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NOISE MONITORING, MODELLING AND MODEL VALIDATION AT THE VICINITY OF NOIDA CITY CENTRE

Sudha Kushwaha[1], Syed Khursheed Ahmad[2], Saurabh Kumar Garg[3]

[1]M.Tech. Student
[2]Professor and HoD
[3]M.Tech. Student
[1,2,3]Dept. of Civil Engineering, Al-Falah University, Dhauj, Faridabad

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Abstract - *The excessive noise, generating from different combination of sources 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 mitigate measures. The objective of this present study, noise monitoring, modelling and model validation at Noida City Centre with special focus on metro station. 2D Noise maps was generated by using online URL based Software* ***https://noisetools.net/*** *for exposure of noise level. For this purpose vicinity of the Noida City Centre has been divided into three different zones viz. Commercial Zone (Noida City Centre), Residential Zone (Noida Sector 48), Silence Zone (Noida sector 49). In each zone four noise monitoring locations have been selected for noise monitoring. The noise levels has been measured using digital CM -1352 Sound Level meter instrument from day time (06:00 a.m. to 22:00 pm) and in night time (22:00 pm to 6:00 am). In each zones, noise levels have been monitored at four selected noise monitoring locations for 24 hours during weekdays and weekend. For commercial zone day time average Leq level ranged between 72.3 and 87.0 dB (A), where it ranged between 61.2 and 74.6 dB (A) during night. For residential zone day time average Leq level ranged between 73.4 and 83.6 dB (A), where it ranged between 57 and 71.8 dB (A) during night. . For silence zone day time average Leq level ranged between 60.3 and 87.1 dB (A), where it ranged between 52 and 73.9 dB (A) during night time. The analysis of results shows that the noise levels of commercial residential and silence zone is alarming. The monitored noise levels in all the three zones of Noida City Center have been observed to be more than the limit prescribed by CPCB, New Delhi, India. The result from the model validation revels that predicted noise level were higher than the monitored noise level at all three zones of Noida City Centre. So the noisetools.net could not predicted the accurately noise level.*

***Key Words*: Noise levels, Noise monitoring, Noise mapping, Silence, Residential, Commercial, Day &Night time**

1. INTRODUCTION

Road traffic noise pollution is one of the major environmental concern in India. Road traffic noise, in particular is considered by the World Health 0rganization to be one of the worst environmental stressors for humans, second only to air pollution. Vehicular traffic contribution is about 55% of the total urban noise.

Ranking given by Central Pollution Control Board, New Delhi (CPCB) Delhi stands at second position. According to 2017 worldwide index study mentioned that residents of Delhi have the maximum amount of hearing loss proportionate to their age. This proves the severity and necessity of mitigating traffic noise. Physical and psychological health consequences occurs due to regular exposure to consistent elevated sound levels; so monitoring and mapping of noise levels can be useful in understanding the complex problem of noise pollution in urban areas as well as planning of noise abatement measures The scope of present study is to monitoring noise level and prediction of noise levels by 2D noise mapping using noisetools.net and model validation of noise prediction model in the context of study location.

These inevitable requirements leads to the need off traffic noise studies regarding noise pollution and its consequences on the environment by various researchers globally including India. Sheetal Agarwal, B. L. (2011) investigated the impact of noise pollution on residents/community residing near roadside. In her study she found that among all noise-generating sources, road traffic was the major source of noise followed by factory/machines. Continuous noise monitoring is carried out for noise pollution studies in Kolhapur, Maharashtra, India by Mangalekar S.B. , J. A. (2012) **a**ccording to them enhanced pressure of noise at all noise monitoring locations was due to increase in number of vehicles and facilities of transportation. All the monitoring locations under study showed higher noise level then the prescribed limits of Central Pollution Control Board (CPCB). Vinita Pathak , B. V. (2008) interpreted noise pollution problem in Varanasi city and found that 85% of the people were disturbed by the traffic noise and 90% of the people reported that main cause of headache, high BP problem, dizziness and fatigue was road traffic noise pollution. Traffic noise was disturbing the daily activities like resting,

reading, communication etc. Many researchers from different countries have carried out studies in the direction of reducing noise levels. Darko I Mihajilov, M. R. (2015) determined adequate duration of semi-permanent noise monitoring to enable cost effective monitoring of road traffic noise and concluded that road traffic noise monitoring with duration of one month is very acceptable and repeatable value for road traffic assessment as well as semi-permanent road traffic noise monitoring with a duration of one week is very usable for the prediction of annual value of noise indicators. Chen, K. T. –H. (2009) analyzed spatial characteristics of urban environment noise by using noise maps and found that noise maps can be useful for investigating noise levels in urban environments. Another researcher's Jentian Stoter, H. d. (2008) described 3D noise mapping in urban areas for improving visualization & assessment of noise level impact on environment and concluded that more accurate assessment of noise impact is possible when different floors of the building close to the noise source. Yugnath Pachippan, B. G. (2013**)** developed a new road traffic noise prediction model for uninterrupted four lane Indian roads using regression analysis. Guarnaccia, C. (2013) implemented a dynamic approach, i.e. include the dependence of noise emission by kinematical parameters, such as, speed, position and acceleration for road traffic noise prediction modelling in non -conventional situations like road situations, traffic jams , extreme traffic flow etc., generally in these situations standard traffic noise model fails. The literature review shows that for mitigation of noise levels from identified sources noise monitoring is the foremost requirements.

2. MATERIALS AND METHOD

2.1 Site Description

The vicinity of Noida city center has been selected as the study locations for the present study which have commercial land use pattern. The Noida city center is also called (Wave city center) is a station of the Delhi Metro, which is situated in sector 39- Noida. The Noida city center Metro Station receives the traffic from the Sector 41, 71, 37 and 24 of Noida. In the present study three zones i.e. commercial, residential, silence according to land use pattern has been selected for noise monitoring

2.2 Noise Monitoring Instrumentation

The noise monitoring within the present study is performed by the hand – held Digital Sound Level meter CM 1352 instrument. A sound level meter consists of microphone, electronic circuit including an attenuator, amplifier, weighing networks and a display unit. The microphone detects the small atmospheric pressure various related to sound and converts the sound signal to an equivalent electrical signal. These signal is then processed by the electronic circuit of the instrument and provides the sound pressure level in dB (A). A weighting frequency measures with the capacity of measuring noise from 30 dB to 130 dB was used for measurements.

2.3 2D Noise Mapping

A Noise Map is a map of an area which is colored consistent with the noise levels within the selected locations. In noise mapping tools, the noise levels could also be shown by contour lines which show the boundaries between different noise levels in selected locations. The map is typically overlaid on a plan of the area. Noise maps are used to avoid, prevent or reduce the harmful effects caused by higher noise exposure level.

The Noise Mapping for the present study is carried out by online URL based software **https://noisetools.net/** at four Noise Monitoring stations/locations (NMS) at three zones of Noida City Centre i.e. commercial, residential and silence zones. It is a software based tool for understanding and implementing the calculations of ISO 9613 and creating interactive models

Table -1: Description of Various land use categories

Zone	Location	Longitude	Latitude
Commercial	Noida City Centre, four Locations	28°34'29.1"	77°21'20.4"
Residential	Sect-48, Noida, four Locations	28°33'15.3"	77°22'25.2"
Silence	Sec-49, Noida, four Locations	28°33'29.0"	77°22'19.1"

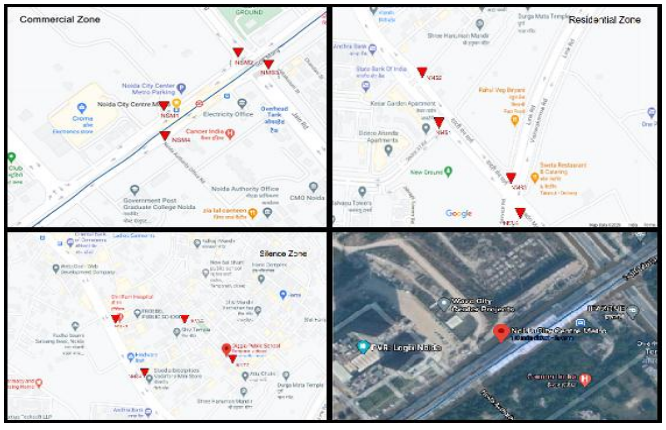

Figure 1: Map of Noida City Centre Showing all three Zones

3. RESULTS AND DISCUSSION

The results of noise monitoring for three zones of Noida City Centre with special focus on metro station are discussed below. The road traffic 2D noise maps are also prepared

3.1 Comparative Analysis of Average Leq at Commercial Zone (Weekdays)

Fig: 2 shows the average noise level Leq variations at all the four locations in commercial zone. Average Leq at location1, daytime ranged between 77.3 dB (A) - 87 dB (A), while at nighttime average Leq ranged between 65.5 dB (A)-74.6 dB (A), at location 2 , average Leq at daytime ranged between 73.5 dB (A)- 79 dB (A) , while at nighttime average Leq ranged between 67.5 dB (A)-73.3 dB (A), at location 3, average Leq at daytime ranged between 75.4 dB (A)- 84.6 dB (A) , while at nighttime average Leq ranged between 64.9 dB (A)-72.9 dB (A).at location 4, average Leq at daytime ranged between 72.3 dB (A)- 79.7 dB (A) , while at nighttime average Leq ranged between 61.2 dB (A)-67.1 dB (A). At all the locations, the comparison of average Leq with the permissible standard (Leq=65 dB (A) for day time) is exceeded and night (Leq =55 dB (A) for night time) is also much exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for commercial zone.

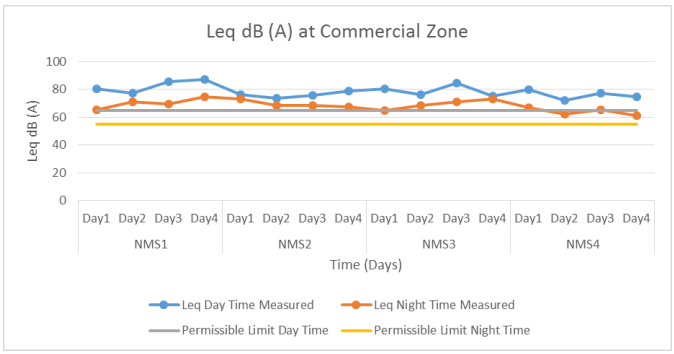

Figure 2: Average Leq at Commercial Zone (Weekdays)

3.2 Comparative Analysis of Average Leq at Commercial Zone (Weekend)

Fig: 3 shows the average noise level Leq at all the locations of commercial zone. Day time average Leq is found to be between 65 -67.8 dB (A), nighttime average Leq is found to be between 55-65.8 dB (A). After the comparison of average Leq with the permissible standard (Leq=65 dB (A) for day time) day and night (Leq =55 dB (A) for night time), is exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for commercial zone.

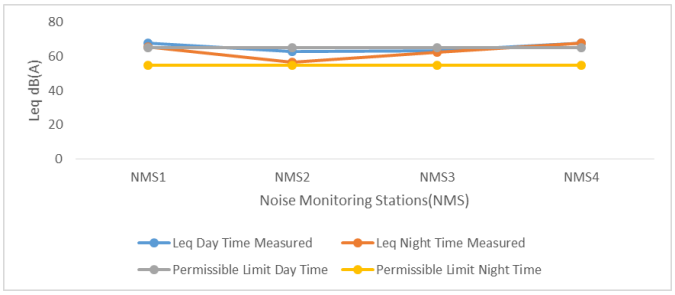

Figure 3: Average Leq at Commercial Zone (Weekend)

3.3 Comparative Analysis of Average Leq at Residential Zone (Weekdays)

In residential zone, fig: 4 shows the variation of average noise level Leq in between days for all the locations. At location1, average Leq at daytime ranged between 73.4 dB (A) - 83.6 dB (A), while at nighttime average Leq ranged between 57 dB (A)-62 dB (A). at location 2, average Leq at daytime ranged between 74 dB (A) - 82.7 dB (A), while at night time average Leq ranged between 62.4 dB (A)-66.5 dB (A), at location 3, average Leq at daytime ranged between 74.4 dB (A)- 79.2 dB (A) , while at nighttime average Leq ranged between 62.2 dB (A)-66.8 dB (A). At location 4, average Leq at daytime ranged between 76.4 dB (A) 81.9 dB (A), while at nighttime average Leq ranged between 65.4 dB (A)-71.8 dB (A). At all the locations of residential zone, the comparison of average Leq with the permissible standard (Leq=55 dB (A) for day time) is exceeded and night (Leq =45 dB (A) for night time) is also exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for residential zone.

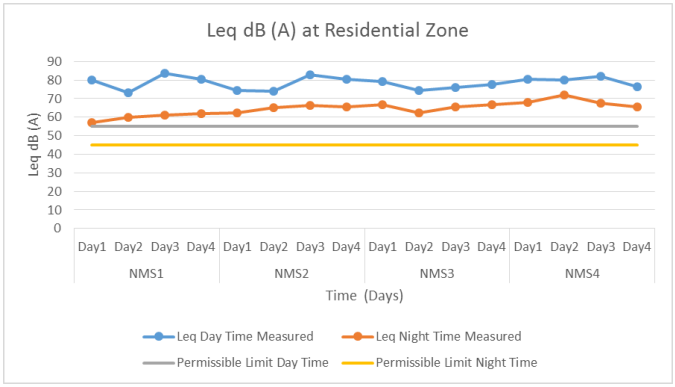

Figure 4: Average Leq at Residential Zone (Weekdays)

3.4 Comparative Analysis of Average Leq at Residential Zone (Weekend)

Fig: 5 shows the average noise level Leq at all the locations of Residential zone during weekend. Day time average Leq is

found to be between 69.1 -72 dB (A), night time average Leq is found to be between 61.6-68.3 dB (A). After the comparison of average Leq with the permissible standard (Leq=55 dB (A) for day time) is exceeded and night (Leq =45 dB (A) for night time) is also exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for residential zone.

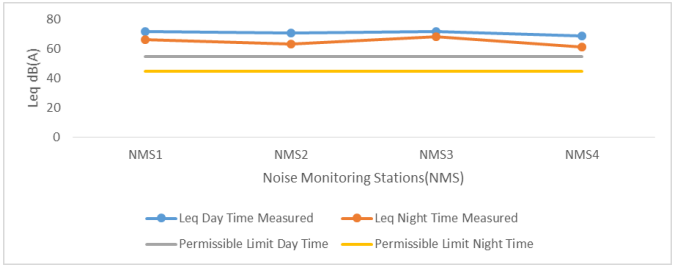

Figure 5: Average Leq at Commercial Zone (Weekend)

3.5 Comparative Analysis of Average Leq at Silence Zone (Weekdays)

Fig: 6 shows the variation of average noise level Leq in between days for silence zone. At location1, average Leq at daytime ranged between 76.9 dB (A) - 87.1 dB (A), while at night time average Leq ranged between 60.5 dB (A)-68.9 dB (A). at location 2 , average Leq at daytime ranged between 65.1 dB (A)- 77 dB (A) , while at night time average Leq ranged between 52 dB (A)-65.7 dB (A), at location 3,average Leq at daytime ranged between 60.3 dB (A)- 67.8 dB (A) , while at nighttime average Leq ranged between 59.8 dB (A)-61.6 dB (A), at location 4, average Leq at daytime ranged between 72 dB (A)-85.1 dB (A), while at nighttime average Leq ranged between 66.6 dB (A)-73.9 dB (A). At all the locations of silence zone, the comparison of average Leq with the permissible standard (Leq=50 dB (A) for day time) is exceeded and night (Leq =40 dB (A) for night time) is exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for silence zone.

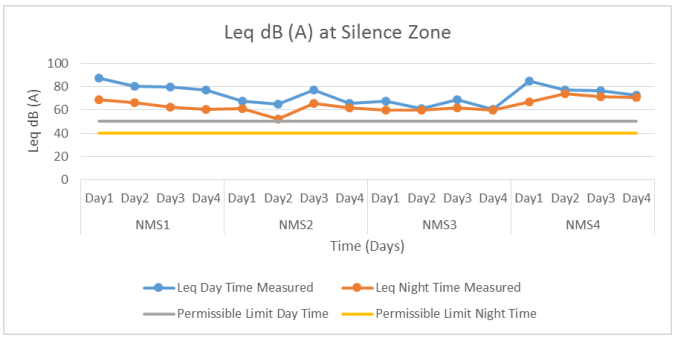

Figure 6: Average Leq at Silence Zone (Weekdays)

3.6 Comparative Analysis of Average Leq at Silence Zone (Weekend)

Fig: 7 shows the average noise level Leq at all the locations of silence zone during weekend. Day time average Leq is found to be between 69.1 -72 dB (A), night time average Leq is found to be between 61.6-68.3 dB (A). After the comparison of average Leq with the permissible standard (Leq=50 dB (A) for day time Leq =40 dB (A) for night time) is exceeded from the permissible limit. The comparison has been done with the permissible standard of CPCB (Central Pollution Control Board), New Delhi, India for silence zone.

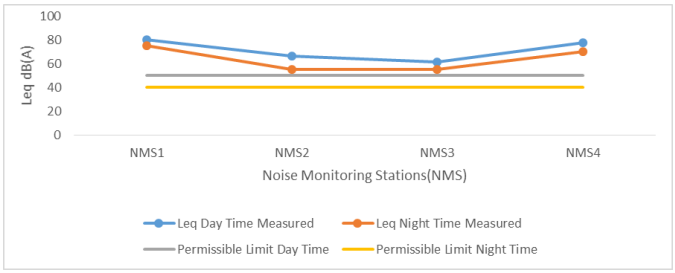

Figure 7: Average Leq at silence Zone (weekend)

3.7 Validation of Prediction of Noise Model for Different Zones

Fig: 8(a), 8(b), 8(c) shows the 2D noise map of different zones prepared by online URL based Tool https://noisetools.net/ .To validate the accuracy of noise model the predicted noise levels is compared with the monitored noise levels. The average difference of predicted to monitored noise level at different zones varies between 2 dB (A) to 15 dB (A). So the https://noisetools.net/ do not predict the actual noise level values at all three zones i.e. commercial, residential and silence zones.

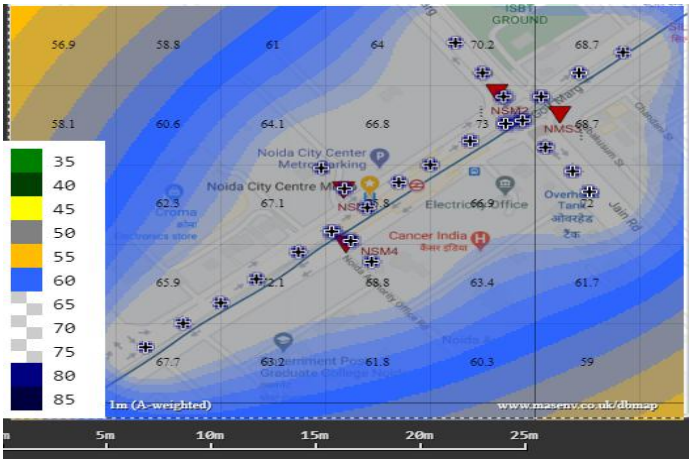

Figure 8 (a): 2D Noise Map for Commercial Zone

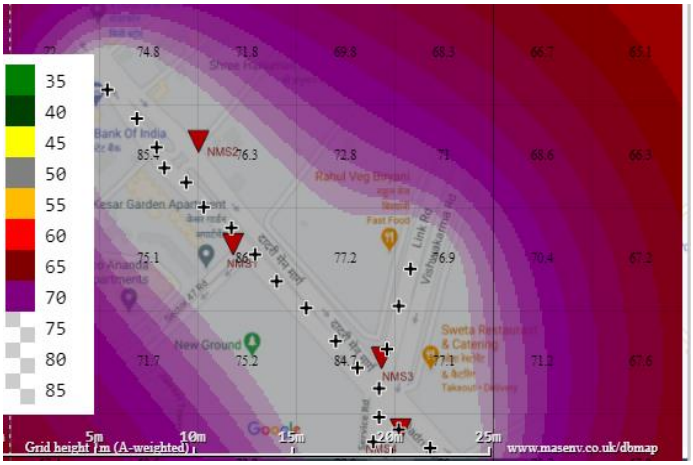

Figure 8(b): 2D Noise Map for Residential Zone

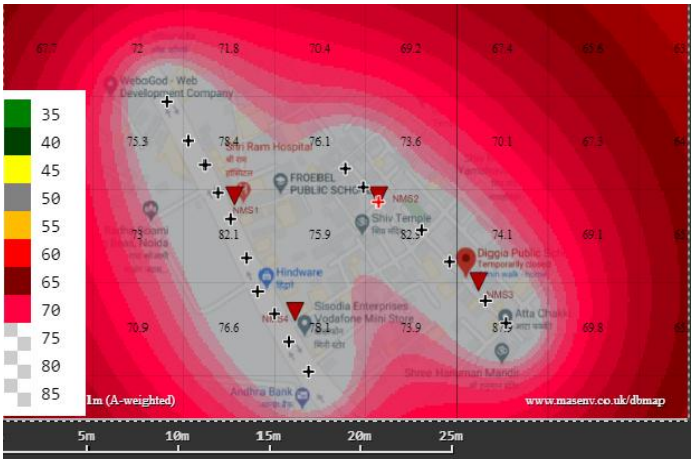

Figure 8(c): 2D Noise Map for Silence Zone

4. CONCLUSIONS

This research paper elucidates the noise level in commercial, residential, silence zones of Noida City Centre. Automobiles specially three and four wheelers (Auto Rickshaw, cars) and poor maintenance as well as music systems used in these three wheelers found to be major sources of noise pollution in Noida City Centre. It is clear from the presented study that all selected noise monitoring stations were exposed to higher noise level as compared to Indian standard noise level prescribed by CPCB (Central Pollution Control Board), New Delhi, India. Noise maps were also created using noisetool.net/db.net for exposure of noise level. After validation of noise prediction model it was found that at selected noise monitoring stations (NMS) monitored noise level is greater than the predicted noise level. So the noise model do not predict the accurately noise levels due to limitations and assumptions of online URL based tool https://noisetools.net/

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BIOGRAPHIES

Sudha Kushwaha Having +5 Years of Teaching Experience in Civil Department as Assistant Professor in Manda Institute of Technology Society Raisar (Bikaner)