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## IMPACT OF NOISE AND VIBRATIONS IN THE PEOPLE IN THE CAR WITH UPGRADES

**Abstract:** Noise and vibration in a closed working environment can significantly affect health, disorders and work of the people especially in complex mental activities and processes. These impacts are particularly pronounced if they are long lasting. Noise and vibration significantly affect the quality of life and work in a closed working environment such as construction vehicles. The paper discusses the sources of noise and vibration, its effects and impacts on people who perform specific and complex tasks in poor working environment. This paper also defined criteria for the permitted level of noise and vibration defined by the relevant legal regulative, as well as measures and methods of protection.

**Keywords:** noise, vibration, testing, standard.

### 1. INTRODUCTION

Under the noise means unwanted sound, or sound effects (noise, noise, speech, etc.), which interferes with a man's activity. To make a sound called noise, it must clearly stand out from other sounds, and sometimes whisper can be classified as noise (eg. In the theater). Music you do not want to listen can also be regarded as noise.

Harmful effects of noise on humans manifests itself in psychological and physiological level, and its impact depends on several factors, among which the most important are: the level (intensity), frequency spectrum and the exposure time [1].

Psychological effects of noise on humans is not possible to define the laws nor the measurable instrumental methods [2]. The psychological impact is estimated based on the reactions of people and manifests itself differently and, in the terminology of the noise level is reflected "strength" and a frequency range of "high" or "color".

Physiological effect of noise on humans is very complex [2]. Tests have shown that noise negatively affects the autonomic nervous system, and this effect depends on the level and

frequency spectrum, duration, timing noise

content, and so on. The consequences can be transient and permanent, which depends on a number of factors which will be discussed here.

Noise, their physical sizes, works on man through the senses of hearing, as it transfers all the stimulation and transform them into auditory sensations to which man reacts subjectively. From the total frequency domain, a normal healthy person hears the sound frequency range of 20 to 20,000 Hz. The level of air pressure at which a man begins to hear is called "threshold" (0 dB), while the upper limit is defined as the "pain threshold" of 120 (130), dB. To illustrate the foregoing, in Figure 1 provides an overview of the audible field healthy people.

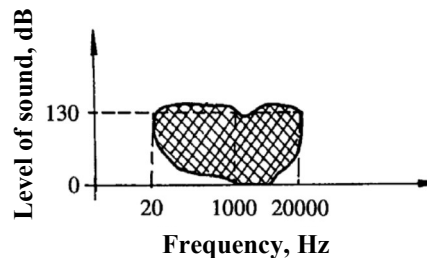


Figure 1. Audible of healthy person

## 2. ORIGINS OF NOISE AND VIBRATIONS

According to one awarded on the basis of origin, the noise can come from [3]:

- construction machinery and mining machines (excavators, dozers, bushland sets, hammers, etc.),
- transport vehicles and equipment (trucks, trains, etc.),
- engines (crushers, mills, cyclones, flotation machines, etc.) and
- electric or electronic devices and equipment.

Classification of noise can be made to the:

- the origin of the formation of (natural and artificial sources),
- source,
- place of origin (in the working or residential environment and etc.).

The most important characteristic of noise is its strength. It represents and expresses the level of noise in decibels, in a certain area or a certain distance from the source. In addition to strength, a very important and noise spectrum. Noise where are represented the higher frequencies (hiss, chirp) is more unpleasant plaster. The third important characteristic of noise, its duration (continuity) and possible rhythm breaks (discontinuities).

## 3. SPREADING SOUND IN MOTOR VEHICLES

Transferring sound from the motor drive transmission, wheels and other sources of sound in the passenger compartment, ie, the interior of the vehicle body, until recently, the only experimentally investigated. Interior upgrades over the body connected to the powertrain, suspension system and wheels. The total noise in the interior upgrades can be described by the equation [3]:

$$L_2 = L_1 - R - 10 \log \frac{A}{S} + 10 \log \left[ 1 + \frac{W^2}{p_1^2} \sum p_n^2 \right] \quad [1]$$

Where is:

- $L_1$  - noise levels in engine compartment,
- $L_2$  - the noise level in the room upgrade,
- $R$  - coefficient of sound insulation,

- $A$  - equivalent absorbcionna surface,
- $S$  - surface emitting noise,
- $W$  - impedance ratio of the partition wall,
- $p_1$  - the sound pressure in the engine compartment and
- $p_n$  - the sound pressure share of openings.

Equation (1) applies in the frequency range above the threshold frequency and does not take into account the amplitude - phase dependence of the sound levels in the room upgrades in the field of low frequency. Cut-off frequency is calculated according to the equation [3]:

$$f_g = \frac{1000}{\sqrt[3]{V}} \quad [2]$$

wherein:  $V$  - volume space upgrade.

## 4. IMPACT OF NOISE AND VIBRATIONS IN THE QUALITY OF LIFE AND WORK IN A SEALED ROOM

Some effects of noise on humans can be expressed as follows [4]:

- Physical factors:
  - Intensity: to form an acoustic trauma, the intensity of the noise must be above the critical threshold. Exposure to noise of 80dB will cause gradual hearing loss in a significant number of people, and even louder noise will only accelerate the emergence of hearing impairment.
  - Range: larger traumatized fact have a high frequency tones, while deep tones are less harmful than the medium and high. However, deep tones, if the high intensity can cause damage.
  - Rhythm: the noise can be at their own pace, constant and variable. Today it is assumed that the constant noise caused heavy damage from variable.
  - Duration of unprotected ear allowed exposure time decreases noise by one-half for each 5 dB increase of the average level. Thus, for example, exposure is limited to 8 hours to 90dB, to 95dB than 4 hours, while the noise from the 100dB of the 2 hours exposure. The maximum possible exposure to the unprotected ear noise is 15 minutes at 115dB. Any noise above 140dB is not allowed. To prevent damage to the inner ear, the time of

exposure to noise must be reduced with increasing intensity.

- Individual factors:
  - Sensitivity: there is a different individual sensitivity to noise.
  - Life expectancy: sensitivity to noise is directly proportional to the age of the person exposed to it.
  - Diseases of the earlier hearing: If there is already a disease of the inner and middle ear more easily arise acoustic damage. In cases of damage to the middle ear leads to the absence of physiological activation of protective mechanisms that protect the inner ear from the effects of excessive sound.

The noise produced cardio - vascular problems, encourages risk factors of coronary disease disturbs heart function and changes are easily observed on the electrocardiogram. Low-frequency noise of high intensity can lead to infarction of isochemistry. Diseases of the endocrine, gastrointestinal, peripheral and central nervous system, resulting in increased noise, can be easily concluded biochemical analysis.

Adverse sound disturbs the bioelectric potentials of brain cells leading to irritability, unwillingness, insecurity, psychomotor disturbance of balance, resulting in stress, decreased ability to work, denial of sleep and rest.

## 5. MEASURES TO PROTECT AGAINST NOISE AND VIBRATION

Fight with noise requires different procedures on the sources and routes of its transmission. Acousticians know that the vehicle virtually no parts that are "neutral" for sound and vibration, but can not exert influence on each other. In this general rule applies here, "It is better to be safe than sorry." So first we have the design and construction of off possible sources of interference, as a primary measure, as long as possible. However, it is clear that between what would acousticians ideally eliminated as the source of interference and what is required from the structural point of view, there is often a conflict, in which acoustics must discounts.

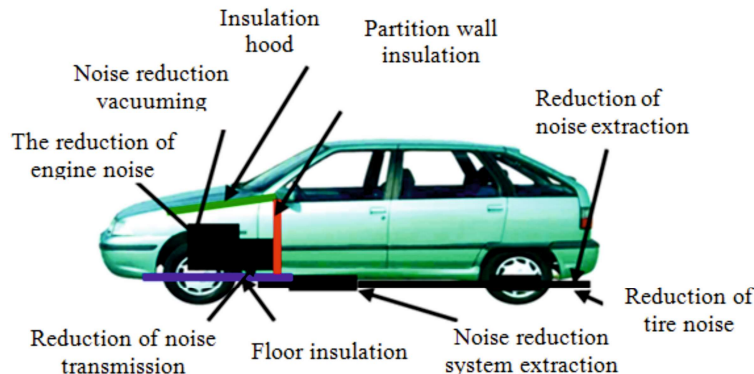


Figure 2. The main city noise reduction [3]

Figure 2 shows the main cities for the reduction of the noise level from the aspect of internal noise, whereby in principle the same rules apply for both the interior of the vehicle superstructure and the interior of the passenger cabin of the vehicle in the picture. The lower the noise inside the vehicle is achieved by better insulation of the partition wall, a smaller share of the ducts (small openings in the dividing wall for the passage of cables, ropes, command slippers, etc.) And greater absorption of the active surface of the interior space of the

vehicle. Also, factors such as dynamically optimized body, and even design the rearview mirror or the bumper, the angle of inclination of the windscreen and the choice of its thickness (reducing weight) can affect the acoustics inside the vehicle.

The noise in the interior upgrades caused by a series of initiative and routes of transmission. Download acoustic and vibrational energy between primary sources and space upgrade occurs simultaneously through solid and air pass. Relationship engine and

transmission, mainly sus main routes of transmission of vibrations.

There are important and long routes of transmission, such as transmission shafts, connection of exhaust systems and more. All listed together primary sources create sound field focused around the walls that surround the room upgrade as a resonator. Under the influence of external effects of the sound field and raises the contracted through a solid medium, the surface surrounding the space upgrades begin to vibrate and become secondary sources. Sound insulation car noise transferred by air, it is usually the most important influence acoustic processing the partition. From the acoustic point of view this should be taken into account known acoustic measures such as sound absorption, sound damping and damping of mechanical noise. Acoustic comfort is defined via: noise level, frequency spectra, the volume and articulation index [5-6].

Measures to reduce the overall noise levels, for example. the engine of a motor vehicle after Merse test method ISO R 362 [24] as [7]:

- improvement - reconstruction of the engine and its systems can reduce noise levels by 3 to 5dB(A),
- partial coating engine sound insulating materials is possible to reduce noise 3 dB(A),
- reducing the number of engine revolutions is possible to reduce the noise level to 4 dB(A),
- complete encapsulation of the engine and its systems can be achieved by reducing the level of noise from 6 to 9 dB(A).

Active protective coating systems, include the systems are added to the initiative with such characteristics (mass, stiffness) - own frequency, which is close or equal to the forced excitation frequency. Such systems are installed most often in cases where construction is not possible to remove impurities force, a schematic representation of this system is shown in Figure 3.

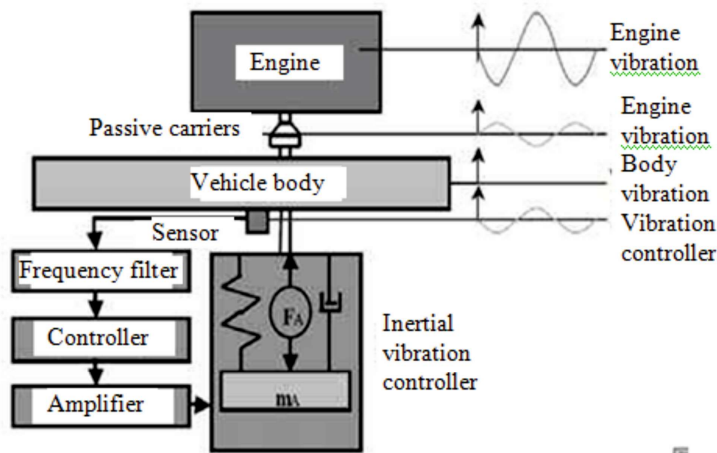


Figure 3. Schematic representation of the active vibration control [7]

## 6. CONCLUSION

Bearing in mind the increasingly stringent requirements to protect the living and working environment, it is expected that the prospects for further development of active and passive

systems for noise and vibration, do not go only in the direction of reducing outside noise, which becomes one of the dominant factors of pollution in urban areas and developed industrial zones, but also in the direction of reducing the level of internal noise.

This is particularly important, given that the intensity and frequency of internal noise in vehicles with superstructure Directorate affect the operational efficiency of operators of

certain systems in the vehicle body and on the preservation of their physical and mental health.

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