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Noise Monitoring and Analysis at Various Zones of Noida City

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ABSTRACT
The excessive noise, resulting from combination of sources, is known to cause adverse health impacts such as increased risk of hypertension and coronary heart disease, psychological stress and annoyance and sleep disturbance in adults. Considering the magnitude of the problem and its significance, it becomes relevant to monitor noise level in order to plan mitigative measures. In present study, the noise levels have been monitored at various zones of NOIDA City. The entire City has been divided into four different zones viz. Sensitive Zone (Okhla Bird Sanctuary), Residential Zone (Sector-15), Commercial Zone (Sector-18) and Industrial Zone (Sector-02). In each zone three locations have been selected for noise monitoring. The noise levels have been monitored using SL-4001 Sound Level meter from 9:00AM to 9:00PM. In each zones, noise levels have been monitored at three at three different locations for 12 hours. The analysis of results shows that the noise levels of sensitive zone is alarming; however, the residential locations have noise levels within the prescribed limits for day time. The monitored noise levels in commercial zone and industrial zones have been observed to be more than prescribed permissible limits for day time.

***Keywords*:** Noise levels, Monitoring, Sensitive, Residential, Commercial, Industrial, Day time

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I. INTRODUCTION

The complex urban sounds cape is shaped by a combination of environmental noise from transit systems, road traffic, construction, industry, the built environment, population density and other sources. These sources are additive to any other sources of noise that individuals may be exposed to, the most important of which has historically been the workplace. However, while occupational sources of noise are well characterized, the contribution of other sources, and that of the urban soundscape (e.g., the totality of noise in the urban setting), to an individual's total noise exposure has not been well described. This is important because excessive noise, resulting from any combination of sources, is known to cause adverse health effects. Noise from road traffic and other sources has been associated with increased risk of hypertension and coronary heart disease, psychological stress and annoyance and sleep disturbance in adults. In children, cognitive impacts and increased psychological stress from noise exposure have been documented. Noise pollution studies and community survey done by Rao P.R and Rao M.G (1992) in the city of Visakhapatnam. According to them the predicted values from the regression equations were found to be far more reliable as compared to the values obtained from the previous studies. In Calcutta metropolis seasonal basis status of road traffic noise and community response (Chakraborty, 1998). It was found that because of traffic noise 30% of the subject were highly distressed. A Study carried out by Mohan (2000) on traffic noise and response of inhabitants living in close proximity to the main roads in New Delhi. He concluded that people living upto the distance of 30 m from the main road are much distressed due to traffic. It is annoying at different degrees to residents living in all the floors in multistoried apartments. A community survey on traffic noise in Jalgaon city is carried out by Ingle and Pachpande (2005). Results of audiometric study showed mild hearing impairment in exposed and unexposed population. Stephenson (1968) confirmed that traffic was the main source of noise in Central London, and details are given of two experiments on measuring the noise contributions made by different types of vehicle. Harman (1973) summarized the results of a noise survey made within the Portsmouth City boundaries are outlined. Measurements were made throughout the 18-hour day at 33 sites which covered a wide range of traffic conditions. Comparisons were made between the published noise prediction methods and the monitored results for sites adjacent to roads carrying free-flowing traffic. A modification is introduced to allow the design parameter employed by traffic engineers to be used in the prediction formula. The fall-off of noise levels with distance was also examined. An area

classification is suggested for situations where the prediction formulae are not able to be applied. Scholes (1970) summarized that traffic noise needs to be described in physical terms such that measurements or predictions of noise exposure in these units are effectively measurements or predictions of nuisance. Traffic noise index and mean energy level proposals fail the requirements of a physical unit intended to be the basis of traffic noise control because of the lack of demonstrated correlation of noise levels with nuisance. Both traffic noise index and mean energy level have been shown to correlate well with nuisance but nevertheless the formulations of these two units are, in some respects, conflicting. KoN.W.M (1978) reported extensive results of traffic noise monitored at 258 roadside sites in the high-rise city. From the results of this investigation the measurement sites can be very simply classified into three categories: enclosed, semi-enclosed and open. Distinct differences were found in the sound pressure levels L10, L50 and L90 and in the standard deviations obtained at the enclosed site and at the semi-enclosed and open sites. Gilbert (1977) summarizes the initial work carried out at Imperial College to develop provisional prediction equation. It then describes how the equation was tested and modified by using data recently acquired at Sheffield and Rotherham. The provisional equation includes a variable, the index of dispersion, whose value cannot at present be predicted. But an alternative equation is described which uses only currently predictable variables. The literature review shows that noise level measurement is foremost requirement in curtailment of noise levels from identified source/ sources. Therefore, the present study aims at to monitor noise level at different time of the day as well as various categories of land use such as sensitive, residential, commercial and industrial area of NOIDA City.

II. MATERIALS AND METHOD

2.1 Site Description

Noida is part of National Capital Region of Delhi, India. Noida has emerged as a hot spot for IT and IT-enabled services industry with many large companies setting up their businesses here. It is becoming the preferred destination for companies offering IT, ITeS, BPO, BTO and KPO services in various domains such as banking, financial services, insurance, pharma, auto, fast-moving consumer goods and manufacturing. The sites were selected where traffic noise levels were expected to be high and cause annoyance to nearby activities. In present study, four different land use categories have been selected for noise monitoring and analysis (Table 1 and Fig. 1).

Table 1: Description of various land use categories

S. No.	Zone	Location	Latitude (North)	Longitude (East)
1	Sensitive Area	Bird Sanctuary, three locations	28˚33′ 17.798″	77˚ 18′ 44.369″
2	Residential Area	Sec-15 , Noida, three locations	28˚35′ 13.59″	77˚ 18′ 40.55″
3	Commercial Area	Sec-18 , Noida, three locations	28˚ 34′ 14.926″	77˚ 19′34.016″
4	Industrial Area	Sec-2 , Noida, three locations	28˚36′ 49.562″	77˚ 22′ 5.081″

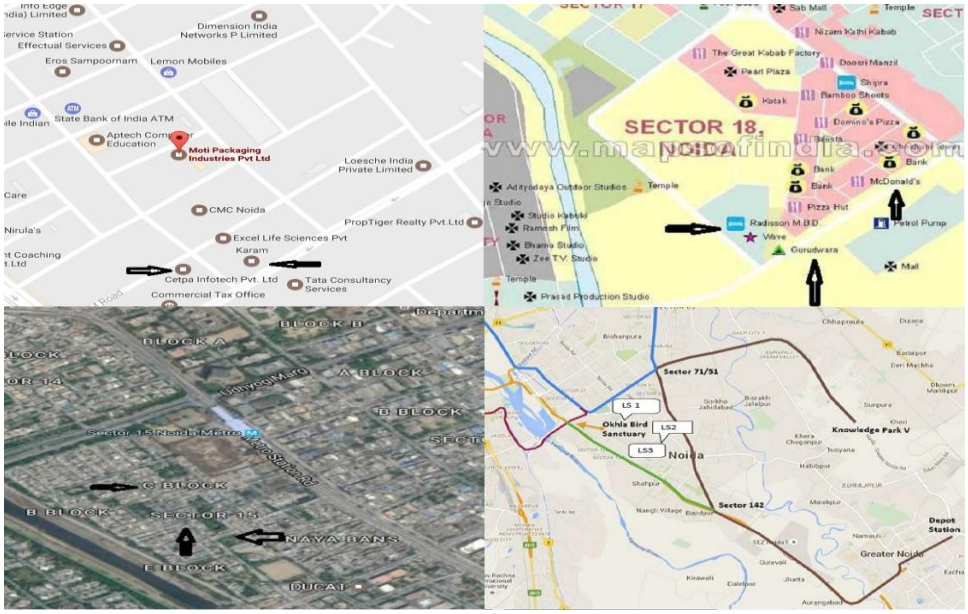

Fig 1.0: Map of NOIDA showing all four zones

2.2 Noise Monitoring Instrumentation

The sound level meter is a hand-held instrument with a microphone. The diaphragm of the microphone responds to changes in air pressure caused by sound waves. A microphone is distinguishable by the voltage value produced when a known, constant sound pressure is applied. The instrument needs to know the sensitivity of the particular microphone being used. Using this information, the instrument is able to accurately convert the electrical signal back to a sound pressure, and display the resulting sound pressure level (decibels dB). A and C sound level meter type SL-4001 with the capacity of measuring noise from 30 dB to 130 dB was used for measurements.

Fig. 2: Sound Level Meter

2.3 Noise Monitoring Procedure

In this study an effort is made to identify the noise level in various zones of Noida City using sound level meter (SL-4001). The noise monitoring has been carried out during peak hours of the day (9.00 AM to 9.00 PM). In each zones, noise monitoring has been performed for 12 hours at three different locations. Noise monitoring has been done at a distance of 3m from road side at an elevation of 1.50 m above the road surface.

S. No.	Monitoring Locations	Time Period	
		Morning	evening
1	Sensitive Area	9:00am	9:00pm
2	Residential Area	9:00am	9:00pm
3	Commercial Area	9:00am	9:00pm
4	Industrial Area	9:00am	9:00pm

III. RESULTS AND DISCUSSION

3.1 Noise Level at Sensitive Area

In sensitive area, at location 1, Fig.3 shows the monitored noise levels at different hours of the day. It shows that the minimum value of noise level, Leq has been found to be 59.5 dB at 11:00 am – 12:00 pm hour of the day while the maximum value is 59.9 dB at 10:00-12:00 am of the day. The average Leq has been estimated to be 59.67 dB which is higher than the prescribed permissible level of 55dB for sensitive area at day time. The maximum noise level obtained may be due to traffic flow during noise monitoring period.

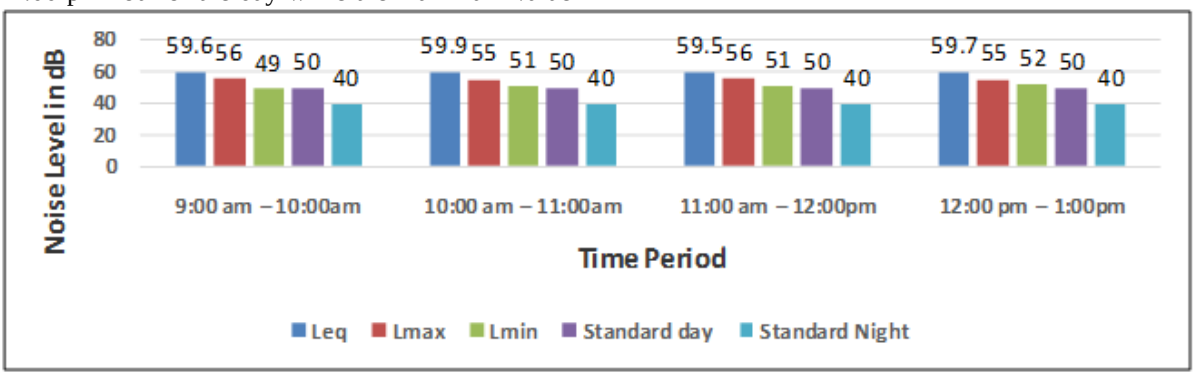

Fig. 3: Comparative Noise Levels at Location 1 of sensitive zone

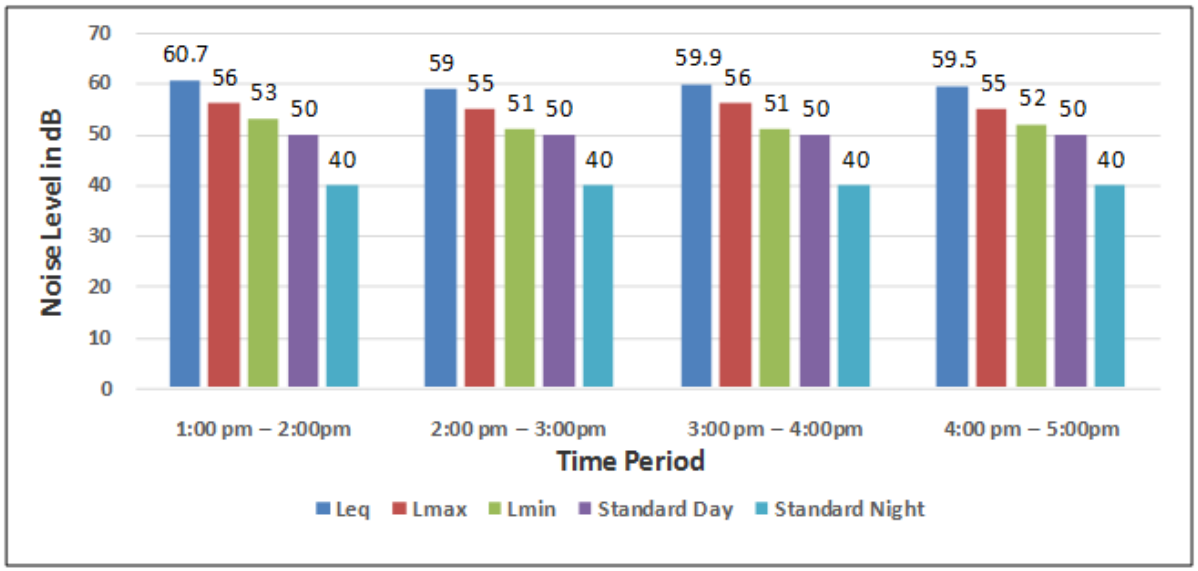

Fig. 4: Comparative Noise Levels at Location 2 of sensitive zone

At location 2, Fig.4 shows the monitored minimum value of noise level, Leq has been found to be 59 dB at 2:00 – 3:00 pm hour of the day while the maximum value is 60.7 dB at 1:00-2:00 pm hour of the day. The average Leq has been estimated to be 59.77 dB which is higher than the prescribed permissible level of 55 dB for sensitive area at day time. The maximum noise level obtained may be due to traffic flow during noise measurement period.

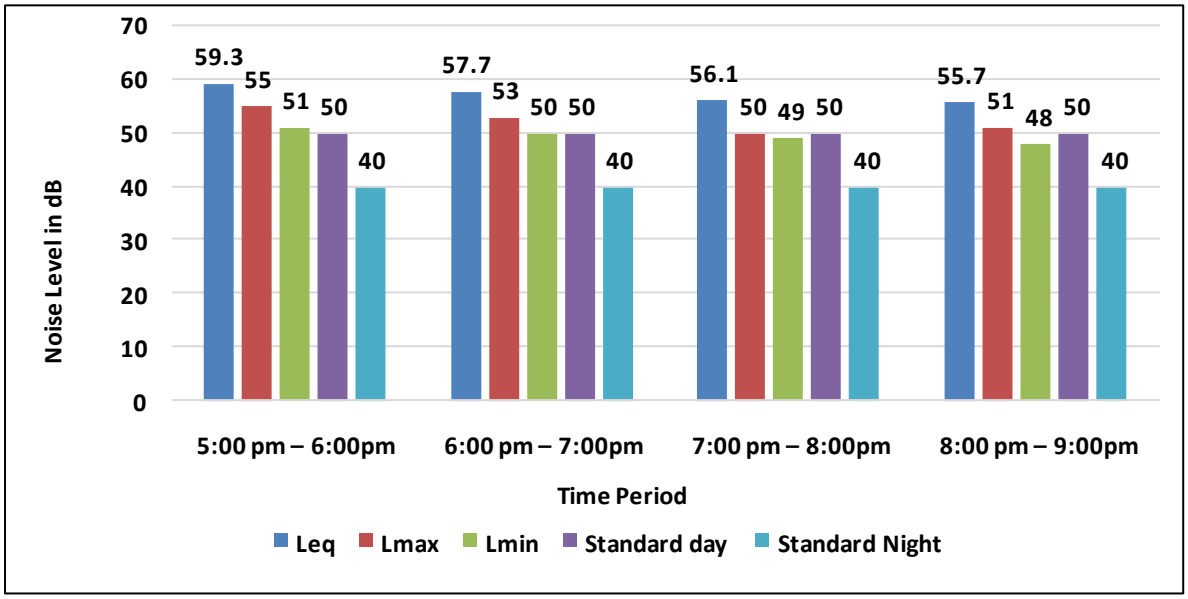

Fig. 5: Comparative Noise Levels at Location 3 of sensitive zone

At location 3, Fig. 5 shows the measured minimum value of noise level, Leq has been found to be 55.7 dB at 8:00 – 9:00 pm hour of the day while the maximum value is 59.3 dB at 5:00-6:00 pm hour of the day. The average Leq has been estimated to be 57.2 dB which is higher than the prescribed permissible level of 55 dB for Sensitive area at day time. The maximum noise level obtained may be due to traffic flow during noise measurement period.

3.3 Monitored Noise Level at Residential Area

At location 1, Fig.6 shows the monitored noise levels at different hours of the day. It shows that the minimum value of noise level, Leq has been found to be 59 dB at 9:00 – 10:00 pm hour of the day while the maximum value is 63.2 dB at 12:00-1:00 pm hour of the day. The average Leq has been estimated to be 61.23 dB which is higher than the prescribed permissible level of 55dB for Residential

area at day time. The maximum noise level obtained may be due to the residential activities and traffic flow during noise measurement period.

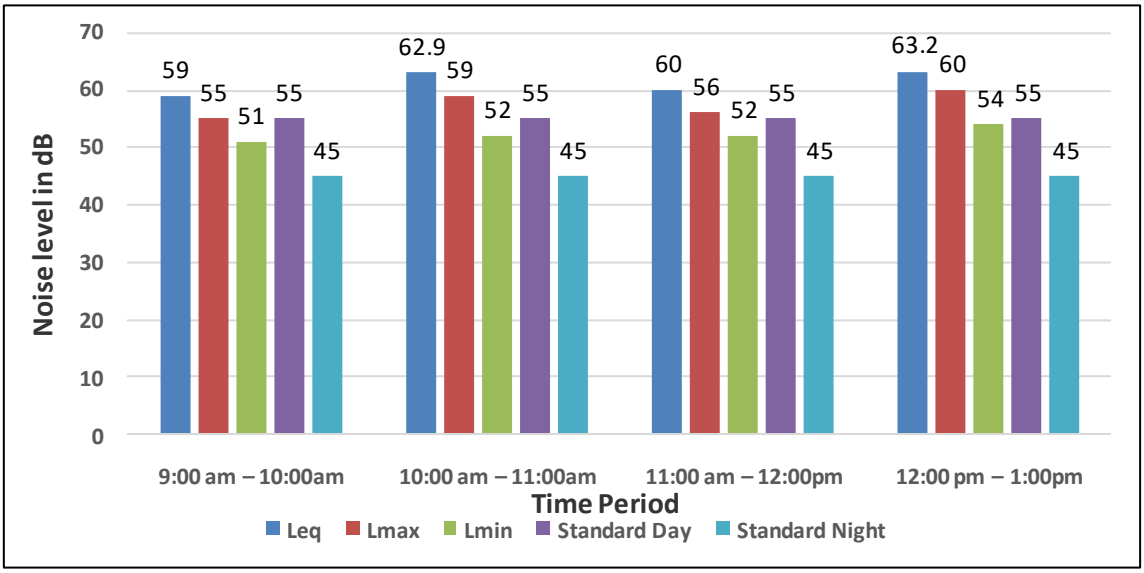

Fig. 6: Comparative Noise Levels at Location 1 of residential zone

At location 2, Fig. 7 shows the minimum value of noise level, Leq has been found to be 60.9 dB at 2:00 – 3:00 pm hour of the day while the maximum value is 63.8 dB at 3:00-4:00 pm hour of the day. The average Leq has been estimated to be 62.2 dB which is higher than the prescribed permissible level of 55dB for Residential area at day time. The maximum noise level obtained may be due to the residential activities and traffic flow during noise measurement period.

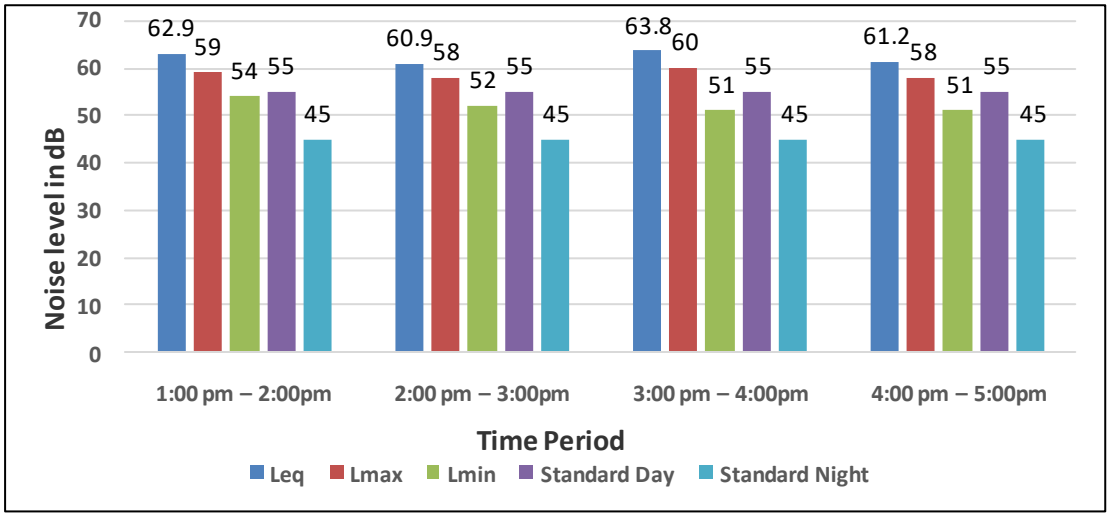

Fig. 7: Comparative Noise Levels at Location 2 of residential zone

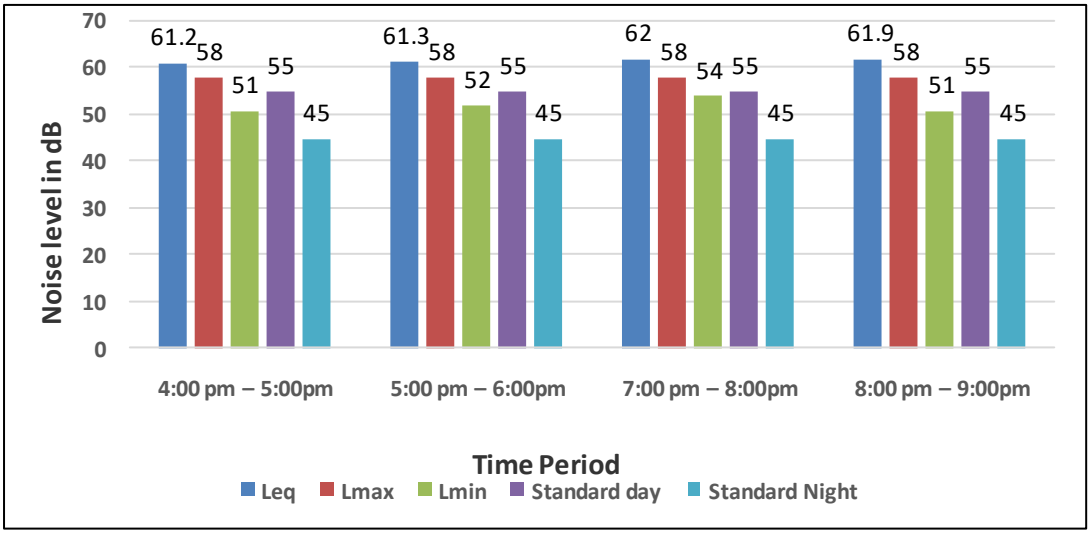

Fig. 8: Comparative Noise Levels at Location 3 of residential zone

At location 3, Fig. 8 shows the minimum value of noise level, Leq has been found to be 61.2 dB at 4:00 – 5:00 pm hour of the day while the maximum value is 62.0 dB at 7:00-8:00 pm hour of the day. The average Leq has been estimated to be 61.6 dB which is higher than the prescribed permissible level of 55dB for Residential area at day time. The maximum noise level obtained may be due to the residential activities and traffic flow during noise measurement period.

3.2 Monitored Noise Level at Commercial Area

At location 1, Fig. 9 shows the monitored noise levels at different hours of the day. It shows that the minimum value of noise level, Leq has been found to be 79.6 dB at 12:00 – 1:00 pm hour of the day while the maximum value is 80.5 dB at 9:00-10:00am hour of the day. The average Leq has been estimated to be 80.23 dB which is higher than the prescribed permissible level of 65dB for commercial area at day time. The maximum noise level obtained may be due to the peak traffic hours during noise measurement period.

At Location 2, Fig.10 shows the monitored minimum value of noise level, Leq has been found to be 77.5 dB at 3:00 – 4:00 pm hour of the day while the maximum value is 79.9 dB at 4:00-5:00 pm hour of the day. The average Leq has been estimated to be 78.5 dB which is quite higher than the prescribed permissible level of 65dB for commercial area at day time. The maximum noise level obtained may be due to the industrial activities and peak traffic hours during noise measurement period.

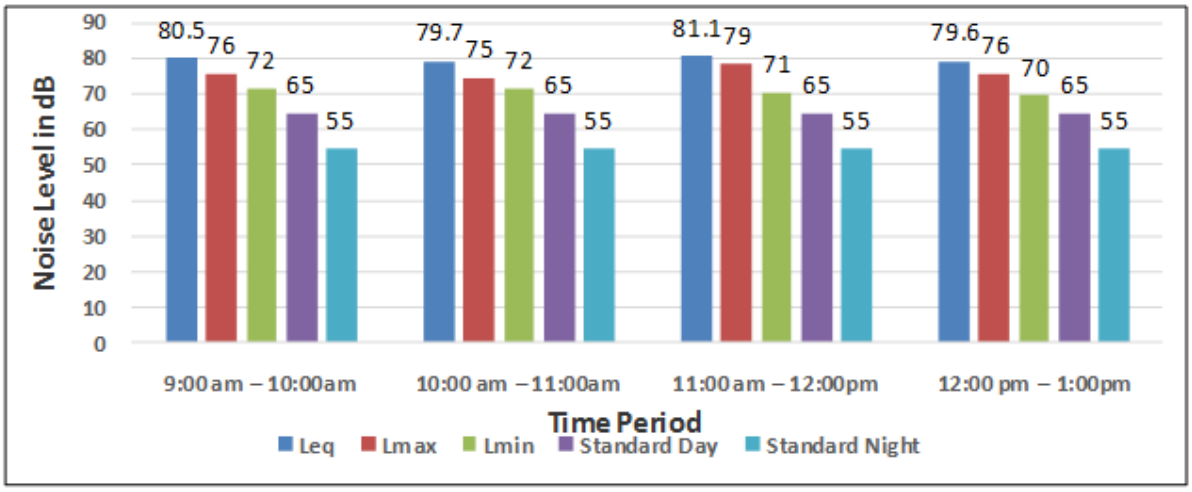

Fig. 9: Comparative Noise Levels at Location 1 of commercial zone

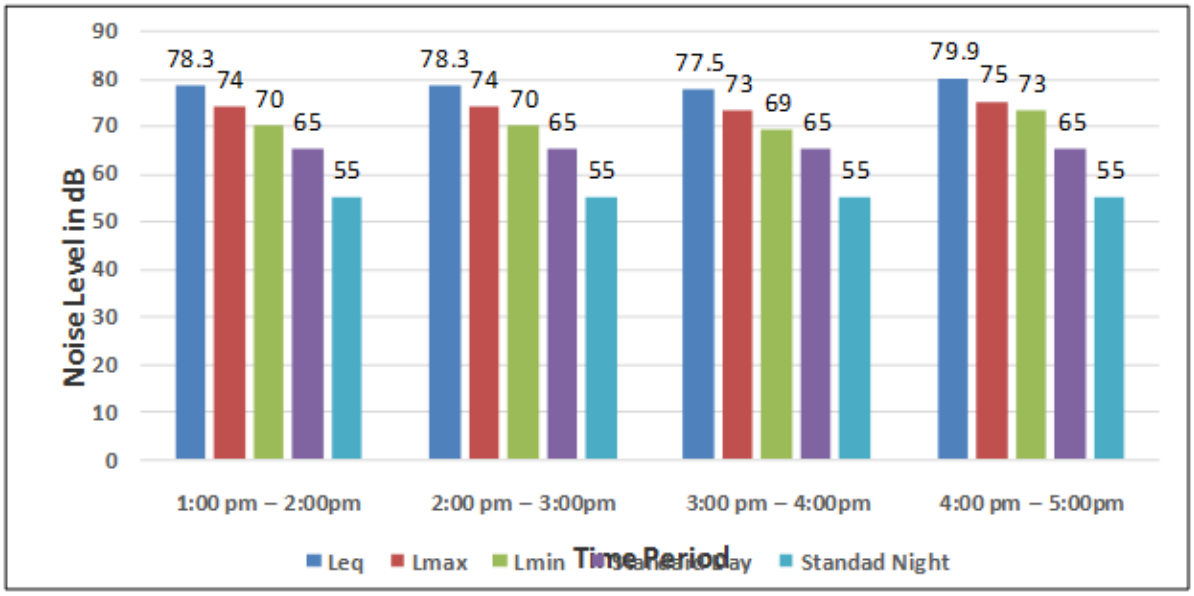

Fig. 10: Comparative Noise Levels at Location 2 of commercial zone

At Location 3, Fig.11 shows the monitored minimum value of noise level, Leq has been found to be 77dB at 8:00 – 9:00 pm hour of the day while the maximum value is 80.1 dB at 4:00-5:00 pm hour of the day. The average Leq has been estimated to be 79.25 dB which is higher than the prescribed permissible level of 65dB for commercial area at day time. The maximum noise level obtained may be due to the industrial activities and peak traffic hours during noise measurement period.

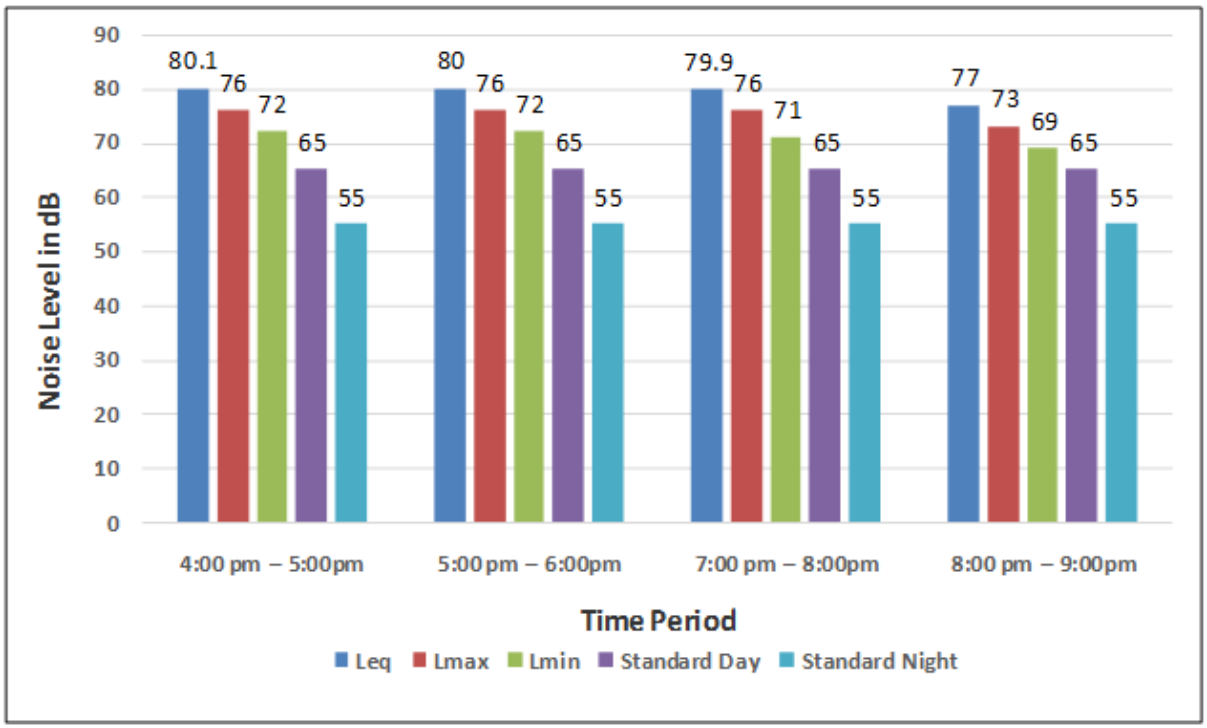

Fig. 11: Comparative Noise Levels at Location 3 of commercial zone

3.1Monitored Noise Level at Industrial Area

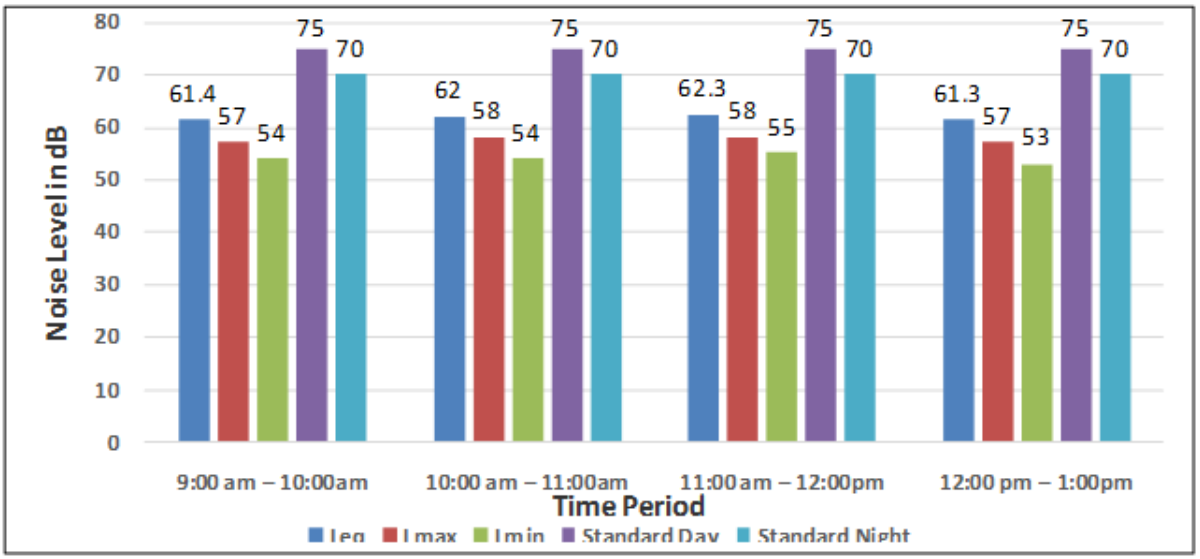

Fig. 12: Comparative Noise Levels at Location 1 of industrial zone

At Location 1, Fig. 12 shows the monitored noise levels at different hours of the day. It is evident that the minimum value of noise level, Leq has been found to be 61.3dB at 12:00 – 1:00 pm hour of the day while the maximum value is 62.3dB at 11:00-12:00am hour of the day. The average Leq has been estimated to be 61.75 dB which is under the prescribed permissible level of 75dB for industrial area at day time. The maximum noise level obtained may be due to the industrial activities and peak traffic hours during noise measurement period.

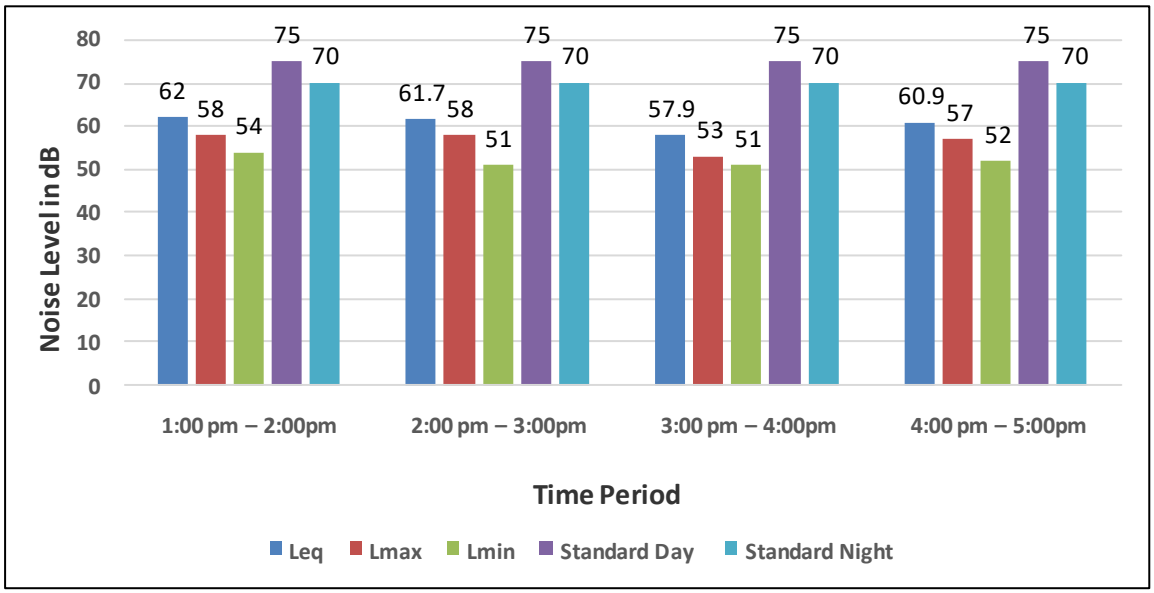

Fig. 13: Comparative Noise Levels at Location 2 of industrial zone

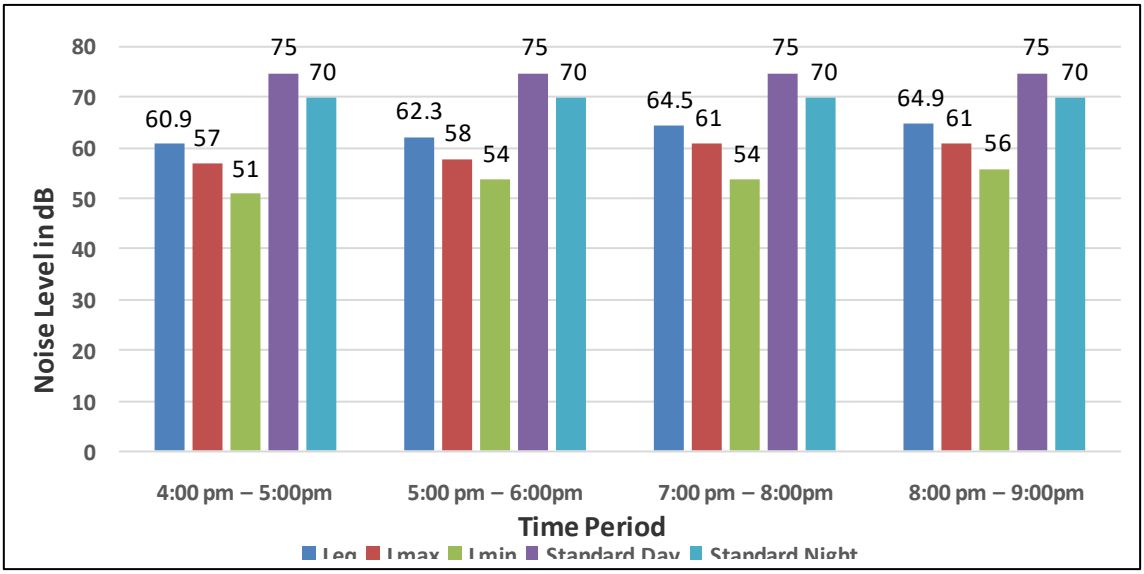

Fig. 14: Comparative Noise Levels at Location 3 of industrial zone

At Location 2, Fig.13 shows the monitored minimum value of noise level, Leq has been found to be 57.9 dB at 3:00 – 4:00 pm hour of the day while the maximum value is 62 dB at 1:00-2:00 pm hour of the day. The average Leq has been estimated to be 60.63 dB which is under the prescribed permissible level of 75dB for industrial area at day time. The maximum noise level obtained may be due to the industrial activities and peak traffic hours during noise measurement period.

At Location 3, Fig. 14 shows the monitored minimum value of noise level, Leq has been found to be 60.9 dB at 4:00 – 5:00 pm hour of the day while the maximum value is 64.9 dB at 8:00-9:00 pm hour of the day. The average Leq has been estimated to be 63.15 dB which is under the prescribed permissible level of 75dB for industrial area at day time. The maximum noise level obtained may be due to the peak traffic hours during noise measurement period.

IV. CONCLUSIONS

The study concluded that the monitored noise levels at different locations of sensitive zone are observed to be above the prescribed permissible limit. However, at residential locations, the monitored noise levels have been found to be within the prescribed limits for day time. The monitored noise levels in commercial zone and industrial zones have been observed to be more than prescribed permissible limits for day time. The general preventive measures to control the noise levels are:

1. The industrial zone shall be located outside the city.
2. The industrial processes shall be improved in view of reducing noise levels by installation of noise suppressors.
3. The green space shall be created between residential and industrial/commercial zones.
4. The acoustics insulation shall be adopted to reduce the noise levels at receptor end.
5. Furthermore, administrative regulations with a view to limit the intensity of background noise within urban environment shall be adopted.

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