Noise Pollution in Washim Town: Sources, Effects, and Mitigation Strategies

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ABSTRACT

In the recent year's due to urbanization industrialization, growth in construction industry and facility provided in road transport in India has created excessive noise pollution which is displeasing for human and animal life. Noise pollution refers to such levels of Noise or Sound in the environment that are disturbing, irritating and annoying to living being. Both physiological and psychological health of human being and behavioral in nature can be affected by Noise Pollution. Also Noise pollution can cause annoyance and aggression, hypertension, high stress levels, hearing loss, sleep disturbances and child development. Washim is district place belonging to Vidarbha Region of Maharashtra State in India. As Washim town is developing area and a connected big rural area, there is a rapid urbanization and migration of people, alarming growth of population is causing serious environmental problems. Noise is one of the environmental problems that uncomforts in daily life. The objective of this paper is to study the noise level values for exceed the standards set by the central pollution control board and, to investigate the various noise parameters at different Zone.

Keywords: Noise Pollution in India, Road Traffic Noise, Noise Indicator.

I. INTRODUCTION

The environmental effects of transportation projects have come under close scrutiny in recent years. Noise is an inevitable part of everyday life; Mild noise can be annoying, excessive noise can destroy a person's hearing. The slightest unwanted sound can become very annoying if it continues for any length of time. While some nearby residents may ignore the continuous hum of a busy freeway, others will never be able to ignore it and increasingly will find it irritating. Over the years the general incidence of noise has been increasing, the development of the steam engine, the petrol engine, and technological machinery in industry, contributed to an increasingly noisy environment in the nineteenth century. This has been further exacerbated in the twentieth century by the diesel engines, the turbo prop and jet engine, the increasing use of faster industrial production machinery, construction site machinery and the increased volume of road traffic. Disturbance by noise is probably the most important environmental impact of the transportation apparatus and affects a large number of people, particularly those living in built-up areas.

II. LITERATURE REVIEW

Ramalingeswara Rao P. et al described that the environmental noise level due to motor vehicle traffic to a first approximation is a function of traffic volume. The values of sound pressure level (L10) resulting from traffic noise measurements over one-hour periods have been correlated with the equivalent measured numbers of heavy, light vehicles per hour (traffic density). A statistical analysis of the data has been made to enable L10 be expressed in terms of the traffic density in the city of Visakhapatnam, India in 1986 and 1987. Plots of L10 against logarithm Nh (equivalent heavy vehicle density) and logarithm N1 (equivalent light vehicle density) for the different zones, as well as for the entire city have been made. The validity of these equations is tested by computing the values of the noise indices from these equations, using the traffic density data and comparing them with the measured values. The difference between the measured and calculated values is very small. [1]
Mishra et al. laid emphasis on the newly introduced bus rapid transit system (BRTS) corridor at New Delhi. The paper included interpretation of primary data to predict the noise levels along the BRTS corridor. It focused on comparative study of modeled and measured noise levels. It also discussed about the impact of this corridor on land use and socio-economic aspects of lives of residents and road users living along this corridor. It recommended mitigating measures like design of noise barrier for stretches where the noise level exceeds the standards set by the Central Pollution Control Board. It observed data different value of noise level has been calculated for effect of the noise on human health, the hourly variation of L10, L50, L90 and Leq noise levels.[2]

Ingle et al. (2004) studied that traffic police have a high danger of listening loss because of street activity exposure. Here appraisals were made at the work place of traffic police of typical sound level and measures got of the listening to status of policemen. This study concentrated on the working of policemen working for 10–12h everyday in noisy environment. The information was gathered on self-reported wellbeing status to

determine the hearing threshold of high and low frequencies via poll and an audiometry. Eighty-four percent of the specimen reported trouble in hearing by one or both ears and hearing loss. The pervasiveness of audiometric listening to impedance characterized as a threshold average greater more than 25dB(A) listening to level was 80% for binaural low frequency normal (250, 500 and 1000Hz), 70% for binaural mid-frequency normal (1000, 2000, 3000 and 4000Hz) and 46% for binaural high frequency normal (3000, 4000, 6000 and 8000Hz) in the traffic policemen.[3]

Chauhan et al. (2010) made assessment of noise level of Haridwar city. They found that traffic noise was the significant contributor to the overall noise. The variation range of SPLmin and SPLmax was between 56.6-102.4 dB in residential zone; 56.7-108.9 dB in commercial zone; 52.4-65.8 dB in industrial zone; and 45-87.8 dB in silence zone. He suggested widening of narrow roads, diversion of traffic to reduce traffic volume, plantation of evergreen trees, restriction on entry of heavy buses and trucks, penalization on use of pressure horns, segregation of slow moving traffic by constructing dedicated lane among other measures. [4]

Pathak et al. (2008) made evaluation of traffic noise pollution and attitudes of exposed individuals in working place of Varanasi city and found that the noise levels have reached an alarming level. 85% of the people were disturbed by traffic noise, about 90% reported that traffic noise is the main cause of headache, high BP, dizziness and fatigue. People with higher education and income level were much aware of health impact due to traffic noise. Traffic noise was found to be interfering with daily activities like resting, reading, communication etc.[5]

Assessment of noise quality in Bolpur- Santiniketan areas of India was made by Padhy and Padhi (2005). Noise is a prominent feature of the environment including noise from transport, industry and neighbors. An important part of noise assessment is the actual measurement of the noise levels. Continuous Leq measurement during day time (0600 – 2100 hr) was carried out in residential, commercial and silence zone location of Bolpur Santiniketan areas during June-December, 2005. The results show that the noise pollution in the city is wide spread throughout most of its area. The noise in this area is composite in nature. Public participation, education, traffic management and structural designing play a major role in noise management.[6]

Khursheed Ahmed Wani (2010) stated that Gwalior is an important historical city of Madhya Pradesh, India. Rising level of transportation mainly by road vehicles i.e., tempos, rickshaws, four wheelers, two wheelers and heavy vehicles is one of the major source of augmented noise pollution in Gwalior. The ambient noise level was measured by using Sound Level Meter SL- 4010. The highest noise level was recorded at commercial area like railway station and accordingly a maximum of 119.2 dBA at Batmorar and 92.7 dBA at Thathipur followed by residential zone a maximum of 69.8 dBA at Pinto Park and 77.2 dBA at Lascar and silence zone 64 dBA at Madhav dispensary and 65.8 dBA at Jiwaji campus were found.[7]

Mangalekar et al (2011) conducted a study of noise pollution in Kolhapur city, Maharashtra, India. Kolhapur city is a district place in the state of Maharashtra, India with population of 5,49,283. It is one of the emerging industrial and commercial cities of Western Maharashtra. Problems of pollution along with noise pollution are increasing with time, especially, due to the increase in the number of vehicles for transportation. In the present study, continuous monitoring of noise levels Leq dB (A) was carried out for three days in the month of December, 2011 at six different sites within the Kolhapur city. On the basis of location, these sites were grouped into industrial, commercial, residential and silent zones respectively. The average noise level at industrial, commercial, residential and silence area were 74.28 dBA, 65.52 dBA, 58.88 dBA and 50.02 dBA, respectively. The results showed that there is an enhanced pressure of noise at all sites due to increase in the number of vehicles and facilities of transportation. All the sites under study showed higher sound level than the prescribed limits of Central Pollution Control Board (CPCB).[8]

Choudhari et al (2011) has reported that noise generated from various industrial activities can disrupt the activities. The scope and purpose of this is to control or minimize the noise pollution and its effects on human being. Noise control method can be classified as noise control at source, during transmission and at the receiver. Using these noise control methods, the noise level can be reduced up to the desired level, i.e., 70 dBA. There are two basic ways of eliminating noise at sources; through the design or modification of machinery itself or through isolation or enclosure of the noise source. Noise can be controlled along the path through separation of worker from noise sources and use of barriers or reflector. Acoustical control is one of most popular technique available for absorbing noise. This paper presents the principles of noise control, various noise control techniques, use of noise control materials at saw mill.[9]

III. METHODOLOGY

In the present study, a noise sample size of 5 minute in each hour at a particular selected distance from the edge of the pavement was recorded. Noise sample was collected in dB (A) scale at every 60 second interval or total 5 reading in one sample size. Instrument used for recording the noise level was digital sound level meter having measurement frequency 31.5 Hz to 8000Hz. The observation readings are taken at a distance 1.2 meter from the edge of road and at right angle to the centerline of road. The observed noise levels were tabulated and the average, Cumulative percentage, Leq, TNI, LNP, NC, L10, L50, L90, Lmax and Lmin were calculated. The study area was divided into 4 different zone details of which are given in table below.

Table 1 –Types of zone and their locations

Sr. No,	**Types of Zone**	**Location**
1	Institutional Zone	Govt. Polytechnic, Washim
2	Commercial Zone	Patani Chowk, Washim
3	Silence Zone	District Hospital, Washim
4	Residential Zone	Civil Line, Washim

IV. NOISE STANDARDS IN INDIA

Most of the countries, keeping in view the alarming increase in environmental noise pollution, have given the permissible noise standards. These are depending on the location and period of day. Industrial areas obviously have somewhat higher acceptable sound levels than those prescribed for residential areas. The collected night standards are stringent than the daytime standards.

Standards by Law in India

Noise has been recognized as ambient air pollutant. Standards in this regard are laid down under Environment (Protection) Rules, 1986 and under the Model Rules of the Factories Act, 1948.The Central Pollution Control Board constituted a Committee on Noise Pollution Control. The Committee recommended noise standards for ambient air and for automobiles, domestic appliances and construction equipment, which were later notified in Environment (Protection) Rules, 1986 as given below in Table-2 [10].

Table 2 -Noise Standards for Different Category of Area

Area Code	**Category of Area**	**Limits in dB(A), Leq**	
		Day time	**Night time**
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone	50	40

Note:

1) Day time is reckoned in between 6 a.m. and 9 p.m.
2) Night time is reckoned in between 9 p.m. and 6 a.m.
3) Silence zone is referred as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority.
4) Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
5) Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.

Recommended noise levels by the Bureau of Indian Standards (BIS)

Following standards of the Bureau of Indian Standards (BIS) and Indian Roads Congress (IRC) are useful for assessment efforts:

a) IRC: 104 - Guidelines for Environmental Impact Assessment of Highway Projects [11].

b) IRC: 64 - Guidelines for Capacity of Roads in Rural Areas [12].
c) IS: 3028 - Measurement of Noise Emitted by Moving Road Vehicles [13].
d) IS: 4954 - Recommendations for Noise Abatement in Town Planning [14].
e) IS: 9779 - Specification for Sound Level Meters [15].
f) IS: 9989 - Assessment of Noise With Respect to Community Response [16].
g) IS: 10399 - Methods for Measurement of Noise Emitted by Stationary Road Vehicles [17].

Bureau of Indian Standards has recommended acceptable noise levels in residential areas, injury range and safe range are as given in Table-3.

Table 3- Acceptable noise levels in Residential Areas

Sr. No.	Location	Acceptable Noise Level in Residential Areas, dB(A)
1	Rural	25-35
2	Suburban	30-40
3	Residential (urban)	35-45
4	Urban (Residential and Business)	40-45
5	City	45-50
6	Industrial Areas	50-60

Ambient noise level standards as prescribed by World Health Organization (WHO)
Recommended noise exposure limits are shown in Table-4.

Table 4 - Recommended Noise Exposure Limits (WHO-1990)

1	Indoor/domestic night time	35 dB(A)	Increased awakening at higher levels
2	Indoor/domestic day time	45 dB(A)	Speech communication deteriorates at higher levels
3	Community /Urban night time	45 dB(A)	Difficulties in falling asleep at higher levels
4	Community /Urban day time	55 dB(A)	Annoyance increases at higher levels
5	Industrial occupational	75 dB(A)	Predictable risk of hearing impairment at higher level

V. NOISE INDICATORS

The equivalent continuous sound level (Leq)
The equivalent continuous sound level has been adopted in a number of countries as means of measuring and assessing noise. It is sometimes referred to by various other terms than equivalent continuous sound level, such as mean energy level and equivalent sound level. The equivalent continuous sound level is given by the level of study noise that has the same energy as the actual time varying noise in question.

$$\mathbf{Leq = L50 + [(L10-L90)^2/56]\ dB(A)}$$

Noise pollution level (LNP)
Noise pollution level specifically devised to take the account of more complex time varying noises. The scale takes account of the equivalent continuous sound level over a particular period of time together with the variability of the noise environment.LNP is significant because in principle, it accounts for annoyance from aircraft, traffic and other sources such as industrial noise. Maximum permissible outdoor value of LNP is 88dB (A)

$$\mathbf{LNP = Leq + (L10-L90)\ \ dB(A)}$$

Traffic noise index (TNI)
It correlates with dissatisfaction towards traffic noise expressed by people. The measurement of TNI is difficult because of the uncertainty arising from background noise coming from sources other than traffic on the road being considered. Prediction is also difficult because of problem in predicting the background noise at large distance from the road.TNI value of 74dB(A) was found by likely to give a 50 % community dissatisfaction with the traffic noise.

$$\mathbf{TNI = 4\ (L10-L90) + L90-30\ \ dB(A)}$$

Noise Climate (NC)
It is the range over which the sound levels are fluctuating in an interval of time.

$$\mathbf{NC = (L10 - L90)\ \ dB(A)}$$

VI. RESULTS AND DISCUSSION

Sample calculation for first location are shown in flowing tables and graphs

Table 5 – Calculation of cumulative percentage of noise for institutional zone of Washim

Noise Level Range in dB(A)	Average Noise Level dB(A)	No. of Noise	Percentage of Time Noise Level Exist	Cumulative Percentage
52-56	54	0	0.00	100.00
56-60	58	0	1.79	98.21
60-64	62	3	3.10	95.12
64-68	66	12	8.69	86.43
68-72	70	45	13.93	72.50
72-76	74	85	17.98	54.52
76-80	78	144	18.81	35.71
80-84	82	206	15.83	19.88
84-88	86	170	9.64	10.24
88-92	90	97	6.90	3.33
92-96	94	45	1.43	1.90
96-100	98	22	1.43	0.48
100-104	102	0	0.00	0.00

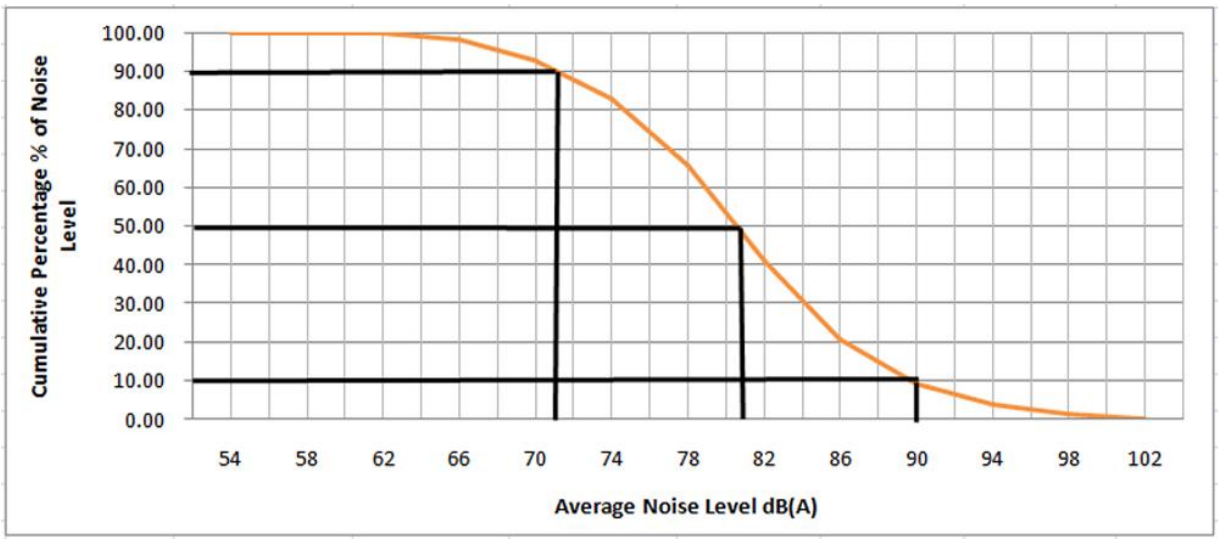

Fig 1 –Cumulative percentage of noise Vs Average noise level for institutional zone of Washim

L10 = 90 dB (A), L50 = 81 dB (A), L90 = 71 dB (A), Lmax =103.7 dB(A),
Lmin = 61.0 dB(A)

Equivalent Sound Energy Level (Leq)
Leq = L50+ [(L10-L90)2/56] dB (A) = 81 + $((90-71)^2 / 56)$ = 87.0 dB (A)
Noise pollution level (LNP)
LNP = Leq + (L_{10}-L_{90}) dB (A) = 87.0 + (90-71) = 106.45 dB (A)
Traffic Noise Index (TNI)
TNI = 4 (L_{10}-L_{90}) +L_{90}-30 dB (A) = 4*(90-71) + 71-30 = 117.0 dB (A)
Noise Climate (NC)
NC = L_{10} - L_{90} dB (A) = (90-71) = 19 dB (A)

Table 6 – Different parameters of noise pollution in Washim town

Types of Zone	Location	L_{10}	L_{50}	L_{90}	Leq	LNP	TNI	NC	Lmax	Lmin
Institutional Zone	Govt. Polytechnic, Washim	90	81	71	87.02	106.5	117	19	103.7	61.0
Commercial Zone	Patani Chowk, Washim	94	83	69	93.42	118.4	139	25	103.9	62.7
Silence Zone	District Hospital, Washim	86	75	64	83.07	105.6	122	22	102.7	56.3
Residential Zone	Civil Line, Washim	82	71	61	78.35	99.35	115	21	99.9	55.4

VII. CONCLUSION

Noise pollution is emerging as an environmental problem in Washim town and other parts of India. This can cause negative impact on public health and welfare. Considering the above aspects, we can conclude that noise dominates the spectrum of environmental noise. The people staying in noisy area especially above 70 dB(A) should take precautionary measures in order to avoid noise induced hearing loss.

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