SOME PRINCIPLE POINTS OF NOISE LEGISLATION IN SLOVENIA

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ABSTRACT

For the last two years Slovenia has been intensively working on new noise legislation. Two acts on community noise have already been introduced and a new occupational noise legislation is now in preparation, in which the author is taking an active part.

The prefered noise descriptors in both legislations are the rating levels. In this way both the impulsive and spectral characteristics of noise are taken into account. Noise limits are set for different regions, depending on the activities to be protected, the time of day when the noise occurs and the type of noise source.

In the field of occupational noise the old legislation of 1971 is still used. The new proposed noise occupational legislation is mainly based on EEC 86/188 directives. However, some additional limitations are introduced, which are presented in this article in more details.

INTRODUCTION

The first occupational noise legislation in Slovenia was introduced in 1971, when it was still a

part of former Yugoslavia. At present it is still used in a modified form in Slovenia and in other republics of former Yugoslavia. In 1976 Slovenia started forming community noise legislation, independent of the other federal units. It took its final form in 1980.

After the break down of Yugoslavia in 1991, Slovenia became an independent state and joined the European Union as its associate member. Because of this, it is working on new noise protection legislation, based on the directives of the European Union.

The new community noise legislation act was already completed and accepted in 1995 and new occupational noise legislation is now in preparation.

The rating value is the most widely used of all noise descriptors and incorporated into all Slovenian legislation acts. However, according to different field of use (occupational or community noise) it is expressed and used in different ways.

OCCUPATIONAL NOISE - THE EXISTING LEGISLATION

Two viewpoints concerning occupational noise protection are considered in this legislation

- hearing damage risk criteria,
- speech and working activities interference criteria.

Hearing damage risk criteria

According to the 1971 act for noise protection at workplaces 7), the A-weighted continuous equivalent level $L_{Aeq,T}$ is set as a quantified noise criteria, which is determined by the equation

$$L_{Aeq,T} = \frac{q}{\log 2} 10 \log\left(\frac{1}{T} \int_0^T \left(\frac{p_A(t)}{p_0} \right)^{\frac{20 \log 2}{q}} dt \right) \qquad \textbf{(1)}$$

where

T is the total measurement time ,

$p_A(t)$ is the A-weighted instantaneous acoustic pressure,

p_0 is the reference acoustic pressure (20μPa) and

q is the exchange rate, the allowed change in noise level for doubling or halving of exposure time.

The rating comprises of three terms

$$L_{Ar,T} = L_{Aeq,T} + K_t + K_i \quad \textbf{(2)}$$

where K_t and K_i are tonal and impulsive corrections in the case of the presence of pure tones or impulsive noise and are equal to 5 dBA each. However, in this act the evaluation of pure tones and impulsive noise is not strictly described. So the decision for impulsive noise is mainly based on experience and criterium of 5 dB difference between adjacent third octave bands in the spectra is usualy used. The influence of pure tones and impulses is not measured concurrently in a single operation, since at the time of intoduction of this legislation no such instruments were available. The decision for their inclusion is made at the end of the measurement.

One of the principal noise control measures is the restriction of exposure time. For stationary noise sources, which prevail in practice, the maximum allowed time T_p is accepted as

$$T_p = \frac{8h}{2^{\frac{L_{Ar}-90}{5}}} \quad \textbf{(3)}$$

In this way, the level is allowed to increase by 5 dBA for each halving of exposure time up to 115 dBA for 15 minutes. For duration of less than 15 minutes, no continuous level above 115 dBA is allowed.

If this control can not be achieved, other antinoise measures are prescribed. However, noise reduction at sources must be at the top of the priority list. A maximum peak noise level is not quoted in the existing legislation.

Both upper limits of $L_{Ar,8h}$ and q are set similary as in the United States, namely 90 dBA and 5 respectively. If $L_{Aeq,8h}$ exceeds 90 dBA, the octave frequency analysis is required. From its results the noise rating curve is analiticaly determined according to the equation

$$NR = \max_{i=1..8}\left[\frac{L_i - a_i}{b_i}\right] \quad \textbf{(4)}$$

where L_i is the equivalent sound pressure level in i-th octave band and a_i and b_i are presented in tabular form in table 1. As an upper limit value for 8h working day NR 85 is set.

Table 1 - noise rating curves coefficients

i	frequency (Hz)	a_i	b_i
1	63	35.5	0.790
2	125	22.0	0.870
3	250	12.0	0.930
4	500	4.8	0.974
5	1000	0	1
6	2000	-3.5	1.015
7	4000	-6.1	1.025
8	8000	-8.0	1.030

Interference with speech communication and work activities

According to the requirements for work activities the legislation differentiate among eight workgroups, starting with workplaces, where no special mental activities are required and where the allowed L_{Ar} is the highest, namely 90 dBA. For other categories, which demand mental activities of different degrees, these values are more stringent. For each group this part of the legislation further considers the relation between the noise source and the employee.

For noise source, which is directly under control of the employee, the allowed L_{Ar} is higher than for the bystander position. Even more restrictive values are set for nonproductive noise sources, such as air- conditioning systems and traffic noise. These limits are tabulated in table 2. In this way some psyhological efects are taken into account. These limits must be considered from the early dessigning stage. They often interfere with the demands of building acoustics legislation.

Table 2 - the ceiling values for different activities and noise sources

Ceiling value (dBA)

No.	Working activity	a	b	c
1	Physical work, where no special mental or communicative activities are required	90	84	80
2	Transportation work	80	74	70
3	Noncreative mental work, where a small degree of concentration or communication is required (control cabins, cocking)	75	70	60
4	Noncreative mental work, where medium degree of concentration or communication is required (routine laboratory work, workshop offices)	70	64	55
5	Noncreative mental work, where a high degree of concentration or communication is required (stores, work with clients)	-	60	50
6	Secretarial offices, frequent phone calls	-	55	45
7	High demanding mental works (scools, meeting rooms, research laboratories, computer programming)	-	-	40
8	Creative mental work with the highest requirements	-	-	35

a - noise sources controled directly by the worker,

b - noise sources at bystander position, not directly controled by the worker,

c - nonproductive noise sources (ventilation, neighbouring factories, traffic noise).

THE PROPOSAL FOR NEW OCCUPATIONAL NOISE LEGISLATION

The new occupational noise criteria is set on the basis of 1). According to the viewpoints of the European Union, the upper limit values 90 dBA for $L_{EP,d}$ and 5 dBA for the exchange rate appear

to be to conservative. Here $L_{EP,d}$ is the daily personal noise exposure and is in fact $L_{Aeq,T}$ normalized to an eight hour working day with 3 dBA as the exchange rate. In the new legislation the same principal form for L_{Ar} as in equation (2) will be accepted. However, the exchange rate will be changed from 5 to 3 and terms for K_t and K_i will be more precisely defined. Although the final decision has not yet been made, the terms for tonal and impulsive corrections will probably be set according to ISO 9612 and some German standards.

Just as in European general directives 1), the limitation of peak sound pressure levels for short-duration (impulsive) noise during the working cycle will be considered as well. For impact or impulsive noise, a maximum peak sound pressure level of 140 dBC will be specified.

For $L_{Ar,8h}$ which exceeds 85 dBA the first action level measures will be considered. Second action levels will take place when $L_{Ar,8h}$ or L_{peak} exceed the values of 90 dBA or 140 dBC respectively. At workplaces, where noise levels exceed those values, feasible administration or engineering controls shall be utilized. The procedures for noise control measures, when these two action levels are reached, will probably be identical to the general requirements of the European Union. In this way the earlier equation for maximum duration of exposure (3) will be modified to

$$T_{allow} = \frac{8h}{2^{\frac{L_{Ar}-L_{allow}}{3}}} \qquad \textbf{(5)}$$

here L_{allow} is 85 dBA for the first and 90 dBA for second action level. Since $2^{1/3} \sim 10^{1/10}$, equation (5) can also be written in a more familliar form

$$T_{allow} = \frac{8h}{10^{\frac{L_{Ar}-L_{allow}}{10}}} \qquad \textbf{(6)}$$

A hearing conservation program with audiometric testing will be considered as well.

Working activity interference

The working activity interference viewpoint will be mainly transfered from the existing legislation. Only the noise limits are expected to be changed.

ENVIRONMENTAL NOISE

On August 1995 the Government of Slovenia introduced new noise community legislation, which is quite different from the previous one.

The environment is now divided into four types of areas, where different degrees of noise protection are required, as seen in table 3 (in legislation the categorisation is more precisely defined).

Table 3 - noise protection areas

Type of neighbourhood	Individual sources		Traffic and overall noise		L_1	
	L_d	L_n	L_d	L_n	day	night
IV. Industrial areas	68	68	80	70	90	90
III. Residental urban areas with some workshops or bussines activities (mixed)	58	48	69	59	85	70
II. Residental and recreational areas, scools	52	42	63	53	75	65
I . National parks, zones of hospitals	47	37	57	47	75	60

Here day and night levels, which are expressed in terms of the time weighted rating level are chosen as the basic units, which adequatelly describe the annoyance caused by the variability of fluctuating or intermittent noise levels, their duration, spectral content and the time of their occurence. Similary, as in some other countries the daily exposure is separated into more time periods:

- the daily time (7^{00} - 19^{00}), T_1 = 12h
- the early morning and the late evening time (6^{00} - 7^{00} and 19^{00} - 22^{00}), T_2 = 4h
- the night time (22^{00} - 6^{00}), T_3 = 8h
- the night hour with the highest rating level, T_4 = 1h.

For each of these periods T_i the rating level $L_{Ar,Ti}$ is determined as

$$L_{Ar,Ti} = 10\log(\sum_{k}\frac{1}{Ti}10^{0.1L_{Ar,k}}.t_k) \quad \textbf{(7)}$$

Here the instantaneous rating level $L_{Ar,k}$ comprises three terms, the first is a measure of the equivalent continuous A-weighted sound pressure level, the second and the third represent the tonal and impulse adjustments during the k-th measurement

$T_i = \sum t_k$ and t_k = time interval for which $L_{eq,k}$ occurs.

$$L_{Ar,k} = L_{eq,k} + K_{t,k} + K_{i,k} \quad \textbf{(8)}$$

For complicated cases, continuous 24 hours measurement are usually carried out, and the results recorded for each hour, in which case t_k is equal to 1h.

From these values two regulative descriptors, day and night level are formed. Day level L_d is calculated as the time weighted mean

$$L_d = 10\ \log\frac{1}{16}(12.10^{0.1L_{Ar,T1}} + 4.10^{0.1(L_{Ar,T2}+6)}) \quad \textbf{(9)}$$

This equation shows, that early in the morning and late in the evening, noise levels are four times (6 dBA) more strictly evaluated than during the day.

The night level is obtained as a result of a comparison between $L_{Ar,T3}$ and $L_{ar,T4}$. $L_{Ar,T3}$ is the average noise level during the whole night time (22 - 6) and $L_{Ar,T4}$ is the maximum hourly averaged level during the night (usualy between 5 and 6 AM). The decision, which value to take for night level depends on the difference between $L_{Ar,T4}$ and $L_{ar,T3}$. If it is greater than 4 dBA then $L_{Ar,T4}$ is taken for the night level, otherwise it is equal to $L_{Ar,T3}$.

The maximum level is related to the 1% level, which is also limited. The background level is recognized through the 99% level.

Although complicated at first sight, the use of these procedures is made easy with the use of modern measuring equipment. In this case the use of BK 2260 Investigator appears to be the most appropriate.

It must be pointed out, that different noise sources are not treated equaly. For roads and railways, higher levels are permitted than for industrial and other sources. In most cases traffic noise is not

measured directly, but calculated using the appropriate models based on German standards such as DIN 18005 and RLS-90 guidelines.

Furthermore, noise limits for individual noise sources are 10-12 dBA more stringent than for the total noise imission level when traffic noise is also included. If no traffic noise is present, this difference is much lower, namely 2-3 dBA.

A long term noise control program is established and implemented every three years. This legislation concerns some domestic noise activities as well. The private use of lawnmovers, concrete mixers and so on is prohibited in densely populated areas (type II) on sundays, holidays and during the night time.

It is mandatory for most noise producers to check the conformity of their sources with legislative demands every three years. If the survey shows, that permissible noise levels are exceeded, the noise producer will be required to attempt engineering controls, in order to bring the situation into compliance.

The existing community noise legislation is widely supported by ISO 1996 standards. In this way the complete statisical analysis is often used. For separate noise events the sound exposure levels are measured as well. Long term average rating levels are encouraged and often used in community noise assessment.

In the case of inside noise, separated internal criteria exist which is tightly connected to building acoustics legislation, which is also in the revision stage.

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