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

I-INCE Classification: 8.2

COMPARISON BETWEEN ITALIAN AND RECOMMENDED EUROPEAN NOISE INDICATORS

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Keywords:
EUROPEAN NOISE INDICATORS, ITALIAN NOISE INDICATORS, NOISE EXPOSURE, ITALIAN NOISE REGULATIONS

ABSTRACT
The Commission of the European Communities is developing its own regulation for Noise Pollution, in order to harmonise Member States related legislation and to obtain an unique description of Noise Pollution in all EU territory. The Italian Regulations differ from the EU recommendations on methodology to measure noise, especially for definition of the indicators to be used. In this paper we analyse the main differences between them and we try to evaluate the corrections to be done to avoid losing of all data already collected. We use the data measured by ARPAT in two large noise mapping campaign held in Pisa and Livorno during last three years. We try to evaluate the effect of the correction due to reflections on close walls and to different definition of indicators, especially for the European day overall value L_{den} and the corresponding Italian L_{day} value.

1 - INTRODUCTION

EU Commission sets up some working teams with the tasks of studying, adjusting and harmonising the physical indicators used to describe noise pollution, in order to determine the most valid measurement technique and the Community strategies to treat noise as a disturbance for populations and its mitigation. Particularly in [1] some noise indicators are introduced: they reflect the experiences due on this specific problem by all Member States and describe at best the annoyance and sleep disturbance that the noise can cause as a potential health damaging factor.
The Italian regulation use some different indicators that should be compared with EU proposed ones, in order to save all data yet collected during the last 9 years. In the following paragraphs we summarised the EU recommendations and the Italian regulation and we show an example of the comparison of the corresponding data obtained following the two methodologies in order to predict the noise exposure of Livorno's and Pisa's inhabitants.

2 - EU NOISE INDICATORS

Particularly in this document two indicators, L_{EU} and $L_{EU,N}$, are introduced. These indices are defined [1] as follows:

- $L_{EU,N}$ is the equivalent level measured during the eight hours night period (in accordance with the EU recommendations, from 11 p.m. to 7 a.m.);
- $L_{EU} = 10\log\frac{1}{24}\left(12\cdot 10^{\frac{L_D}{10}} + 4\cdot 10^{\frac{L_E+5}{10}} + 8\cdot 10^{\frac{L_N+10}{10}}\right)$

in which the following equivalent levels are introduced: L_E calculated in the 4 hours evening period that is, in accordance with the EU Recommendations, from 7 p.m. to 11 p.m.; L_D calculated in the interval from 7 a.m. to 7 p.m.; $L_{N,}$ calculated in the interval from 11 p.m. and 7 a.m..
The long term average indicators should be reported separately for each specific outdoor noise source present, with measures carried out at an height of 4 meters. In measurements only the incident sound is to be considered, leaving aside the contribution due to the reflection effects caused by any wall near the

measurement point. Otherwise the measurement must be carried out at least at 3.5 meters away from the nearest wall to make negligible the contribution of the reflection. Finally, measurements must be representative of the calendar year during which the assessment has been made; this year must be also meteorologically representative of the mean of the last ten years.

3 - ITALIAN NOISE INDICATORS

The Italian regulations [2] introduce two indices: L_{day} and L_{night} defined as the equivalent sound pressure level measured correspondingly over 16 day time hours (from 6 a.m. to 10 p.m.) and during the eight hours night period (from 10 p.m. to 6 a.m.). These values are averaged over a week or more. These levels have no correction for reflections and there is not any distinction for the source causing noise during the measurement campaign. However, there are penalties for tonal, impulsive and low frequency components to be added to the measured L_{AEQ} [3]. In order to protect the population more during the night period, the Italian regulation impose noise limits 10 dB(A) less than corresponding day time limits [4]. The Italian noise level limits are distinct for emission by the noise source, total noise level and quality value to be reached in the next years, but there are some differences for the limits when applied to the transport facilities such as streets and railways.

4 - COMPARISON BETWEEN EXPOSED POPULATION CLASSES REFERRED TO THE TWO SETS OF INDICATORS

We tried to convert the set of measures acquired in Livorno and Pisa during last three years in order to compare results obtained using Italian regulations and those using EU recommendations. We corrected the results as suggested by WG1's document to eliminate effects due to reflections, although the results of a performed measurement campaign show a correction reflection factor of 1.5 dB(A) at 1 meter away from the facade [5].

Here we present the results obtained for the comparison of the percentile distribution of the sample of exposed population studied in the two measurement campaigns, starting from geo-referenced data on the distribution of the population in the two municipal areas. The real representativeness of the sample of streets selected on the basis of the urban experiences of the two cities is proved in [6].

The comparison is performed by means of the distribution of results in classes, obtained depending on the index chosen. "EU" subscript specifies the corresponding index provided for by the European recommendation. In the comparison with L_{EU} the daytime period equivalent level, L_{day}, has been taken into consideration as the indicator provided by Italian regulations, because this index comes closer to the noise index L_{EU} than a weighted average between L_{day} and L_{night}: this because in the Italian Regulations the difference between day time and night time noise limits is 10 dB(A) and L_{EU} already considers this difference in its definition.

The results in figure 1 shows how the distribution of the noise exposure classes, obtained from Livorno's (labelled LI in the plot) and Pisa's (labelled PI in the plot) sets of collected data, are changed using the EU indices. The total sample here used is composed by 9010 residents in Pisa (about 9% of its total population) and 40221 in Livorno (about 25% of its total population). We should notice a significant different noise exposure distribution coming out of the Italian regulation, determined above all by the reflection factor correction.

5 - CONCLUSIONS

Here has been presented a preliminary estimation of the impact that the acknowledgement of the recommendations of WG 1 *Noise Indicators* of European Commission would have on an Italian scale. The EU indices could cause an overestimation of the annoyance due to noise in the cities we studied, using reflection correction factor suggested by the proposal, that was not verified by a specific performed measurement campaign. Considering the proximity of Italian houses to the streets, this factor is crucial also in order to recover a huge data set of measurements acquired following Italian measurement procedures. We would put attention to characterise reflections, to avoid overestimation of exposure, and take into account that the change of indicators can cause variations in the noise limiting values provided by the Italian current regulations.

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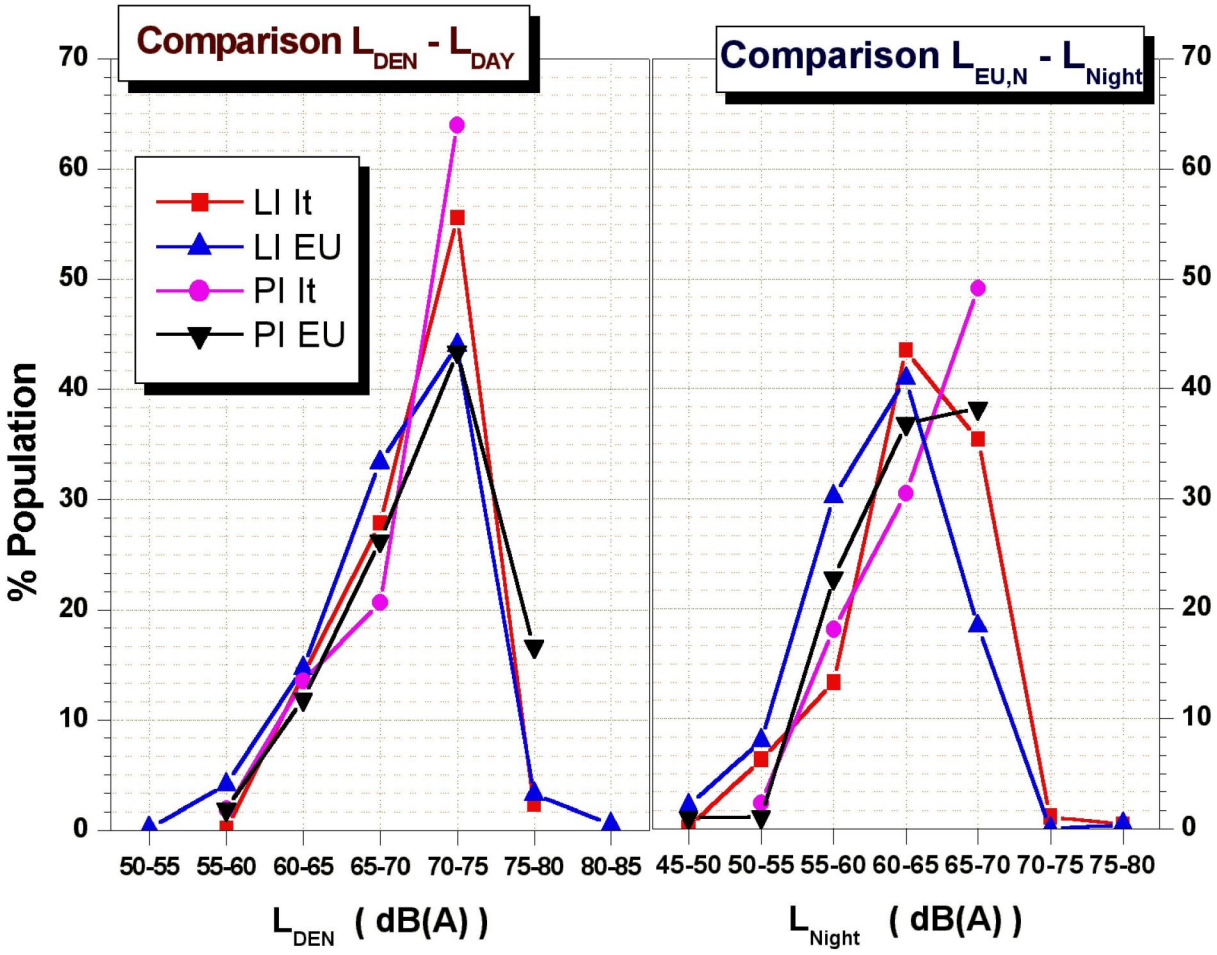

Figure 1: Comparison between the exposed population from the Pisa's and Livorno's data.

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