Study of noise pollution in Angul Town, Odisha, India.

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ABSTRACT

The noise level measurement was carried out to assess the traffic generated noise in AngulTown Campus during the month of March 2015 and April 2015. Extech's Datalogging Sound Level Meter (model 407764) was used to measure the noise level. In the present work twelve locations were selected for the study. The measurements of noise levels at the building facades were carried out in three different time intervals of the day i.e. in the morning 8-10am, midday 11am-1pm and in the evening 6-8pm. The instrument was set to record noise samples at 2 sec intervals during the 10 minutes of exposer time. Equivalent sound pressure level (L_{eq}),noise climate (NC) and noise pollution level(L_{np}) were computed for statistical analysis of noise level. The present study reveals that the noise levels exceed the prescribed noise standard set by the Central Pollution Control Board, India (CPCB, 1998). The results of the analysis suggest that the maximum equivalent noise level was in the morning 9-11am and minimum in the midday at 11am-1pm.

Keywords: Noise pollution, Equivalent noise level, Traffic noise.

1. Introduction

Noise pollution is now one of the most significant environmental issues in many large cities. Noise pollution adversely effects on human health, degradation of environment and quality of life. Since the severties noise has been considered as a major problems of annoyance in cities (Zannin PHT et.al. 2005). Noise pollution is considered as one of the major factors affecting the quality of life in urban areas. This noise problem is mainly due to growing busy traffic. In Odisha, some studies on the traffic noise monitoring have been carried out at different cities like Jharsuguda , Balasore , Bhadrak and the average noise levels in these cities have been found to be more than the recommended value. Heavy traffic volumes, higher speeds, and greater number of trucks and buses in general and motor bikes in particular, improper stoppage of buses at locations rather than desired bus stoppage, improper parking of four wheelers along the road create enormous noise. Noise descriptors such as L_{10}, L_{50}, L_{90}, Leq, TNI (Traffic Noise Index), NPL (Noise Pollution Level) and NC (Noise climate) were assessed to reveal the extent of noise pollution in this town. As there is no defined basic noise levels on the roads prescribed by Central Pollution Control Board (CPCB), India; the detected noise levels of this town in day time were compared with tolerance limit on roads (traffic noise) during day -time 70 dB (A) prescribed by WHO .

It has been reported that exposure to excessive noise may leads to prematurity of new-born babies, disruption to the normal growth and development of premature infants, affecting the physical and psychological behavior of the individuals, permanent hearing loss; cause nausea, vomiting, pain, hypertension, high blood pressure, cardiovascular problems, deterioration of sleep quality, restlessness, depression, fatigue, allergy, mental stress and annoyance (T. Vidya Sagar et.al.2006, Oyedepo and Saadu 2009). In the literature it can be found that many large cities are now under the grip of noise pollution with noise levels much higher than the recommended values (Al-Mutairi et al. 2011, Wazir Alam 2011 , Pathak et al. 2007 ,Singh and Jain 1994 ,Oyedepo and Saadu 2009, Sommerhoff et al. 2004 , Doygun *and* Gurun 2007). Effects of noise pollution on human health have not attracted much attention yet unlike other pollutants (Goswami et al. 2011).It is also observed that the control of noise pollution has been hampered by insufficient knowledge of its effects on humans and of dose–response relationships, as well as by a lack of sufficient data, especially in developing countries (Oyedepo and Saadu 2009).

Wazir Alam 2011 had carried out a noise survey in Guwahati, the capital city of Assam, India and the noise environment of the city was stated to be not satisfactory. Unplanned and rapid urbanization, industrialization, increasing population as well as number of vehicles, poor traffic management, poor road condition etc. can be identified as the major causes of higher noise indices in most of the Indian cities that increases the noise pollution to an alarming level. Angul Town a leading commercial and industrial town of Odisha , India, is exposed to highway traffic generated

noise and has ample chances of getting affected by traffic noise. In the present work an experimental study has been carried out to assess the noise level in the Angul Town area.

2. Materials and method

2.1 Study area

Angul Town is one of the most important Industrial town in Odisha. This premier town is situated on the (20º 05' to 31 º 15' N Latitude and 84º 15' to 85 º 23' E Longitudes). The National Highway 55 passes through the Town dividing the city in to two halves. The length of the NH-55 within the Angul town is just above 3kms. The Thana chhak traffic point, of Angul town, is a road junction of NH-55, NH-55 is very close to the residential colony of the Angul town. All the important buildings such as Court, Library, Administrative building, bank, post office, Guest house and Hospital are located at a distance of about 30m to 100m from the NH-55 The very fast growing traffic population plying on the NH-55 creates nuisance and results in increases of noise pollution.For the present study 12(Twelve) locations were selected considering its different activities like academic, office, civic amenities (Banking and Medical), and residential. The different sampling sites and their approximate distances from the National Highway No. 55 are as shown in table 1.

Table 1 Name of locations ,longitude,latitude and their approximate distances from the NH-55

SL.No	Name of the locations	Longitude	Latitude	Distance in meter
1	Police Training college	20 49 28.5 N	85 05 33.9 E	50
2	Model Police station	20 50 16.4 N	85 05 52.7 E	50
3	Bus stand	20 50 26.7N	85 05 09.8 E	100
4	D.H Post office	21 04 29.9 N	84 44 48.4 E	100
5	Stat Bank of India	20 50 16.4N	85 05 47.8 E	30
6	Distict Court	20 50 14.8 N	85 05 45.0 E	30
7	Govt.District Hospital	20 50 20.8 N	85 05 39.8 E	100
8	Angul High School	20 50 08.0 N	85 05 36.2 E	30
9	Jagannath Temple	20 50 03.9 N	85 05 36.7 E	50
10	Masjid	20 50 03.5N	85 05 29.0 E	40
11	Divyajyoti Talkies	20 49 54.1N	85 05 07.8 E	40
12	Angul Mahila Mahavidyalaya	20 50 00.4N	85 05 28.6 E	40

All the sampling sites selected have boundary walls and tall trees on both sides of the National Highway No. 55. The average height of the boundary walls are about one meter. The height of the boundary walls of the Administrative building and State Bank of India , Angul main branch were slightly higher than the rest and were measured to be about 1.5 meter from the ground level.

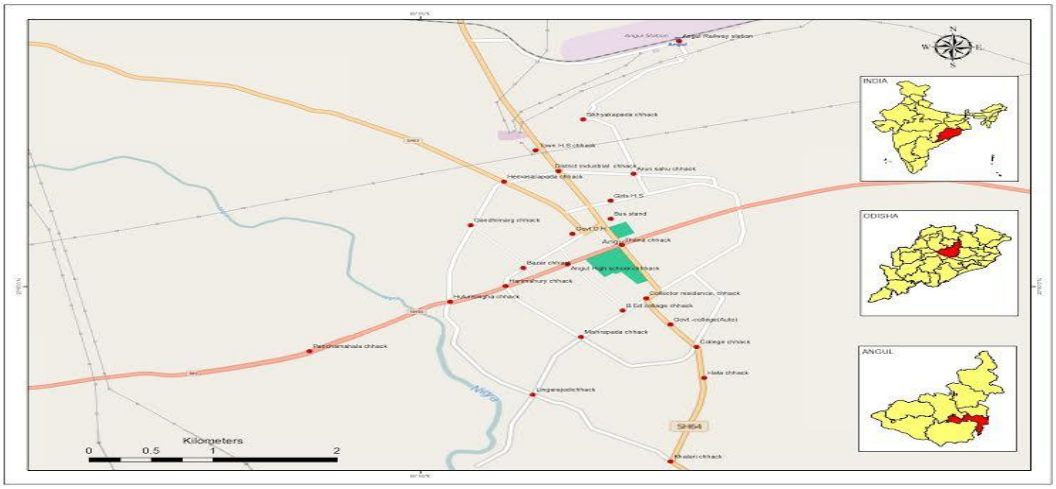

Figure 1: Noise sampling sites in Angul Town area

2.2 Noise Sampling

In the present study measurement of noise-level has been carried out in normal traffic conditions, three times a day, i.e. 8–10 A.M., 11AM –1 PM. and 4–6 P.M. on different week days in the month of M arch 2015 and April 2012. The instrument (Extech's Datalogging Sound Level Meter) used for the measurement of noise level comply with application standard IEC 651, Type 2; ANSI 1.4 Type 2, capable of measuring sound level of range 30-130 dB(A) and frequency range 31.5Hz-8kHz fitted with Electret condenser microphone . The instrument was calibrated before taking noise samplings and was set to record noise samples at 2 sec intervals during the 10 minutes exposer time. The sound level meter was placed at a height of 1.5 meter above the ground level and at a minimum distance of 3 meter from the building facade.

2.3 Noise Indices

The parameters used to evaluate and analysis of noise levels are equivalent sound pressure level (L_{np})Noise climate (NC) and Noise pollution level(L_{np}) . The equivalent sound pressure level (L_{eq}) has been used most widely to measure the noise level which represents the continuous noise level that would have produced the same effects as the varying sound. Noise climate (NC) shows the fluctuation of vehicles depicted in dB(A) and noise pollution(L_{np})indicates the noise pollution

level, represents short tern variation of (L_{np}). The variations of noise levels in the present study are assessed from the statistical distribution of noise levels in the environment. The Sound levels exceeding 10%, 50% and 90% of the total time intervals during a particular period are designated as L_{10}, L_{50}, and L_{90} respectively.

These noise measures are defined as

Equivalent sound level is given by, $L_{eq} = 10\log\left(\frac{1}{n}\sum_{i=1}^{n} 10^{\frac{L_i}{10}}\right)$, (2.1)

where L_i is i[th] sound pressure level

Or, $L_{eq} = L_{50} + \frac{(L_{10}-L_{90})^2}{60}$ (2.2)

Noise pollution level, $L_{np} = L_{eq} + (L_{10} - L_{90})$ (2.3)

Noise Climate, $NC = (L_{10} - L_{90})$ (2.4)

3. Results and discussions

The present study reveals that all the sampling sites are affected by the traffic noise as these noise levels are higher compared to the standards of the Central Pollution Control Board, India (CPCB, 1998) for the prescribed area category as shown in table 2. Being an Industrial town falls under the commercial zone and the permissible noise limits for this category zone are maximum 50dB(A) during day time(6am-9pm) and maximum 40dB(A) during night time(9pm-6am).

Table .2 Noise standards as given by the central pollution control Board , India (CPCB, 1998)

Area Code	Category of Area/Zone	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	Silent Zone	50	40

The present study suggest that equivalent noise level (L_{eq}) is maximum during the time interval in the midday 11am-1pm and registered minimum during the time interval midday at 11 am - 1pm at the sampling stations. The average equivalent noise level(L_{eq})was ranged between 59.7 dB(A)– 65.3 dB(A) during 8-10 am of the day, between 56.4dB(A)-64.7dB(A) during the hours 11am-1 pm and ranging between 57.2dB(A)-65.4dB(A) during the time interval6am -8pm respectively (Fig3.1) .The minimum equivalent noise level(L_{eq}) registered at Angul District

H.Q. Hospital followed by Civil Court was justified as the distance was maximum (approximately 100m) from the noise source among the all sampling sites. Similarly maximum equivalent noise level(L_{eq})was registered at State Bank of India, Angul. Town main branch followed by Model police station as these sampling sites were close to the Thana square traffic noise source (50m) among the all sampling sites (Figure 3).

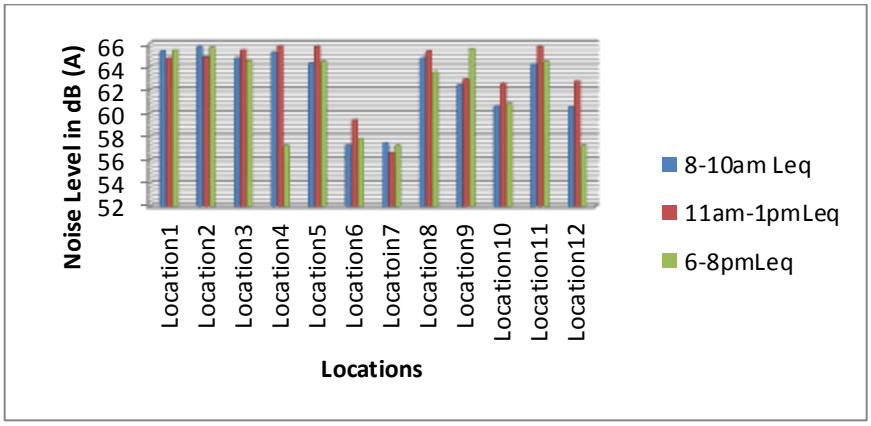

Figure 2: Measurement of equivalent noise level (L_{eq}) at different locations

The mean equivalent noise level(L_{eq})is 62.5 dB(A) with standard deviation 2.4dB(A) during 8-10am, 60.7 dB(A) with standard deviation 2.7 dB(A); during 11am-1pm and 61.8 dB(A) with standard deviation 2.3 dB(A); during 6-8pm respectively (Table 2). The small values of standard deviation (2.3-2.7 dBA) indicate the uniformity of traffic generated noise pollution in the Angul Town area

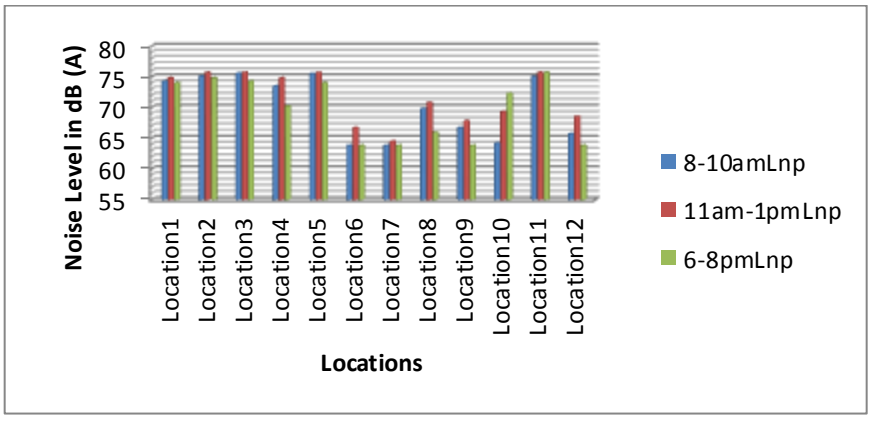

Figure 3: Measurement of L_{np} at different locations

The average noise climate NC varies between 9.1- 10.8 dB(A) during 8-10 am with mean value of 9.8 dB(A) (Figure 3.2) and standard deviation 0.6 dB(A) (Table 3.2). During the hours 11am-1 pm NC varies between 8.3-10.6 dB(A) with mean value of 9.1 dB(A) and standard deviation 0.9 dB(A).

During 6-8pm NC varies between 7.5- 10.4 dB(A) with a mean value of 9.1d B(A) and standard deviation 1.1 dB(A)as shown in Figure 4 and Table 3.

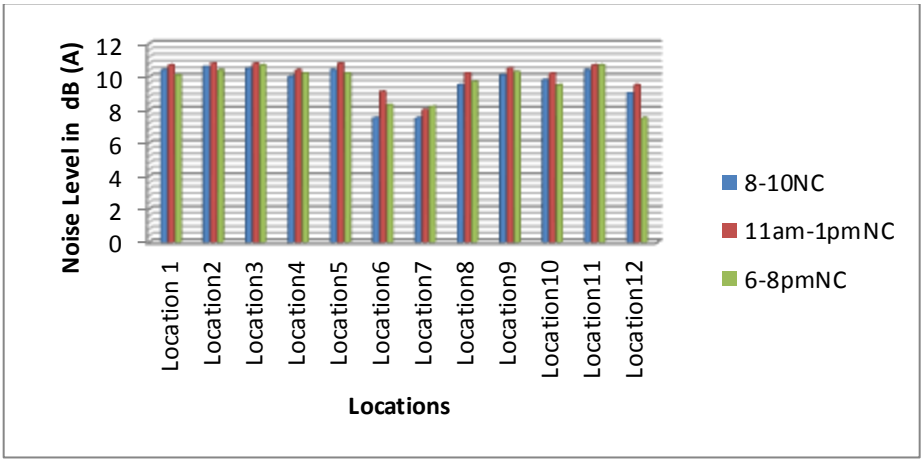

Figure 4: Measurement of NC at different locations

Table .3. Traffic noise levels measured at different locations of Angul town.

Noise level in dB(A)	Time Period dB(A)	Maximum dB(A)	Manimum dB (A)	Mean dB(A)	STDEV dB(A)
L_{eq}	8-10am	65.3	59.7	62.5	2.4
	11 am-1Pm	64.7	56.4	60.7	2.7
	6-8pm	65.4	57.2	61.8	2.3
L_{10}	8-10am	69.3	62.2	66.5	2.6
	11 am-1Pm	68.7	61.3	64.7	2.5
	6-8pm	68.6	61.8	6.8	2.7
L_{50}	8-10am	62.3	56.2	60.1	2.3
	11 am-1Pm	61.5	55.1	57.8	2.8
	6-8pm	63.1	55.6	59.7	2.4
L_{90}	8-10am	60.1	53.4	56.6	2.1
	11 am-1Pm	58.3	53.7	55.2	1.6
	6-8pm	59.4	52.9	55.3	1.8
L_{np}	8-10am	75.1	67.1	70.7	2.9
	11 am-1Pm	75.7	64.3	69.2	3.7
	6-8pm	74.8	66.2	66.3	3.8
NC	8-10am	10.8	9.1	9.8	0.6
	11 am-1Pm	10.6	8.3	9.1	0.9
	6-8pm	10.4	7.5	9.4	1.1

The average noise pollution level(L_{np})for the selected twelve sampling sites are ranged from a low of 67.1 dB(A) to a high of 75.1 dB(A) during 8-10am(Fig 3.) with mean value of 70.7dB(A) and standard deviation 2.9 dB(A) (Table 3.). During 11am-1pm, (L_{np}) varies between 64.3-75.7 dB(A) (Fig 3.) with mean value of 69.2 dB(A) and standard deviation 3.7dB(A) (Table 3.). During 6-8pm (L_{np}) varies between 66.2- 74.8 dB(A) with a mean value of 66.3dB(A) and standard deviation 3.8dB(A) as shown in Figure 3 and Table 3.

4. Conclusion

It is inferred that the detected noise levels of this town were more than the respective tolerance limit on roads (traffic noise) during day (70 dB A) time (W.H.O., 1999). It is obvious that detected noise is a very high level, corresponding to the day time limit recommended by the WHO for urban centers (55dB).

The present study reveals that all the sampling sites are affected by the traffic noise as these noise levels are higher compared to the standards of the Central Pollution Control Board, India (CPCB, 1998) for the prescribed area category. The maximum equivalent sound pressure level (L_{np}) , was registered in the midday 11am-1pm and minimum during midday at 11am-1pm.The small values of standard deviations indicate the uniformity of traffic generated noise pollution inAngul Town area.. The study revealed that the mean equivalent sound pressure level in the morning was 62.5 dB(A) which was about 12.5 dB(A) above the prescribed noise limits for the silence area category. Similarly, the mean equivalent sound pressure level in the midday and evening were 60.7 dB(A) and 61.8 dB(A) respectively, also well above the prescribed noise limits for the prescribed area category.

National Highway no. 55 is mostly responsible for all these nuisances and noise in the Angul Town area as highways are always liable to have large numbers of vehicles of various kinds plying throughout the day. Traffic noise affects the ability to work, learn, rest, relax, sleep, etc. Thus, there should be ban of hydraulic horn and banning very old vehicles Reduction of noise levels to some extent may be possible by plantation of trees especially shrubs on both sides of the road. The best solution to this problem would be a bypass road. New highways and over bridges must be built at appropriate places to abate congestion of traffic. Public awareness programmes should be conducted at all levels to educate people regarding the health affects due to prolonged noise exposure. The Angul Administration needs careful attention for abating road traffic noise through modification of traffic flow and also by sustainable traffic management.

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