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Ergonomics International Journal
ISSN: 2577-2953

Prevalence of Traffic Noise in Jalandhar City

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Research Article

Volume 1 Issue 3

Received Date: November 16, 2017

Published Date: December 11, 2017

DOI: 10.23880/eoij-16000126

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Abstract

Traffic noise becoming a significant environmental quality problem in economically developing countries and a cause of society's increasing annoyance. The present study is focused upon measuring the traffic noise pollution in Jalandhar City. The study included four sites of city. A weighted (Leq) ambient noise was assessed by using a quest sound level meter "model SOUNDPRO SP-DL-1-1/3". OSHA norms for hearing conservation were incorporated including an exchange rate of 5 dB (A)*, criterion level at 90* dB (A), criterion time of eight hours*, threshold level equal to 80 dB (A), upper limit equal to 140 dB (A) and with F/S response rate. The results of the study revealed that interstate bus terminal Jalandhar and Jyoti chowk were found at the highest level of noise pollution due to traffic. However Rama mandi and Maqsudan chowk were found moderately polluted area. The study recommended that there is a need of implementing the noise pollution criteria in the city. The appropriate noise control measures should be implemented.

Keywords: Traffic noise; Noise pollution; Punjab; Jalandhar City

Abbreviations: SPL: Sound Pressure Level; SIL = Sound Intensity Level; IHD: Ischemic Heart Disease; WHO: World Health Organization

Introduction and Literature Review

Noise Pollution

Noise pollution is a disturbance to the human environment that is escalating at such a high rate that it will become a major threat to the quality of human lives. Noises in all areas, especially in urban areas, have been increasing rapidly. Poor urban planning gives rise to noise pollution. In simple terms, noise is unwanted sound. Sound is a form of energy which is emitted by a vibrating body and on reaching the ear causes the sensation of hearing through nerves. Sounds produced by all vibrating bodies are not audible. The frequency limits of audibility are from 20 HZ to 20,000 HZ.

Sound pressure level (SPL) or sound level L_p is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. The commonly used reference sound pressure in air is P_{ref} = 20 μPa (rms), which is usually considered the threshold of human hearing.

Sound Intensity

➢ For a specified direction and point in space, the average rate at which sound energy is transmitted through a unit area perpendicular to the specified direction.

The measure of a ratio of two sound intensities is

$$L_1 = 10\log_{10}\left(\frac{I_1}{I_0}\right)dB$$

If I_0 is the standard reference sound intensity

$$I_0 = 10^{-12} W / m^2$$

(W = watt), then instead of "dB SPL" we use "dB SIL". (SIL = sound intensity level).

Permissible Noise Level Criteria

The permissible noise pollution criterion is shown in Table 1. Day time shall mean from 6.00 a.m. to 10.00 p.m. Night time shall mean from 10.00 p.m. to 6.00 a.m. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

S.No	Category of area (Code)	Day time Intensity(dB)	Night time ntensity(dB)
1	Industrial Area (A)	75	70
2	Commercial Area (B)	65	55
3	Residential Area (C)	55	45
4	Silence Zone (D)	50	40

Table 1: Permissible Noise Criteria in India.

Traffic Noise and its Health Effects

Traffic noise has become one of the main environmental quality problems in developed countries and causing noise annoyance among the citizens. In Europe about 113 million citizens (17% of the population) are exposed to ambient noise levels above Leq 65 dB(A) and about 9.7 million citizens are exposed to noise levels above 75 dB(A) [1]. The main source of acoustic nuisances is road traffic. There is a growing amount of evidence that road traffic noise increases about 1-3 decibels a year in most cities. According to prognosis, the noise load will double in a 15-year period [2,3]. Excess noise has a wide range of effects on individuals, ranging from disturbance to chronic stress and damage to hearing. Therefore, the World Health Organization (WHO) has attributed noise to occupational risk factors [4]. Traffic noise causes annoyance, emotional distress, and chronic stress and increases the risk of hypertension [5-7]. Long-term noise causes changes in homeostasis, which are accompanied by disorders in heart rhythm, muscle tenseness and changes in brain electrical potentials [8]. A positive association was found between noise annoyance and serum lipid levels [9], exposure to noise and fibrinogen, and plasma viscosity [10], causal risk factors of ischemic heart disease (IHD). Exposure to noise increases physiological stress indicators – catecholamine's and steroid hormones and through the neurohumoral pathway stimulates changes in the cardiovascular system, stimulates arterial hypertension, development of IHD [11,12], and might increase myocardial infarction (MI) risk [13,14]. There are only a few published community studies, among them Berlin case-control study [15,16] and Cearphilly and Speedwell cohort studies [17]. Epidemiological studies have shown that noise-induced health effects depend on noise character and exposure time, as well as duration and other environmental factors. Individual sensitivity, age and susceptibility to noise determined noise-induced responses. Large individual differences in sensitivity to noise co-vary with expressed annoyance resulting from noise. Lack of measurements of noise levels in human settlements, difficulty in exposure quantification and the small number of cases are factors of great importance why epidemiologic evidence of cardiovascular effects caused by environmental noise exposure is still limited.

Additional studies since then have also found an association between work-related noise and blood pressure [2-5]. Although one of the studies has suggested the effect is only transient in people under the age of fifty. Possible biological mechanisms for the association between noise and high blood pressure are: 1) release of stress hormones such as steroids; and 2) activation of the sympathetic nervous system with release of epinephrine. Animal models have shown both these changes. Additionally, a recent article demonstrated genetic changes (damage) in rat heart cells. These changes persisted after noise exposure ceased [6]. Finally chronic noise exposure has been associated with hyperlipidaemia [7]. Hyperlipidaemia may by causing atherosclerosis increase the risk for hypertension.

Methodology

The study included four sites of city namely; interstate bus terminal Jalandhar, Jyoti Chowk, Maqsudan Chowk, Rama mandi. A weighted (Leq) ambient noise was assessed by using a Quest sound level meter "ANSI SI. 43-1997(R 2002) Type-1, model SOUNDPRO SE/DL". OSHA norms for hearing conservation were incorporated including an exchange rate of 5 dB (A), criterion level at 90 dB (A), criterion time of 8 hrs, threshold level = 80dB (A), upper limit = 140dB (A) and with F/S response rate. In. The sound pressure was recorded for 15 minutes each time on each work station and one long term recording for 8 hrs was done. At each section sound pressure was recorded at least 4-5 times at different locations where the movement of the workers was most frequent. There was hardly a difference of 0.5 to 1.0 dB (A) between long term recoding and short term recording. Most

Results

The results of the study revealed that noise levels at various locations at Shaheed-E-Azams Bhagat Singh interstate bus terminal Jalandhar city were found be significantly higher than the prescribed limits of 65 dB(A) as shown in Table 2-Table6. At the same time Punjab Armed Police (PAP) Chowk was found to be the second highest area of traffic noise pollution. Subsequently Jyoti Chowk and Maqsudan Chowk were found to be the area moderate traffic noise pollution.

S.No.	Time	Maximum(DB)	Minimum(DB)	Average(DB)
1	8:00AM-10:00AM	71	68.3	70.39
2	12:00PM-2:00PM	76.1	73.4	74.98
3	4:00PM-6:00PM	78	73	74.82
4	8:00AM-10:00AM	73.5	68.4	70.98
5	12:00PM-2:00PM	76.9	75.4	75.94
6	4:00PM-6:00PM	76.5	73.1	75.36
7	8:00AM-10:00AM	72.7	68.2	70.41
8	12:00PM-2:00PM	76.1	75.3	75.86
9	4:00PM-6:00PM	75.8	73.6	75.28

Table 2: Noise level during peak hours at Shaheed-E-Azams Bhagat Singh interstate bus terminal Jalandhar.

S.No.	Time	Maximum(dB)	Minimum(dB)	Average(dB)
1	8:00AM-10:00AM	56.5	47.2	52.73
2	12:00PM-2:00PM	68.5	66.0	67.65
3	4:00PM-6:00PM	69.9	62.0	65.75
4	8:00AM-10:00AM	54.6	46.5	52.34
5	12:00PM-2:00PM	71.2	66.2	67.91
6	4:00PM-6:00PM	68	61.9	64.68
7	8:00AM-10:00AM	55.6	47.3	52.30
8	12:00PM-2:00PM	72.9	64.3	68.28
9	4:00PM-6:00PM	73.5	61.4	65.15

Table 3: Noise level during peak hours at Jyoti Chowk.

S.No.	Time	Maximum(dB)	Minimum(dB)	Average(dB)
1	8:00AM-10:00AM	54.6	47.1	53.52
2	12:00PM-2:00PM	63.2	59.2	61.76
3	4:00PM-6:00PM	62.3	56.9	59.1
4	8:00AM-10:00AM	55.0	51.7	53.85
5	12:00PM-2:00PM	65.2	58.9	61.33
6	4:00PM-6:00PM	62.4	58.3	59.51
7	8:00AM-10:00AM	52.8	46.2	49.58
8	12:00PM-2:00PM	65.1	52.9	60.36
9	4:00PM-6:00PM	65.8	58.6	61.376

Table 4: Noise level during peak hours at Maqsudan Chowk.

S.No.	Time	Maximum(dB)	Minimum(dB)	Average (dB)
1	8:00AM-10:00AM	59.95	53.15	56.5875
2	12:00PM-2:00PM	71.525	65.3	68.91875
3	4:00PM-6:00PM	70.075	64.725	67.68125
4	8:00AM-10:00AM	58.5	53.45	56.29375
5	12:00PM-2:00PM	71.475	65.95	68.84375
6	4:00PM-6:00PM	69.15	64.325	66.475
7	8:00AM-10:00AM	56.925	52.425	54.55625
8	12:00PM-2:00PM	68.95	64.05	66.46875
9	4:00PM-6:00PM	68.625	64.55	66.63125

Table 5: Noise level during peak hours at PAP Chowk.

Station name	Maximum noise level	Noise range	Comparison with Indian standard	Region	Remarks
ISBT Jalandhar	78 dB	68.3-78 dB	> 65 dB	Commercial Area	Highly polluted
Jyoti Chowk	73.5 dB	47.2-73.5 dB	> 65 dB	Commercial Area	Moderately Polluted
PAP Chowk	71.5dB	52.5-71.5 dB	> 65 dB	Commercial Area	Moderately Polluted
Maqsudan Chowk	65.8 dB	47.1-65.8 dB	> 65 dB	Commercial Area	Moderately polluted

Table6: Comparative Analysis Jalandhar city, Punjab.

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