have to be evaluated for efficiency in each case.

5. REFERENCES

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