

ESTIMATION OF DAY TIME VARIATION IN AMBIENT NOISE LEVEL AT DIFFERENT AREAS OF ALLAHABAD

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INTRODUCTION

It is widely a recognized fact that the developmental effect frequently produce not only sought for benefits but other often unanticipated undesirable consequences. Throughout recorded history, mankind has been plagued by a variety of both natural and man-made ills. In the 21st Century, we are experiencing the manmade plague of environmental noise from which there is virtually no escape, no matter where we are - in our homes and yards, on our streets, in our cars, at theaters, restaurants, parks, arenas, and in other public places. Despite attempts to regulate it, noise pollution has become an unfortunate fact of life worldwide. In a way that is analogous to second-hand smoke, second-hand noise is an unwanted airborne pollutant produced by others; it is imposed on us without our consent, often against our wills, and at times, places, and volumes over which we have no control (USEPA, 1978). However, up to the 1960's noise pollution was a distant cousin in the family of environmental issue. Noise is more subtle pollutant, aside from sonic booms that can break windows; noise usually leaves no visible evidence. It is a silent enemy which is among the most frequently forgotten of the environmental pollutants whose effect can be far reaching. Noise can harm us in more ways than we can think of and at time without us knowing about it (Noise Pollution: Deafening Decibel, 2006). It will be not wrong to say that noise bug has bit every part of the countries and the disease is fast spreading to other areas. It is safe to assume that noise in communities is increasing. It level directly or indirectly related to the population density which keeps on increasing. Noise impacts on peoples life through annoyance, sleep disturbance, reduced work or school performance, stress and anxiety, reduced enjoyment of home life and other physical health effects are found to persist among the residents (EPA, 2007; Goines and Hagler, 2007).

In India also, during early 90's noise pollution was recognized by general public. Indian government considers noise as an air pollutant under The Air (Prevention and Control of pollution) Act, 1981. The environmental protection Act 1986, Schedule III gave the Ambient Air Quality Standard in respect to noise for industrial, commercial, silent and residential zones. However, anyone who walks down the street can easily assess that these limits are violated regularly during the course of day. Every space including hospitals, educational institute and homes all needs acoustics and sound isolation. Allahabad is one of the religious city of india which not only host thousands of pilgrims during Magh and Kumbh at its end but also accommodates thousands of youth came for education from different part of the country every year. Thus, it drew attention to estimate the noise level of the city. Present study was conducted to monitor noise pollution level at different zone in Allahabad with objective to estimate ambient noise level of the area and the variation at hourly level for day duration.

ABSTRACT

Noise is an issue of major concern. Despite attempts to regulate, it keeps on increasing worldwide. Attempt has been made to estimate the noise level at different zones of Allahabad with an objective to estimate ambient noise level and the variation at hourly level for day duration. 8 different zones, distinguish into four categories to conduct the monitoring throughout the daytime. L_{10} and L_{90} were measured and Leq calculated through the standard formula. L_{90} measured in between 55 to 60.5 dB A. and value of L_{10} varies from 69.5 to 100.3 normally in rushing hours even approaches 103.7 at certain point. At $p < 0.05$ suggest that railway station (83.9 dB A) was most polluted in term of AAQNL with average of followed by Rambagh (80.04 dB A). Mahewa is least polluted (70.53 dB A) but still far beyond the CPCB Standard. Noise level follows same pattern for all the sites viz; low at morning hours, continuous increase till midday, more or less constant till afternoon than increases at evening. Study conclude that noise is prevailing in all the areas and late morning hours and evening time have elevated level to which most of the city population exposed.

KEY WORDS

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Estimation
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MATERIALS AND METHODS

8 different site at Allahabad city viz; Mahewa R1, Baihrana R2, Chowk area C1, Katra C2, Civil Lines CR1, Rambagh CR2, Bus Station Zero Road PU1 and Railway Station PU2 (R: residential, C: commercial and PU: Public utility transport) has been selected to conduct the monitoring throughout the daytime (7:00 am – 10:00 pm). Instrument use for the purpose was Standard SLM (sound level meter) model No. TES1350 with measuring range from 35-130dB. For each the site monitoring was conducted for five days. 3 days at major road areas and two days for inner zones of the area to get the clear estimation of noise level of the area as whole. L_{10} (L_{10} is a value of sound which has been crossed 10% of time of the monitoring duration) and L_{90} (L_{90} is a value of sound which has been crossed 90 % of time of the monitoring duration) values were measured and Leq was estimated through the standard formula (Kudesia and Tiwari 1993-94).

$$Leq = \frac{1}{2} (L_{10} + L_{90}) + .0175(L_{10} - L_{90})$$

Hourly Leq was based on L_{10} and L_{90} of hour and ambient Noise level (day time) was calculated on the same bases from 15 hr data. Later the level of noise been compared with the Central Pollution Control Board (CPCB) standard of noise for day time.

RESULTS

Allahabad is among very ancient cities of India and unfortunately it is very hard to demark residential, commercial or public utility centers separately. All the areas were having residential com commercial places in neighborhoods. Although to get realistic information on noise level at Allahabad city, different area selected were present different utility purposes. Ambient Noise level of different area have been studied in reference of CPCB standard of noise level and also compared site wise to identified noisiest area among.

Residential area

Mahewa and Baharana have been treated as residential area. Mahewa located on other side of river Yamuna. Monitoring zone of the area is the SHIATS university campus and adjoining surrounding. In all this area comprises of different colleges of the university, residential area of the campus and nearby residential zones with patches of daily need marketing. As per the observation traffic is basically restricted to working class people as most of the traffic is diverted by NH-27. Monitoring for noise level in Leq (dB A) results as 79.27 -89.84 (D1), 82.87 – 91.89 (D2), 78.59 – 91.86 (D3), 67.82 – 86.87 (D4) and 67.75 – 83.44 (D5) (Fig. 1) and Bhairana is located at the zone near to the adjoining road of three major NH viz NH1, NH27 and NH2. However the area selected for the monitoring was located far from the intersection thus can be treated as residential. Roads are not very wide as required for management of traffic due to its connectivity to NH. This leads to heavy loads of all type of traffic. The Leq (dB A) of this area

calculated as 67.27 to 84.39 (D1), 68.18 to 86.54 (D2), 67.39 to 88.18 (D3), 62.96 to 83.08 (D4) and 66.24 to 80.27 (D5) (Fig. 2).

Commercial areas

Chowk and Katra are two major market area of the old Allahabad. They have been center of commercial activity since long. Chowk is main whole sale market area of all types of requirement with narrow streets made up of cemented or bricked structure with two or three story building on both sides, old and reconstructed structures can be easily sighted. It always experiences high traffic with traffic jam. Monitoring shows that Leq of the area varies from 64.86 – 85.91 (D1), 64.63 – 84.55 (D2), 65.46 – 85.62 (D3), 61.01 – 79.18 (D4), 60.41 – 76.04 (D5) (Fig. 3). Katra is also an old market area of the city with Anandbhavan, planetarium and Allahabad University in vicinity. This makes it important for noise monitoring. Five days monitoring of this area reveal that Leq values are 64.11 – 89.65 (D1), 62.86 – 87.38 (D2), 65.28 – 84.85 (D3), 57.65 – 83.48 (D4), 58.82 – 79.43 (D5) (Fig. 4).

Residential com commercial area

Civil lines and Rambagh are such area of Allahabad. Civil lines area is among commercially active area along with high standard surrounding residential area. Roads of this area are basically wide and main roads have divider. Traffic is continuous throughout the day. Hourly calculated values of Leq varies as 62.63 to 80.44 (D1), 66.65 to 83.66 (D2), 62.57 to 83.48 (D3), 71.53 to 83.42 (D4) and 58.11 to 75.0 (D5) for the year 2009 (Fig. 5). And Rambagh is a juncture zone of old Allahabad city to new developed area. It has small market with temples, hospital and city railway station in vicinity along with scattered residential zone. Although most of the roads are well maintained and experience all type of traffic throughout the day at main roads however surrounding residential area does not experience very heavy load of traffic. Leq dB(A) varies as 79.27 -89.84 (D1), 82.87 – 91.89 (D2), 78.59 – 91.86 (D3), 67.82 – 86.87 (D4) and 67.75 – 83.44 (D5) (Fig. 6).

Public utility areas

Zero road Bus station and Railway station are such areas. Zero road Bus station is situated at old part of highly congested city and occupied by whole sale market area of spices and condiments. Approximately more than 60 buses are still having regular platform here. Most of the time of day it experienced traffic jam condition and noise of vesicle. Leq varies as 68.25 – 80.58 (D5) for year 2009 and 72.64 – 86.64 (D1), 71.6 – 87.9 (D2), 66.54 – 87.44 (D3), 66.04 – 87.44 (D4), 65.04 – 78.50 (D5) (Fig. 7) and Allahabad Railway Station comes among the busiest track (Delhi-Haworh) and hosted more than 200 trains regularly. Outside to the railway station toward city side has roads are very crowdie, not enough wide to smoothen the traffic. Leq for the day hours goes as 76.94 – 91.62 (D1), 80.28 – 92.37 (D2), 82.03 – 91.90 (D3), 79.24 – 88.77 (D4), 73.31 - 84.72 (D5) (Fig. 8).

Table 1: showing Ambient Noise Level of different site at Allahabad

Sites	RC1	RC2	R1	R2	PU1	PU2	C1	C2
ANL in Leq	73.1cd	80.0ab	70.5d	75.2c	76.4bc	83.9a	72.7cd	73.4 cd

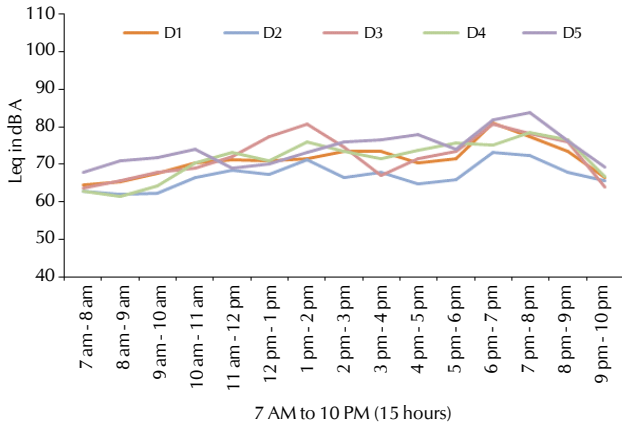


Figure 1: Showing day time noise level in Leq for 5 days monitoring at Mahewa

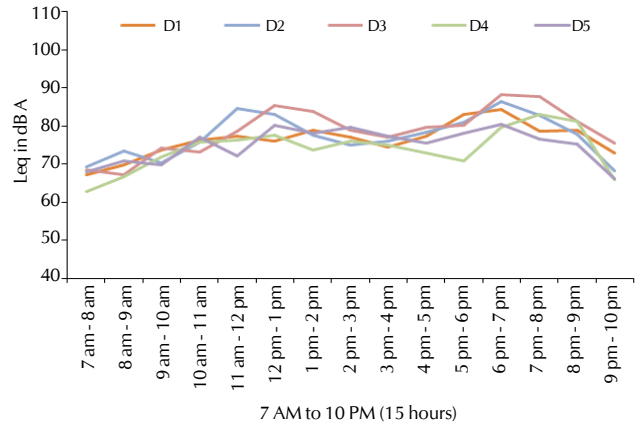


Figure 2: showing day time noise level in Leq for 5 days monitoring at Baihrana

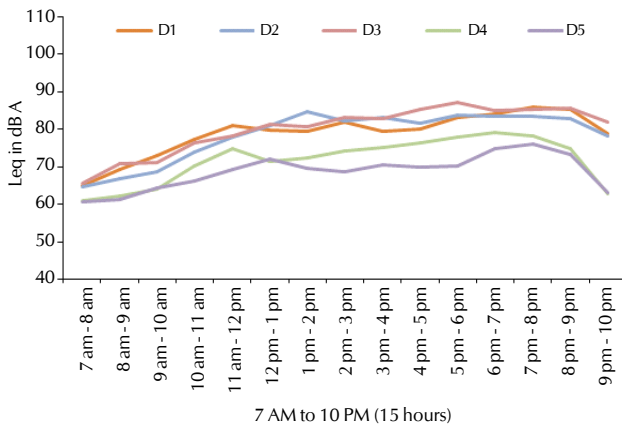


Figure 3: showing day time noise level in Leq for 5 days monitoring at Chowk

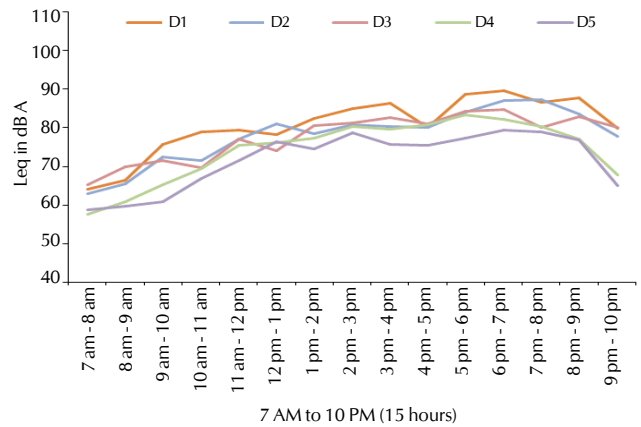


Figure 4: showing day time noise level in Leq for 5 days monitoring at Katra

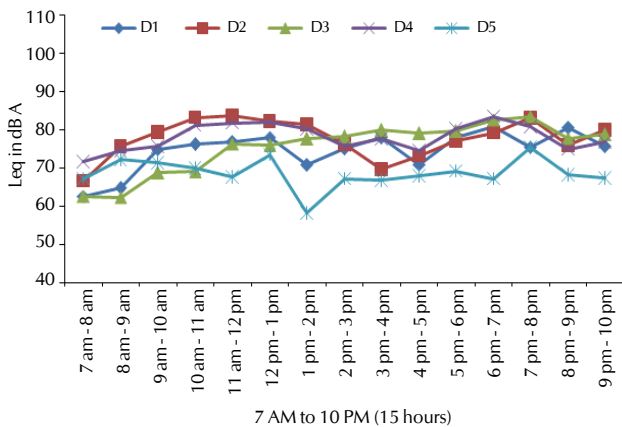


Figure 5: showing day time noise level in Leq for 5 days monitoring at Civil lines

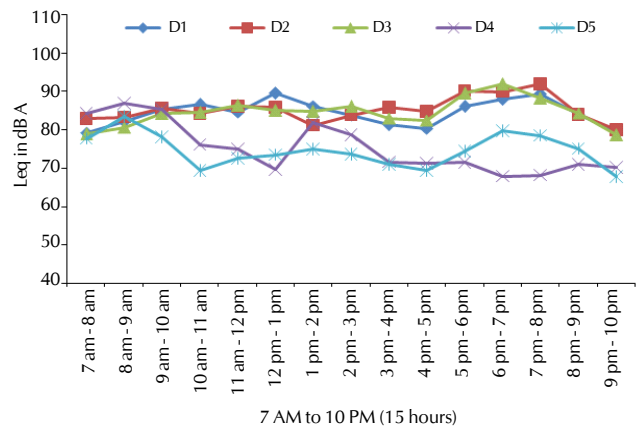


Figure 6: Showing day time noise level in Leq for 5 days monitoring at Rambagh

DISCUSSION

Noise is among air polluted without boundaries and persistency. It is playing havoc to our life. All areas were evaluated together for the noise level and pattern it follows. To bring out the noise level at common platform average of 5

days values at hourly level is being compared. Comparison of hourly variation of Leq value (dB A) for 15 hours (Fig. 9) for different sites suggests that for all sites daily variation in the Leq value follows the same pattern of equivalent noise level i.e. during the early morning hours there is comparatively less noise level than during the late morning time. further as it

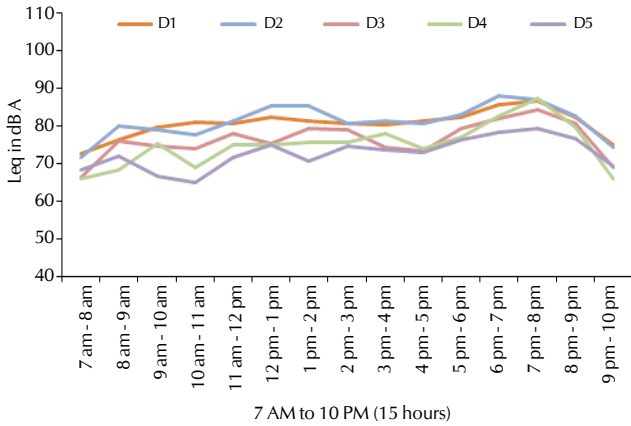


Figure 7: showing day time noise level in Leq for 5 days monitoring at Zero road bus station

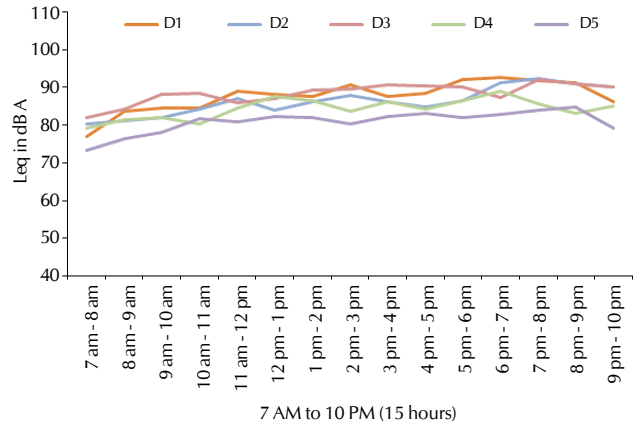


Figure 8: showing day time noise level in Leq for 5 days monitoring at Railway station

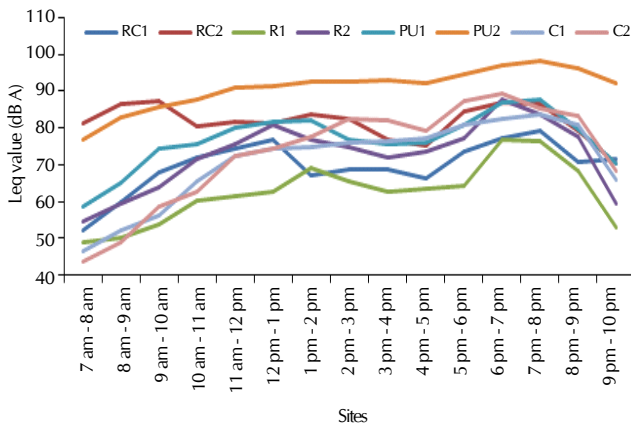


Figure 9: Showing hourly day time variation in Leq value for different site at Allahabad city

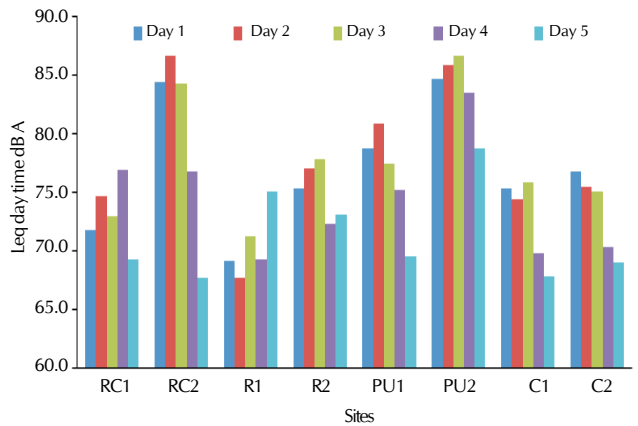


Figure 10: Showing ambient noise level for five days at different site of Allahabad city

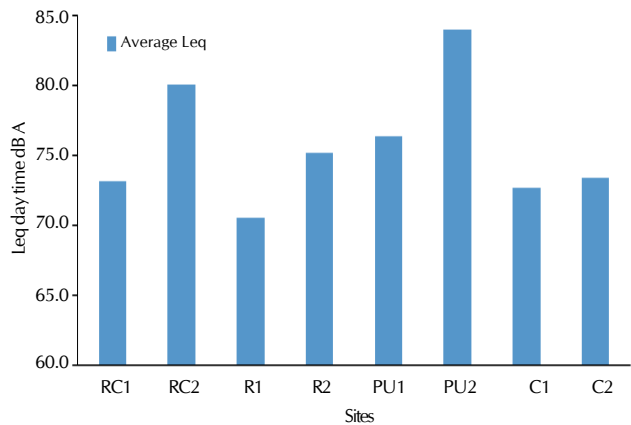


Figure 11: Showing ambient noise level for different site at Allahabad city

approaches the noon again the level goes down and with slight deviation remain steady and as the evening approaches there is increasing in noise level which remain high till the night falls. During the late hour there is again decrease in the level. This variation in the noise level can be explained on the basis of L_{90} and L_{10} values. In a survey of rush-hour traffic in

Rome, the mean value of statistical noise level L_{90} , L_{50} , L_{10} were measured and were found to be much higher than the standard (Cannelli, 2009). Noise level measured in 37 major locations at Dhaka from 7 am to 11 pm during working days. Leq , L_{10} , L_{50} and L_{90} have been calculated and levels are found far above the acceptable limit for all the time (Allen, *et al.*, 2009) However noise pollution level in selected area of northern india Viz Agra, Mathura, Firozabad and Bharatpur shows Leq is largely influenced by L_5 (Saha, *et al.*, 2009) Similarly 282 location on main traffic section were selected at tehran and Leq , L_{10} (L_{max}) L_{90} (L_{min}) indicators were used and remarkably high value for Leq average during peak traffic load condition and in least traffic condition was 77.2 ± 2.1 dB and 64.5 ± 2.2 dB respectively, which are higher than the acceptable level of 55dB (Omidvari and Nouri, 2009). In our findings also at early morning hours, when the rush is low and traffic load is less on the roads the value of L_{90} and L_{10} both are low however with this there is increase in traffic for school going vehicles than office going hours which result in major increase in the value of L_{10} which is responsible for such pattern of Leq level. However in traffic noise study at Vishakhapatnam exceeds 90dB even in morning hours that acts as a source of nuisance (Murli, *et al.*, 1983). Similarly at university campus Balasore, Orissa, day time environmental noise at different

location were found to ranging from 70.4-94.2, 79.0-96.1, 77.8-110.2, 70.8-90.3, 71.0-87.5, 71.1-84.4, 72.5-86.9 and 74.0-85.4 dB (A) (Goswami, *et al.*, 2011).

The value of L_{90} for morning hours measured in between 55 to 60.5 and it increases to 69.4 even up to 72.1 in extreme case for different area. The value of L_{10} varies from 69.5 to 100.3 normally in rushing hours and approaches 103.7 at certain point during 5 day period of monitoring. Similarly Day-Night equivalent noise level (Ldn) was determined at Asansol that ranged between 67.16 dB(A) and 89.44 dB(A). The percentile noise level (L_{90}) exceeded the CPCB standard in all cases and varied from 72.36 dB(A) to 102.45 dB(A) (Banerjee and Chakraborty, 2006). Further a different study confirms higher noise level at Haridwar as minimum and maximum observed noise levels ranges between 56.6 db and 102.4 dB for all the selected area residential area, 56.7 db to 108.9 dB for commercial area and 45.0 to 87.8 dB for silent zone (Chauhan, *et al.*, 2010). The variation in noise level due to L_{10} and L_{90} is also confirms by the level of noise during day period is 18.9%, 8.3% and 28.8% higher on working days than compare to nonworking days for industrial, commercial and silent zone at Haridwar (Sharma *et al.*, 2010).

Statistical analysis of average noise level of different places for day time states that $p < 0.05$, f calculated value is 7.959 thus statistically p at 1% and 5% level of significance suggest that PU2 (railway station) was most polluted in term of AAQNL (Ambient Air Quality Noise Level) with average of (83.9 dB A) followed by RC2 (Rambagh) with ambient noise level (80.04 dB A). Study conducted at Varanasi (Pathak *et al.*, 2008.), Dehradun (Ziauddin *et al.*, 2007) city confirms the finding of similarly high level of noise at transport sections. Lowest level of ambient noise (70.53 dB A) was recorded at R1 (mahewa) (Fig. 10 & 11 and Table 1) is also violating the noise standards. Alarming rate of noise level is becoming a common story of all the cities in India. A study at lucknow also supports high level of noise at different areas of the city ranging at residential areas, between 67.7 to 78.9 and 52.9 to 56.4; in commercial cum traffic areas 74.8 to 84.2 and 68.2 to 74.9 and in industrial areas 76.9-77.2 and 72.2-73.1 dB(A) during day and night time respectively (Kisku *et al.*, 2006). Studies conducted in other cities of india like Delhi (Singh and Mahajan, 1990), Calcutta (95dB A) (Chakrabarty *et al.*, 1997) and in other countries like Curitiba (Brazil) level exceeded 85% time from level of 65dB A (Zannin, *et al.*, 2001). Studies at Flanders (Belgium) (Stassen *et al.*, 2009) and Daka (Karmaker, P. 2009) also confirm the rising of noise level. There are studies conducted on urban park (Henrique, *et al.*, 2006) also pointing finger towards increase level on noise. Further in Daka (Bangladesh) such high level of noise drastically impacting the life and health of the people all over the world. Studies estimates that 85% of the people were disturbed by traffic noise, about 90% of the people reported that traffic noise is the main cause of headache, high BP problem, dizziness and fatigue (Pathak, *et al.*, 2008).

Study at different location of Allahabad states high level of noise encroachment at all selected area. Railway station area (83.9 dB A) and Rambagh (80.04 dB A) was most polluted and Mahewa is least polluted (70.53 dB A) in terms of noise among the areas statistically. However all the sites were far beyond the limit provided by CPCB i.e 45 dB A for residential area even

above the traffic noise limit of 70 dBA. Variation in noise level during the day is highly influence by the road traffic and follows same pattern for all the sites viz; low at morning hours, increases continuously till midday, than lower slightly but more or less constant till afternoon and finally increases at evening.

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