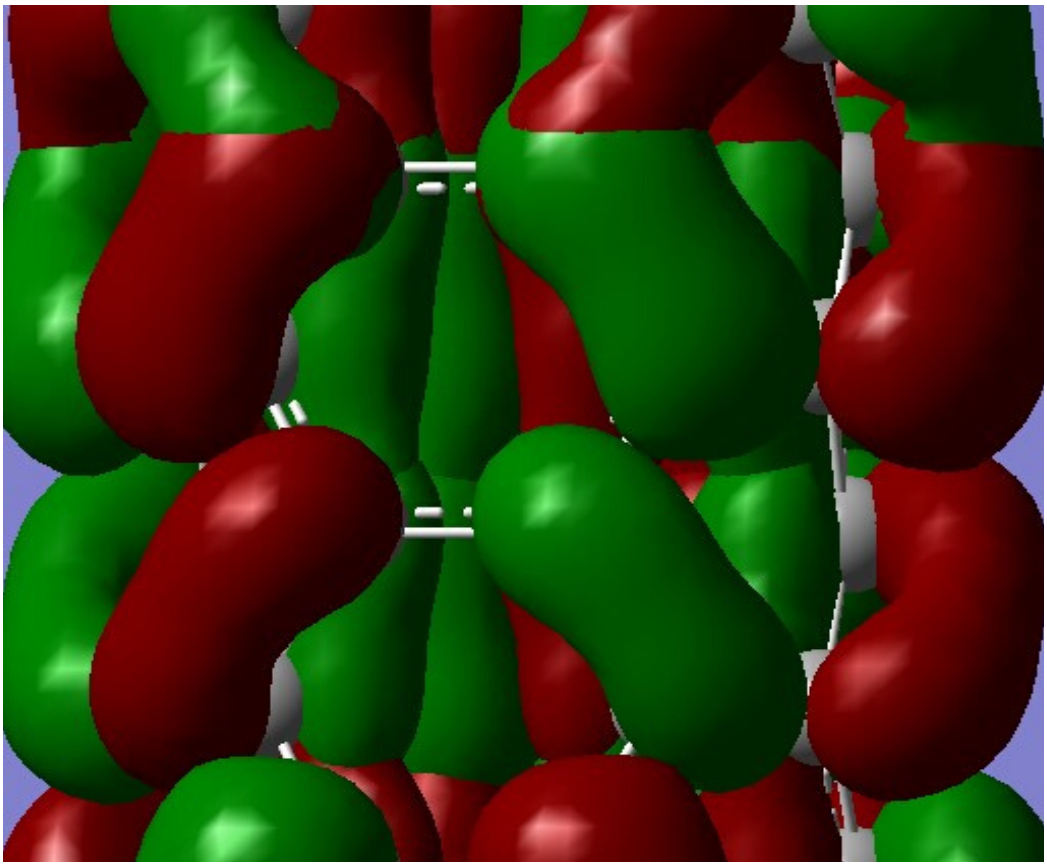
Volume 8, December 2019 ISSN 2542-2545

The HIMALAYAN PHYSICS

A peer-reviewed Journal of Physics



Department of Physics, Prithvi Narayan Campus, Pokhara
Nepal Physical Society, Western Chapter, Pokhara

Him. Phys. **8** 27-32, (2019)

Himalayan Physics

Noise pollution levels in Pokhara metropolitan city

Research Article

Kamal Raj Poudel[1,2*], Parashu Ram Poudel[1]

1 Department of Physics, Prithvi Narayan Campus, Bagar, Pokhara, Nepal

2 Physics Research Initiatives, Pokhara, Nepal

Abstract: Unwanted and unpleasant sound which disturbs quality of life is called noise. Noise pollution is the propagation of noise with harmful impacts on the activity of human or animal life. This study attempts to assess the noise pollution level and build awareness about the noise pollution. Sound Level is measured at eleven different locations of Pokhara Metropolitan City which include major traffic points and trade centers in four different sections of time (i.e 7am to 8am, 9am to 10 am, 12pm to 1pm and 4 pm to 5 pm) by using Sound Level Meter. The key noise pollution indices such as equivalent continuous noise level (L_{eq}) and noise pollution level (L_{NP}) were computed. Result shows that Leq ranges from 76.37 to 83.21 dB and Noise Pollution Level is from 86.36 to 94.91 dB. Here the result shows, at most of the places noise parameter exceeds the value recommended by Nepal Government and WHO.

Keywords: Sound Level • (L_{eq}) • Traffic Noise Index • Noise Pollution Level

1. Introduction

The sound that produces an unpleasant effect on the listener is called noise. Sound which may be desired by one person may not be desired by another person. So noise may be defined as the wrong sound in the wrong place at the wrong time. The word 'noise' is derived from Latin word 'nausea'. When there is lot of noise in the environment it constitutes noise pollution. Noise pollution is regarded as technology generated problem. The industrialization, scientific and technological developments are contributing to the development of society but at the same time these are also the main causes of environmental pollution. Noise pollution is recognized as a major problem for the quality of life in urban areas all over the world.

Noise pollution takes place when there is either excessive amount of noise or an unpleasant sound that causes temporary disruption in the natural balance. This definition is usually applicable to sounds or noises that are unnatural in either their volume or their production. Our environment is such that it has become difficult to escape noise. Even electrical appliances at home have a constant hum or beeping sound. By and large, lack of urban planning increases the exposure to unwanted sounds. This is why understanding noise pollution is necessary to curb it in time. Some of the major health hazards induced by noise pollution are permanent hearing loss, high

* *Corresponding Author: poudelkp123@gmail.com*

blood pressure, muscle tension, migraine, headaches, higher cholesterol level, gastric ulcers, irritation, insomnia, increased aggression and psychological disorder.

The government of Nepal has formulated noise level standard for different areas for day and night time is given in Table 1.

Table 1. Noise level standard

Area	Noise Level (dB)	
	Day time	Night time
Silent zone	50	40
Industrial area	75	70
Business area	65	55
Rural residential area	45	40
Urban residential area	55	45
Mixed residential area	63	40

Nepal Health Research Council and WHO carried out a research on noise level at different commercial area of Kathmandu valley and found that maximum level of 77 dB(A) at Kupondole and minimum level of 58 dB(A) at Tribhuwan University gate [1]. The study of noise level around Tribhuwan international airport carried out by Sapkota [2], showed the highest noise level up to 101.5 dB at Gothatar and least 63.5 dB at Datodol.Noise level in Siddharthanagar Municipality carried out by Bhattrai [3] in different locations found that noise level at all places were above the level prescribed by Government of Nepal. The maximum noise of 81.9 dB was recorded at Buspark and minimum of 54.5 dB at medical college premises. Monitoring of noise level at 24 sites from November to February 2002 in Kathmandu valley carried out by Kandel et al. [1] found Putalisadak as noisy place having loudness 83.5 dB. Krishnamurthi et al. [4] reported that noise level in Banepa city of Nepal varied from 60.1 dB(A) to 110.2 dB(A).

2. Methodology

Sound Level Parameters

Weighted decibel levels

The noise level exceeded for x percent of time is denoted by L_x. The most common noise exceeded level used is L_{10} noise level which means noise level exceeding for 10% of time and calculated as 10th percentile of data. Noise level exceeding for 50% and 90% are respectively denoted by L_{50} and L_{90} and are calculated as 50th and 90th percentile of data.

Equivalent Energy level

The average intensity over a given period of time, given the symbol L_{eq} and expressed in decibels relative to the reference intensity of the threshold of hearing. Equivalent energy level is calculated by using formula,

$$L_{eq} = 10 \log_{10} \left(\frac{1}{N} \sum_{i=1}^{N} f_i 10^{0.1 L_i} \right)$$

where, f_i is time fraction for that the sound level is in i^{th} interval which is 1 second in slow mode of sound level meter and L_i is sound level [5].

Note that L_{eq} is not identical with the average dB level (L_{50}), although it will be similar when the fluctuation in dB is small (i.e. less than 5 dB). For greater fluctuations, L_{eq} is higher, since the measurement method gives greater weight to higher intensities. For instance, the decibel average of three measurements of 20, 50 and 80 dBA is 50 dBA, but Leq = 75 dBA. As a result, the measurement is generally regarded as the best indicator of the effects of duration and loudness.

Noise Pollution Level (LNP)

Noise Pollution Level is a procedure recently introduced in the U.S. in an attempt to relate various earlier studies of community noise. The measurement is conceived so that it combines the ambient noise level with the degree of steadiness in time of the noise (assuming that the less steady it is, the more distracting and annoying it becomes). The basic definition is:

$$L_{NP} = Leq + L_{10} - L_{90}$$

where, L_{eq} is the equivalent energy level and is measured in dB. This measurement system applies to any environment, unlike those specifically concerned with aircraft and traffic. As a result, however, it is incapable of determining whether the noise being measured is wanted or unwanted sound [6].

A sound level meter is an instrument which has a microphone, amplifier and weighting networks, and an indicating meter which gives a reading in dB. It is used to measure sound that travels in air. It is commonly a mobile instrument with a microphone. The diagraph of the microphone respond to changes in air pressure caused by sound wave. That is why the instrument is sometimes referred to as a sound pressure level meter. Sound level meters are commonly used in noise pollution studies for the quantification of different kinds of noise especially for the industrial, environmental and aircraft noise. Here we use sound level meter of model IEC 651 TYPE II, having high degree of accuracy.

Figure 1. Sound Level Meter

To collect data here eleven different sample places are taken at random considering certain criteria such as high traffic zones, main trade centers, and residential areas. At each location data are taken four times a day. The sound level meter was placed on its stand of one meter height and distance of 5 meter from central road on main junctions whereas central part of trade centers. While taking observation sound level meter was set to response fast and selected dB(A).

3. Results and Discussion

Weighted decibel levels

The noise level exceeded for x percent of time is denoted by L_x. The most common noise exceeded level used is L_{10} noise level which means noise level exceeding for 10% of time. Noise levels exceeding for 50% and 90% are respectively denoted by L_{50} and L_{90}. L_{10}, L_{50} and L_{90} are shown in Table 2.

Table 2. Weighted Decibel Levels at different location.

Place	Weighted Decibel Levels (L_x)		
	L_{10}	L_{50}	L_{90}
Mahendrapool Chowk	86.03	81.75	76.49
Chipledhunga Chowk	82.95	77.50	73.84
Sabhagriha Chowk	84.58	80.80	74.58
Bus Park	88.80	85.60	79.92
Mustang Chowk	84.10	80.80	73.73
Hallan Chowk	82.40	77.90	72.95
Zero KM Chowk	84.77	79.20	73.77
Buddha Bisal Bazar	79.10	75.60	69.11
Trade Mall	82.39	77.45	69.21
Shree Complex	82.84	76.05	69.71
Bhatbhateni SM	83.04	79.35	69.36

It is found that maximum L_{10}, L_{50} and L_{90} is 88.8 dB, 85.6dB and 79.92dB respectively at Bus Park, it implies Bus Park is most noisy spot of Pokhara. Minimum value of L_{10}, L_{50} and L_{90} is 79.1dB, 75.6dB, and 69.11dB respectively at Buddha Bisal Bazar.

Equivalent Energy Level

The average intensity or equivalent energy level over a given period of time is given by the symbol L_{eq} and expressed in decibels relative to the reference intensity of the threshold of hearing. Equivalent Energy Level at different places is given in Table 3.

Table 3. Equivalent Energy Level at different location.

Place	Equivalent energy Level (L_{eq})
Mahendrapool Chowk	83.21
Chipledhunga Chowk	82.72
Sabhagriha Chowk	82.60
Bus Park	80.96
Mustang Chowk	82.09
Hallan Chowk	79.07
Zero KM Chowk	81.75
Buddha Bisal Bazar	76.37
Trade Mall	78.93
Shree Complex	79.98
Bhatbhateni SM	80.96

Noise Pollution Level(L_{NP})

A Noise Pollution Level obtained at different places is tabulated in Table 4.

Table 4. Noise Pollution Level (L_{NP}) at different location.

Place	Noise Pollution Level (L_{NP})
Mahendrapool Chowk	92.75
Chipledhunga Chowk	91.83
Sabhagriha Chowk	90.60
Bus Park	94.91
Mustang Chowk	92.46
Hallan Chowk	88.52
Zero KM Chowk	87.77
Buddha Bisal Bazar	86.36
Trade Mall	92.11
Shree Complex	93.11
Bhatbhateni SM	94.64

Pollution level is 94.91 dB at Bus Park, which is maximum and 86.36 dB at Buddha Bisal Bazar which is minimum.

4. Conclusions

Noise level at different eleven sites of Pokhara is found to be greater than maximum permissible noise level recommended by Nepal Government [7]. Out of seven major traffic junctions Bus park is more noisy and out of four trade centers Bhatbhateni Super Market is the noisiest. It is also found that trade centers have low sound level than traffic junction; from this we can conclude that vehicles are the major cause of noise pollution. Noise Pollution Level at Bus Park is maximum (i.e. 94.91dB) and least at Buddha Bisal Bazar (i.e. 86.36dB). This may due to high flow of vehicles because Bus Park is not only parking stand but it is the place from where vehicles are left to different places of country from Pokhara.

5. Acknowledgements

We want to acknowledge to Research Management Cell, Prithvi Narayan Campus Pokhara to provide grant to carry out this research.

References

[1] Kadel H, Regmi S, Pradhananga T. Noise Level Monitoring in Kathmandu Valley. Nepal Journal of Science and Technology. 2003;5(1).

[2] Sapkota B. A study of continuity noise in Kathmandu valley airport. Royal Nepal Academy of Science and Technology. 1997;.

[3] Bhattarai LN. Noise Level Status in Siddharthanagar Municipality, Rupandehi, Nepal. Himalayan Physics. 2014;5:69–74.

[4] Murthy VK, Majumder AK, Khanal SN, Subedi DP. Assessment of traffic noise pollution in Banepa, a semi urban town of Nepal. Kathmandu University Journal of Science, Engineering and Technology. 2007;3(2):12–20.

[5] Langdon FJ, Scholes W. The Traffic Noise Index: A Method of Controlling Noise Nuisance. 1968;.

[6] Robinson DW. Towards a unified system of noise assessment. Journal of Sound and Vibration. 1971;14(3):279–298.

[7] Nepal Rajpatra. Government of Nepal; 2069 BS.

[8] Ozer S, Yilmaz H, Yesil M, Yesil P. Evaluation of noise pollution caused by vehicles in the city of Tokat, Turkey. Scientific Research and Essay. 2009;4(11):1205–1212.