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THE ROAD TRAFFIC ACOUSTIC EMISSIONS INFLUENCE

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ABSTRACT

Transportation (on road, water and through air) is the most powerful potential source of acoustic pollution these days, so its framing in general ecological cycle is not suitable.Man must better understand the unity of the nature with all intimate connections between all its factors and to insert them in these complex structures and objective phenomena.

KEYWORDS: noise, traffic, road infrastructure, acoustic panels

1. INTRODUCTION

The road traffic noise measurement can be performed on the vehicle or on the entire road stream. The noise measurement of a single vehicle is useful to determine the noise emitted by each category of vehicle.

A certain intensity of an acoustic event can trigger autonomic reactions. It can increase the blood pressure for short periods of time and reduce the volume of blood pumped by the heart, induce changes in respiratory rate and /or pulse rate, cut peristaltic movements of the stomach and modify the peripheral blood irrigation [6].

Adrenalines secretions cannot be reduced by natural physical reactions (attack or flee). The emergence of physiological reactions, reducing the peripheral blood irrigation for example, can be a sign of normal processing of acoustic excitation. Lack of such reactions may indicate a damaged body. On the other hand, a very strong reaction or repeated triggering of successive reactions can cause disease.

Figure 1 schematically represents exposure to road traffic.

Fig. 1 - Schematic illustration of exposure to road traffic noise

Guideline values for noise levels which generate certain effects are shown in the table below.

Maximum values are shown values in 1% of the time.

The psychological moment has a great importance on individual perception of noise. There are psychological situations in which, what one believes to be real is more important than reality itself.

There are factors related to noise that have nothing to do with the effect of noise but with the effect on the general well-being. The sound becomes noise only after a negative subjective evaluation.

Sounds perceived as noise have negative effect on the general well-being.

Table 1 Noise Values

Guidance values			The effect of noise exposure
$L_{A\,eq}$ [dB(A)]		L_{Amax} [dB(A)]	
exterior	interior	interior	
1	2	3	4
-	8	0	Changes in sound quality
-	-	40	The threshold value for the physiological changes (FEG in standby)
-	45	-	Communication disorder
45-55	-	-	Side Table (0÷20% disturbed)
-		55	Autonomic reactions in sleep
-		55	Intelligible phrases in 99% of cases
-	-	60	Awakening threshold
-	-	60	Primary effects (autonomic)
65		-	Significant reactions of the population, disturbed 30÷705, 5÷15% plaintiffs
-		75	Significant autonomic effects
80	-	-	60÷90% The Population is heavily disturbed
-	85	-	Start of deafness
-	-	100	Possible psychological equilibrium limit
-	-	>130	Extra aural effects, disease.

Temporary relationship between the listener and the noise generator is very important for the perception of sound or noise. The same sound, a motorcycle for example, can cause pleasure to the driver or discomfort to a tenant under whose window the motor biker parked it.

The problem of traffic noise decreasing, in particular, and the ambient one, in general, may be regarded as a problem or as having solutions dictated by the degree of individual civic responsibility.

The table above reflects the way the intensity of different sources of environmental noise is received. That was achieved in a certain situation of railway traffic noise emission.

Table 2 The estimated values for the source intensity

Intensity	Estimation of source intensity by affected factors						
	Air traffic	Neighbourhood	Restaurants Discos	Road traffic	Rail traffic	Industry	Playground for children
1	2	3	4	5	6	7	8
High	42%	25%	37%	30%	25%	24%	20%
Quite high	21%	27%	12%	18%	14%	19%	12%
Medium	21%	25%	28%	27%	33%	30%	33%
Low	15%	19%	22%	25%	27%	25%	26%
They don't know	1%	3%	1%	0%	0%	2%	9%
The order of intensity	1	2	3	4	5	6	7

The noise generated by the railway traffic is received as being less intense than the same level noise produced by the road traffic.

The road traffic noise is different from the one produced by the railway traffic:

- Is an extended action;
- The ratio between peak and average value is lower;
- Contains several peaks, and individual acoustic events;
- Has irregularities compared to rail which is regularly;
- Spectral of is richer in low frequencies

100-200Hz, compared to 1000 ÷ 2000Hz for railway traffic.

Sensitivity to noise is different from person to person but it changes with age and time of the day-the man is more sensitive 10dB (A) during the night than day time- and depends on certain physical and mental condition at the moment of exposure to noise. The unexpected noises are considered to be extremely harmful, as well as those generated by an insolent behavior that ignores the presence of other people.

The way different subjects estimate their sensitivity to noise is shown in the figure 2 below:

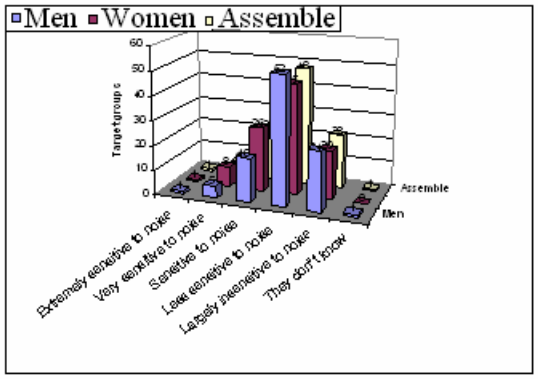

Fig 2. Sensitivity to sound for different subjects

2. PREVENTING OR REDUCING THE ROAD TRAFFIC NOISE

We distinguish four main groups of possibilities and measures to prevent/reduce road traffic noise, namely:

- Possibilities and measures applicable to motor vehicles;
- Possibilities and measures applicable to the runway (main streets or roads);
- Decreasing noise emissions generated by traffic through the influence of new rules for motor vehicle traffic;
- Decreasing noise emissions from road traffic route through design including location and acoustic shielding.

Measures to reduce noise emission of vehicles refer to the actions of four groups of causes (where these are equally important) or only one, in some cases, if the importance is different.

To create a database necessary to generate noise maps, the requirements of the following documents should be considered: Directive 2002/49 EC of 25 June 2002; Decision 321/14 April 2005; 12 OM 678/1344/915/1397 2006 (Guide interim methods); OM 1830/2007 the approval of "Guidelines on the implementation, analysis and evaluation of strategic noise maps".

The calculation methods for different noise sources in an urban area ruled by the mentioned legislation are: Road traffic: French Method NMPB-Routes-96 (SETRA - CERTU - LCPCCSTB) and French standard XP S31-133 Rail Traffic: The Dutch method SRM II – 1996 (The Netherlands national computation method published in 'Reken - en Meetvoorschrift Railverkeerslawaai'96, Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 20 November 1996'), Air traffic: ECAC.CEAC Doc. 29 'Report on Standard Method of Computing Noise Contours around Civil Airports', 1997, Industrial Noise: ISO 9613-2: "Acoustics - Abatement of sound propagation outdoors, Part II: General method of calculation".

According to EU legislation, stationary vehicle noises are restricted.

The path can be covered with sound-absorbing layers [11].

Different layers of rolling (last state road coverage) currently used in road construction can reduce noise from cars by up to 2dB (A).

These values are the values obtained by averaging reductions.

Due to variable weather conditions that must be considered in roads construction, the same asphalt recipes cannot practically guarantee a reduction of up to 2dB (A) as specified after math mediation operations. Although an asphalt recipe for mixtures can theoretically reduce noise by up to 2dB (A) due to inherent variations in asphalt layering this reduction cannot be guaranteed in practice.

As any landscape professional already knows, installing trees and vegetation on a berm between roadway traffic and residences may be aesthetically pleasing, but these elements are not effective noise control barriers (see figure 3).

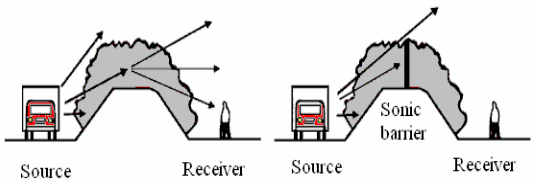

Fig. 3 - Distribution and acoustic control

The selection criteria of choosing coatings are, primarily: vehicle traffic, chassis loads, grip and runway durability. These criteria are generated by economic considerations and traffic safety. Traffic management failure and driver's nervousness, as consequences of non-compliance with traffic signs and/or speed limit, clearly lead to increased noise and road

traffic besides increasing the number of traffic accidents.

Durability is important to reduce road noise as long as potholes on a damaged road do not reduce noise without a significant speed reduction.

Rolling layers of roads are chosen depending on traffic and allowable load per axle. Motor vehicles are the main source of chemical and noise pollution in the cities.

They consume non-renewable fossil fuels and intense flows of vehicles require large areas and generate a pronounced effect of spatial separation.

The negative influence of the optical appearance is added to all that, the streets, sidewalks or lanes being blocked or congested by stationary vehicles and pedestrians or cyclists, impairing movement.

The causes of worsening environmental pollution effects of vehicles are, mainly, the increase the in number of vehicles and uncivilized driving manner, in contempt of the law and not considering the possible environmental damage [13].

The environmental noise produced in the proximity of highways by motor vehicle traffic is a result of combining a wide variety of sources (individual vehicle types, categories, and wear patterns).

The mix or composition related to motor vehicles, depends on the motorway, the time of the day and other factors. For the assessment of the environmental noise by calculation, the existence of two main categories of vehicles is admitted: heavy vehicles and cars. Uncertainties that result from these categories are usually lower than those inherent in the calculation.

It is necessary to consider the noise characteristics of these two categories of vehicles in order to calculate the level of noise in the highway proximity. The noise emitted by a truck moving on a highway depends on the operating mode and the way of driving. Full description of the noise emitted by truck requires knowledge of the cycle or cycles of noise displacement emitted on each cycle sequence. Truck noise can be considered a result of the merging of two main sources: the pulsation and tire-tread interaction.

The propulsion noise in each gear depends on engine speed.

3. CONCLUSIONS

Since maximum propulsion noise does not practically depend on speed and tire noise generated by the tire-runway interaction increases with speed, there is a critical speed at which the tire noise becomes predominant.

The sound generated by the tire at a certain speed depends on the building characteristics and, therefore, there is a critical speed to be considered for each particular heavy vehicle and it is based on the type and number of vehicle tires including trailer. Critical speed is higher than 48km/h.

The noise generated by the propulsion system prevails at lower speeds.

Noise from tire-tread interaction is due to structural noise radiation of the tire and the capture process followed by exclusion of air in the tire profile cavities.

This noise component depends on the speed of the vehicle.

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