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STUDY OF NOISE POLLUTION IN CIVIL CONSTRUCTION

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Abstract: *The paper presents a study of the documentary on the sound pollution in civil constructions. Through this paper identifies the sources of noise, it shows appreciation and possibilities of diminishing its effect upon workers in construction. This paper is part of a study regarding sound pollution evaluation in civil construction.*
Key words: *sound pollution, civil construction, workers in construction.*

1. GENERAL CONSIDERATIONS

Noise is an unwanted signal, of natural or artificial origin, the overlapping of information submitted by or developed into a system.

The main parameters of the noise are: frequency, intensity, duration, mode of action and the duration of noise in a noisy environment.

The vibration amplitude of a sound vibration produces a sensation upon our auditory organ, the volume of air vibration constitutes noise intensity [1]. The acoustic energy flow through unit area perpendicular to the direction of propagation of sound, it is the **acoustic intensity**, noted I, in that point [W/m^2].

It depends of average sound pressure [N/m^2], the speed of sound propagation [m/s], is the density in the propagation medium [kg/m^3], and the speed of sound through that medium [m/s].

For a quantitative expression of the intensity noise, use Bell-ul [B]. Bell-ul is relative unit of measure based on the logarithm of the ratio between acoustic intensity and of conventional acoustic intensity, established as $I_0 = 10^{-12}$ W/m^2 and has been considered as the lower limit of the sounds audible by humans [2]. For very high-valued intensities has been adopted in decibels [dB].

2. THE SOURCES OF NOISE IN CIVIL CONSTRUCTION

There are many engineering activities involving work in terms of noise. According to HG 300 since 2006, annex 1, is playing a non-exhaustive list of the activities of civil engineering construction [3]: excavation, earthmoving, construction, assembly and dismantling of prefabricated elements, furnishings or equipment, transformation, renovation, repair, dismantling, demolition, maintenance, maintenance-painting and cleaning, landfills, consolidations, upgrades, refurbishment, extensions, restorations, breaking up.

Annex No. 2 to the same HG 300 /2006 provides a non-exhaustive list of work involving particular risks to the safety and health of workers:

1. Work which puts workers at risk of being under landslides, swallow of marshy swampland/times of falling from height, due to the nature of the activity carried out, the procedures used and the environment periodical of the workplace;

2. Where exposure to chemicals or biological weapons pose a particular risk to the safety and health of workers or for which surveillance of sănatatii workers is a legal requirement;

3. Works with exposure to ionizing radiation for which specific legal provisions

oblige the delimitation of controlled or supervised areas;

4. Work in the vicinity of high-voltage power lines;

5. Work which puts at risk of drowning;

6. Works of wells, underground earthworks and tunnels;

7. Works with compressed air tubes;

8. Jobs that involve the use of explosives;

9. Works of assembly and disassembly of prefabricated elements.

Works in categories 6, 7, 8, or 9 are major sources of noise through the activity itself.

Other activities, that involve particular risks for the health and safety of workers would seem to have to deal with the noise as to realize these works requires the use of specific machines and often very noisy.

A major problem arises in what use of these machines is that the wear and tear of machinery and the fact that due to wear and tear and increase the noise level emitted by the machine.

Work on construction sites is a seasonal work, work 8-10 months a year and usually in winter, in Romania, the construction sites close because of unsuitable working conditions both for workers and for the working methodology.

3. EQUIPMENT AND DEVICES USED IN CONSTRUCTION THAT ARE CONSIDERED SOURCES OF NOISE

Under a construction site workers builders use a multitude of equipment specific to each phase of the process.

According to [6], we have a list of such equipment, the definition of each, and setting of standards relating to noise emission, conformity assessment procedures, technical documentation and how to collect data concerning the noise emission in the environment from such equipment.

Such equipment for use outside the buildings, which regardless of the action item (with or without motor) are intended to be used according to their type and which contributes to environmental noise exposure, and have a lot of noise pollution. They are presented in the following pictures [7], [8], [9], [10], [11].

Fig.1. Elevator building

Fig. 2. Roller

Fig. 3. Air compressor

Fig. 4. Portable rigs

Fig. 5. Backhoe loader

Fig. 6. Bulldozer

Fig. 7. Dumper

Fig. 8. Excavator

Fig. 9. Mini-Charger

Fig. 10. Motor graders

Fig.11.Hydraulic hammer

Fig. 12. Frontal charger

Fig. 13. Cranes

Fig. 14. Asphalt finishers

Fig. 15. Electric generator

Table 1.

Table with values up to the permissible sound power level of equipment used outside buildings [6]

Type of equipment	**Characteristics equipment*** ***P - installed power [kW];***	**The permissible sound power level [dB/lpW]**	
		Stage I Starting at 3.01.2005	**Stage II Starting at 3.01.2007**
Compaction machines only vibrating, with rollers, vibratory plates and vibratory tampers	$P \leq 8$	108	105
	$8 < P \leq 70$	109	106
	$P > 70$	89 + 11 lg P	86 + 11 lg P
Bulldozers, Chargers, Chargers – crawler excavators	$P \leq 55$	106	103
	$P > 55$	87 + 11 lg P	84 + 11 lg P
Bulldozers, Chargers, Chargers – Dumpere, Wheel loader, Graders, Compactors, Garbage pits for type charger, Mobile cranes, Driven by an internal combustion engine, Counterbalanced, Mobile cranes, Compaction Machines with only nevibratori paving, Paver-finishers, Hydraulic drive groups	$P \leq 55$	104	101
	$P > 55$	85 + 11 lg P	82 + 11 lg P
Excavators, Dock lifts for construction materials, Construction winches, Moto-hoes	$P \leq 15$	96	93
	$P > 15$	83+ 11 lg P	80+ 11 lg P
Concrete-breakers, Portable picks	$m \leq 15$	107	105
	$15 < m < 30$	94 + 11 lg *m*	92 + 11 lg *m*
	$m \geq 30$	96 + 11 lg *m*	94 + 11 lg *m*
Tower cranes		98 + 11 lg P	96 + 11 lg P
Generator sets, Welding generators	$Pel \leq 2$	97 + lg Pel	95 + lg Pel
	$2 < Pel < 10$	98 + lg Pel	96 + lg Pel
	$Pel \geq 10$	97 + lg Pel	95 + lg Pel
Compressors	$P \leq 15$	99	97
	$P > 15$	97 +2 lg P	95 +2 lg P
Lawn mowers, Lawn cutting machine / Cutting	$L \leq 50$	96	94**

machines lawn edges	2 < Pel < 10	100	98
	2 < Pel < 10	100	98**
	L > 50	105	103**

*** P – installed power [kW]; PEL-power [KW] (for welding generators: conventional welding current multiplied by the conventional load voltage, too low for the highest value of during assets indicated by the manufacturer); L-cutting width [cm];**

**** These are indicative numbers only. Definitive numbers will depend on future changes of this HG. In the absence of such subsequent changes, numbers from stage I will continue to apply in stage II.**

According to deliver the noise level on building sites can meet many different [6]:

1. Equipment subject to noise limits (equipment and devices to which the guaranteed sound power level must not exceed the permissible level shown in the table 1, with the limit values according to the [6]:

2. Only marking equipment noise (sound power level shall be marked on the equipment below and showing only the level of noise produced by them):

- aerial access platforms;
- worksite elevators for construction materials, electrically operated;
- band saws;
- stuff with circular saws;
- portable chain saws;
- combined vehicles for high pressure washing and emptying;
- compacting machines;
- mixers for concrete and mortar;
- construction winches with electric motor;
- cars for transporting and applying the pressure of the concrete and mortar;
- loading conveyor;
- drilling machines;
- hydraulic hammers;
- crane motor driven internal combustion;
- power trowels paving;
- equipment for pillars of foundations;
- pipe launchers;
- generating sets;
- section available for burrowing by ditches;
- concrete mixers;
- water pumping groups.

All the equipment listed above at point 1 and point 2 before being placed on the market or being put into service must bear the CE marking (Figure 16) accompanied by the indication of the guaranteed sound power level (Figure 17).

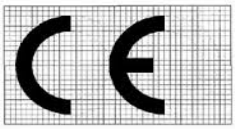

Fig. 16. Bookmark CE [6]

Everything in this more [12] are provided: amplified sound power level weighting coefficient, measured sound power level (measured values can be determined either on a single machine representative for the type of industrial equipment, either as an average of the measurements of a number of industrial machinery) and the guaranteed sound power level (the level guaranteed by the manufacturer confirming that it wasn't moved beyond considering the technical instruments used which are mentioned in technical books). In Figure 17 is the simbol with the standardised dimention for this plate.

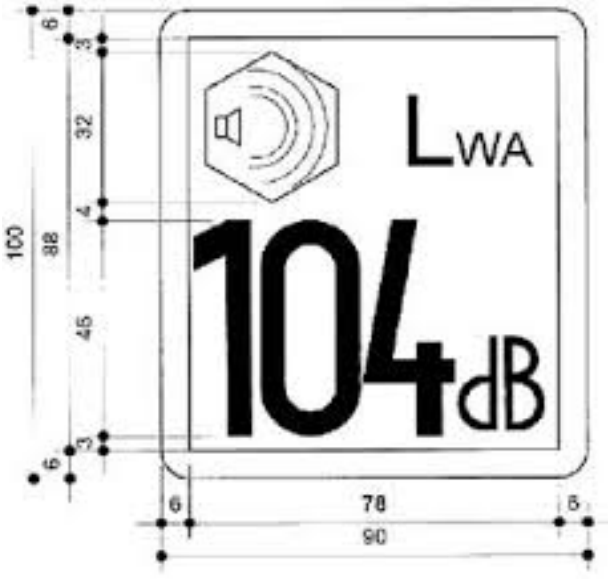

Fig. 17. Model icon indicating sound power level

The manufacturer or his authorized representative shall transmit a copy to the Labor inspection of the EC declaration of conformity for each type of equipment placed on the market or put into function in Romania, within 5 days from the date the application was received, the labor inspection to you retransmitted Ministry of economy and commerce. All for the purpose of collecting data on noise Ministry of economy and Commerce formulated a copy of the EC declaration of conformity to the European Commission.

4. FORECASTING AND THE IMPORTANCE OF SOUND LEVEL ON BUILDING SITES

The construction sector has characteristics that make it different from other sectors of activity. Every construction site in part a particularly and they can consider that every construction site has the conditions to specific activity.

Under this [3] is a coordinator for safety and health during the elaboration of the paper and a project coordinator for safety and health during the realization of the work and the Office of the Coordinator for safety and health during the elaboration of the project work and the Office of the Coordinator for safety and health during the realization of the work or of subsequent interventions may be owned by the same person. This designated person will need to be involved in all phases of the activity and to keep the register of the day of health and security on site.

In drawing up the documentation start a worksite must be included and security tools and health protection, named in Romania P.S.S. – safety and health plan to the contractor and where appropriate, subcontra-ctors in a harmonized manner.

The beneficiary of the work or the project manager must ensure that, before the opening of the construction site, a plan to be established by the occupational safety and health, and it must be kept by the project manager for five years from the date of reception of a final work.

Normally under the law [3] shall be used in accordance with the norms of machinery noise emission and optimal positioning of the machinery must be done and depending on the noise emission.

5. METHODS FOR DETERMINING THE OVERALL NOISE LEVEL ON A CONSTRUCTION SITE

Methods for the determination of noise levels on a construction site may be group by using the following methods:

1. It can determine the level of noise on a building site theoretically making a weighted average of the noise emissions calculated and presented in the technical documentation.

This is a quick, but because each dock has it's own features unlikely to estimate the noise level on the construction site using this method to be close to the reality of actual sound level emitted.

It can get these data decisions that do not lead to the effectiveness of preventive measures and risk reduction of noise on site.

2. The second method would be the effective determination date by spot measurements on each machine and job.

This method would be ideal theoretically, but practically provides for the use of additional resources (human and financial) to determine the actual level of noise. But here comes the fact that the life of a dock is not perennial, no matter how long it takes for construction activity in terms of financial and human resources is not the most economical and so unlikely that it will be adopted as the method of determining the noise level on the site.

3. Another method used in other countries, e.g. Italy, is to use a Bank of data on noise emissions of equipments and similar devices already in use on various construction sites.

This method is fast and takes into consideration the wear and tear of machinery and devices and gives a much clearer picture of the level of noise that can be reached in the work of the site.

6. CONCLUSIONS REGARDING THE PRODUCTION OF NOISE IN CONSTRUCTION

The abundance of equipment and devices used in construction, that in the working process, the human operator is the default (for now) and physically present next to the machine, make a noise factor of danger from the increasingly stressed health operators handles these equipment.

Getting some actual measurements in situ concrete, is likely to determine the future approach and the change in methodologies of work and production more efficient, in terms of safety in the workplace much higher.

It is very important to create a database in addition to data and updating its thoughtfully prevention and protection measures of the effects of noise on building sites to be more effective. All of which lead to a better organization of work on the construction site from the point of view of safety at work and health of workers.

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Studiu general al poluării sonore în construcții civile

Rezumat: *Lucrarea prezintă un studiu documentar asupra poluării sonore in construcții civile. Prin lucrare se identifică sursele de zgomot, se prezintă posibilitățile de apreciere şi de diminuare a efectului acestuia asupra lucrătorilor din construcții. Această lucrare este o parte a unui studiu în ceea ce priveşte evaluarea poluării sonore în construcții civile.*

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