

DETERMINATION OF TRAFFIC INDUCED NOISE POLLUTION AND ITS IMPACT ON HOSPITALS OF LUCKNOW CITY

**A Project Submitted
in Partial Fulfillment of the Requirements
for the Degree of**

**MASTER OF TECHNOLOGY
In
Environmental Engineering**

By

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BBD UNIVERSITY

**BABU BANARASI DAS UNIVERSITY
LUCKNOW**

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CERTIFICATE

Certified that **HIMANSHU SINGH (1180470001)** has carried out the research work presented in this Project entitled “**DETERMINATION OF TRAFFIC INDUCED NOISE POLLUTION AND ITS IMPACT ON HOSPITALS OF LUCKNOW CITY**” for the award of **Master of Technology in Environmental Engineering** from Babu Banarasi Das University, Lucknow under our supervision. The Project embodies results of original work, and studies are carried out by the student himself and the contents of the Project do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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DECLARATION

We hereby declare that the project entitled “**DETERMINATION OF TRAFFIC INDUCED NOISE POLLUTION AND ITS IMPACT ON HOSPITALS OF LUCKNOW CITY**” submitted by us in the fulfillment of the requirements for the award of the Degree of **MASTER of Technology in Environmental Engineering**, to the **Babu Banarasi Das University, Lucknow**, is record of our own work carried under our supervision and guidance of **Mr. Kamal Nabh Tripathi** (Assistant Professor) of Department of Civil Engineering,, Babu Banarasi Das University, Lucknow. We further declare that the work reported in this project has not been submitted either in part or in full, for the award of any other degree or diploma in this university or any other institute or university.

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ABSTRACT

This study is based on to understand the level of noise pollution in different areas of the Lucknow city .Traffic noise which has been generally accepted without complaint until recently has become intolerably noticeable. There are so many causes for noise pollution but the greatest increase in the noise level of metropolitan cities has been directly related to the vehicular noise. The number of vehicles in Lucknow metropolitan city is growing rapidly. Continuous exposure is a matter of concern with respect to health of Lucknowites in the long run. The result of this study show that the levels of noise pollution in Lucknow city far exceed the acceptable limit during peak days (Saturday, Sunday, Thursday and National Holidays) as per set by CPCB Even the vulnerable institutions like hospitals faces noise wich has much higher noise level than acceptable limit. For overcoming this problem in Lucknow city ,Uttar Pradesh, India government should take necessary action. There are four fundamental ways in which noise can be controlled: reduce noise at the source, block the path of noise, increase the path length, and protect the recipient. In general, the best control method is to reduce noise levels at the source

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CHAPTER

1

INTRODUCTION

1.1 GENERAL

This study is based on to understand the level of noise pollution in different areas of the Lucknow city and find out the interrelationship between the number of vehicles and the level of noise pollution. Since the industrial revolution the daily lives of people, particularly in urban environment, have been invaded by unwanted and disruptive sounds. Traffic noise which has been generally accepted without complaint until recently has become intolerably noticeable. Not only the actual number of operating motor vehicles increasing annually but there is an upward trend in speed and weight, plus an always universal adoption of diesel engine for commercial vehicle use. There are so many causes for noise pollution but the greatest increase in the noise level of metropolitan cities has been directly related to the vehicular noise. The number of vehicles in Lucknow metropolitan city is growing rapidly.

Lucknow Metropolis lies between the coordinates of 26° 30' N to 27° 10' N latitudes and 80° 30' E to 81° 13' E longitudes. It is the capital city of the most populous state of Uttar Pradesh in India. Lucknow is situated in the middle of Gangetic Plain and spreads on the banks of the river Gomati, a left bank tributary of river Ganga. It enjoys a central position in the state of Uttar Pradesh. It is bounded on the north by Sitapur, on the south east by the Rae Bareilly, on the north east by Barabanki, on the North West by Hardoi and on the south west by Unnao.

The height of Lucknow city above mean sea level is 123 meters. The total land area of Lucknow city is 310 Sq. km. Lucknow has got an extensive network of roads and railways and it has grown all around in a radius of 25 Km. the road network is primarily of radial pattern. Nine regional roads converge into the city from all directions linking Lucknow to Kanpur, Sultanpur, Kursi, Faizabad, Hardoi, Rae Bareilly, and Mohaan. The city is very favorably located at a junction of three National Highways other five Provincial Highways. The NH-24 links it to Delhi in the north; NH-25 links it to the west and south via Kanpur, Jhansi and Bhopal; and NH-28 links to Patna and Calcutta in the east via Gorakhpur.

Kanpur and Lucknow are separated only by 80 kms. Lucknow - Kanpur area has become an area of intense interaction reflected by changes in land use, mushroomed development in all sectors of the economy. It is also well connected with the railway network falling in the Northern and North Eastern railway zones. Almost all the major train routes touch this city. It has good rail network touching all the important rail junctions in the country. Railway ministry has given some special train to Lucknow. The famous Satabdi and Rajdhani express passes from Lucknow to various part of the country. The city has two major railway stations one is Lucknow railway junction and other is Charbagh station. The major railway lines are Lucknow-Kanpur-Jhansi, Lucknow-Delhi, Lucknow-Gorakhpur, Lucknow-Rae Bareilly. Lucknow is well connected with the other important towns and cities of the country by air routes. Lucknow has direct flight to Delhi, Mumbai, Bangalore, Patna and Sarjah. The Lucknow airport located in Amausi is only 20 km far from the city and has 7453 feet long runway. The Air India, Indian Airlines and Sahara airways has regular scheduled flights from Lucknow to other parts of country.

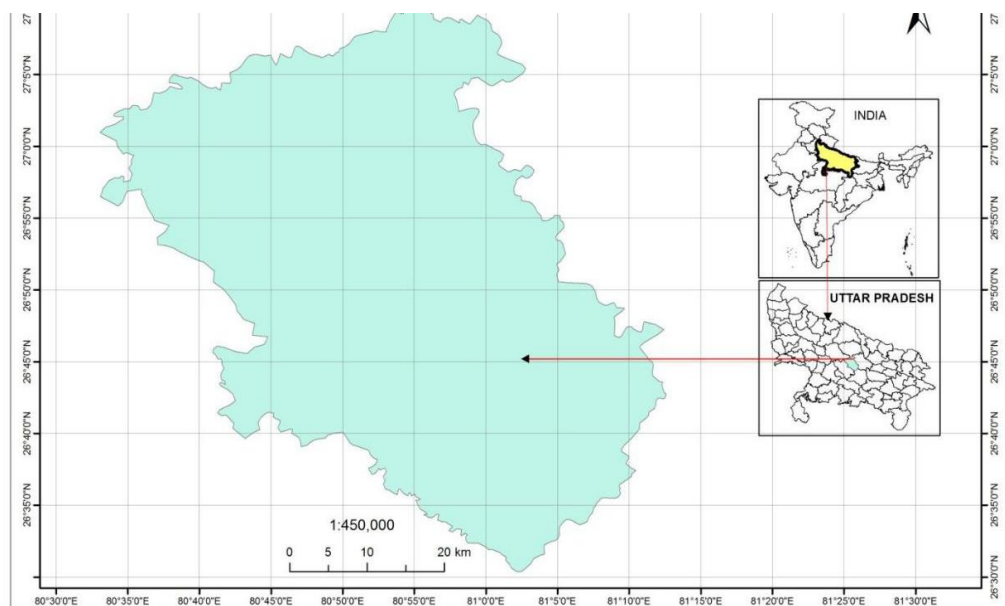


Fig 1.1 :Lucknow City Map

1.2. Problem statement:

Noise pollution is a major problem in many large urban areas in both developed and developing countries. It is one of the scourges of the modern world. It is an unwanted product of our technological civilization, and is becoming an increasingly dangerous and disturbing environmental pollutant.

1.3. Need of study:

Realizing the need to control and regulate noise levels, the Ministry of Environment and Forests, Government of India, have notified .

1.4. Objectives

The main objectives of the present study have been presented as follows.

- To quantify the levels of noise pollution in Lucknow.
- To draw the noise profile of different places of Lucknow at various hours of the day.

CHAPTER

2

REVIEW OF LITERATURE

Al-Mutairi et al. (2009) studied the traffic noise levels in Kuwait and found that traffic noise levels were above the standard prescribed limits especially at arterial roadways and freeways. Two Models viz. the regression model and US FHWA-TNM model were applied for noise level prediction. The study revealed that the TNM model consistently underestimated the generated noise levels from traffic while the peak hour regression model over estimated the traffic noise levels.

Golmohammadi et al. (2009) prepared a compact model for prediction of road traffic noise for the city of Hammadan taking into consideration the ambient traffic conditions. Noise levels and other variables were measured and used to develop a statistical regression model based on A-weighted equivalent noise level for Iranian road conditions.

Ismail et al. (2009) studied the day and night time equivalent noise level at the selected locations of Malaysia and observed that the locations near the main road and near the boundary of an industrial area showed higher equivalent noise levels and background noise levels as compared to monitoring stations located near the residential areas. Also it was inferred from the developed model that the noise level would increase proportionally with the development of the country in the next five to ten years.

Goswami (2009) studied traffic noise status in terms of standard noise indices, community response and community health effects in Balasore city. The study reported that 63% respondents were dissatisfied with the noise level in their dwellings. Road traffic noise was considered the most significant source of noise as 49% of respondents reported being highly annoyed by the road traffic stream and 28% of subjects reported sleep disruption due to night time movement of vehicles.

Kluizenaar et al. (2009) investigated the relationship existing between night time road traffic noise exposure and self reported sleep problems. The study revealed that road traffic noise during the night resulted in an increased risk of subjects getting up tired and not rested in the morning. Further residential road traffic noise exposure was causing

sleep disturbance and had significant implications for daily life in the general population. Also it was observed that noise exposure may induce or aggravate the symptoms of insomnia.

Mohammadi (2009) while investigating community response to urban traffic noise of Iran reported that the main isolated source of noise was traffic (50%) followed by street noise (34%). About 70% of the people surveyed classified the noise in their street as “very high”; 52% and 48% of the respondents considered noise bothering them more in morning and evening respectively and for 86% and 86.8% of the subjects traffic noise was causing physical and psychological annoyance. The main sufferings caused due to exposure to noise were: irritability (40.8%), insomnia (24%), difficulty in concentrating (16%) and conservation disruption (16%).

Rampal and Pathania (2009) assessed noise levels in institutional and commercial units of Bishnah and found that all the institutional and commercial units exhibited values of noise levels higher than the values prescribed by CPCB.

Ravichandran et al. (2009) assessed the noise pollution levels in SIPCOT industrial area in Tamilnadu and found L_{eq} levels exceeding the permissible limits. The exceeded noise levels were due to the close proximity of national highway.

Rawat et al. (2009) developed mathematical model of environment noise impact for prediction of road traffic noise in Dehradun city. Percentage of heavy vehicles, speed of vehicles and traffic flow were found to be the key factors that play significant role in traffic noise emission and environment impact on public health. The predicted noise levels were then compared with the measured levels which gave highly significant results.

Selander et al. (2009) carried out work to support the hypothesis that long term exposure to road traffic noise was associated with an increased risk of myocardial infarction.

Givargis and Karimi (2010) presented an artificial neural network model to carry out prediction of hourly A-weighted equivalent sound pressure levels ($L_{Aeq,1h}$) for impervious bituminous type of road surfaces in Tehran at distances less than 4 m from the nearside carriageway edge and mean traffic speeds of less than 75km/h. The efficiency of the model was examined using non-parametric tests like Wilcoxon matched-pairs signed-

rank test for the training step and the Kolmogorove Smirnov test for two independent samples for the validation step. The results indicated that a neural network approach could be applied in a statistically sound manner for traffic noise prediction in Tehran.

Mishra et al. (2010) evaluated and analyzed the traffic noise emissions along bus rapid transit corridor in Delhi and concluded that traffic noise caused by heavy traffic flow conditions was significant and exceeding the permissible national CPCB standards.

Nejadkoorki et al. (2010) while analysing the street traffic noise pollution in the city of Yazd, Iran revealed that noise levels of the city were above the permissible national standard for urban areas but an apparent decrease was observed in sound levels between 2002 and 2008 which might be due to advances in vehicle design. The developed model was successfully used to predict noise pollution.

Phan et al. (2010) carried out dose–response relationship between L_{den} and percent of highly annoyed respondents in Hanoi (Northern Vietnam) and Ho Chi Minh City (South Vietnam). The overall study emphasized the potential large-scale effects of noise on the well-being of the people in both the cities and revealed that the road traffic noise in these cities was characterized by high noise exposure and frequent and impulsive horn sounds.

Rampal et al. (2010) studied day time variations in noise levels at major crossings of Jammu city and concluded that all the crossings showed variations in the status of noise level due to variability in various attributes like traffic flow rate, degree of jams, commercial activity, location etc. at different selected crossings.

Rampal and Kotwal (2010) assessed (L_d) day time average noise level at eleven major crossings of the Jammu city and observed all the values to exceed the permissible limits prescribed by Central Pollution Control Board. The calculated value of L_d at all the sites were statistically significant at 0.05 (5%) level of significance.

Salomons et al. (2010) studied the numerical modelling of traffic noise. Two incoherent line sources were compared, a point source and a line source and different solutions for their sound field was found. It was also found that conventional methods for calculating traffic noise may result in considerable numerical errors particularly for receiver positions near the infinite line through the line source. To avoid such errors an optimized general

segmentation algorithm of the line source was used at least for situations with more or less smooth functions for the excess attenuation and source directivity.

Sharma et al. (2010) developed a geographical information system (GIS)-based noise simulation model to generate noise levels in Versova region of Mumbai, India. The study involved the use of various factors like effect of infrastructure, road network, traffic volume, meteorological parameters, effect of land use and various mechanical components. The correlation coefficient between the observed and simulated noise levels during day and night time was observed to be 0.84 and 0.74, respectively at 95% confidence level.

Tsukui et al. (2010) developed new road traffic noise prediction method by integrating sound power calculation model with dynamic traffic flow calculation model. This model was used for prediction of road traffic noise for 32 urban areas including low noise road surfaces in Japan and Netherlands.

Wani and Jaiswal (2010) studied traffic noise and subjective community response in the Gwalior city. The study was based on a questionnaire survey which reported that 50% of the subjects were always annoyed and 33% had a constant headache. For speech interference, 43% subjects were highly affected, 21% were moderately affected, 32% low, and 4% were least affected.

Agarwal and Swami (2011) developed an empirical noise prediction model for heterogeneous type of traffic flow conditions in Jaipur city. The model was applied for evaluation of equivalent noise level (L_{eq}) in terms of equivalent traffic density number. Ten commercial road networks were selected for monitoring and modelling. Factors like Equivalent number of light vehicles ($EqLv$) and heavy vehicles ($EqHv$) were used for evaluating the equivalent traffic density for each class of vehicles. Correlation was plotted between equivalent traffic density and $EqLv$ and $EqHv$ and equivalent noise level [$L_{eq}(o)$] was observed for the calculation of equivalent noise levels in terms of both light vehicles [$L_{eq}(Lv)$] and heavy vehicles [$L_{eq}(Hv)$] for different selected locations as well as for the entire city. Further, regression equations were developed between $L_{eq}(o)$, $L_{eq}(Lv)$, and $L_{eq}(Hv)$. The study revealed that the light motor vehicles were the main source of noise pollution in the city.

Amutha (2011) carried out an empirical study of environmental noise pollution in Tuticorn district of Tamilnadu and observed automobiles and public address system (loudspeakers) to be the major sources of noise pollution. The sample population was surveyed determine various effects of noise on the individuals in improper communication, sleeplessness and reduced efficiency. Public education was found to be the best method for noise control.

Brown and Tomerini (2011) studied the distribution of noise level maxima, L_{AFmax} , generated during pass-by of over 85000 vehicles on different urban arterials of Australia under normal traffic and vehicle operating conditions. It was observed that articulated trucks generated higher noise levels than the non-articulated trucks and they in turn produced higher noise levels than cars. Motorcycle maxima were found almost similar to those of non- articulated trucks. For 60 Km/hr roadways, L_{AFmax} upto 72 dB(A) was generated by cars, but maxima above this was generated by articulated trucks. For 100Km/hr roadways, this level reached above 78 dB(A).

Coensel et al. (2011) studied effects of natural sounds on the perception of road traffic noise and found that acoustic design measures have a far reaching impact on a sounds cape quality. The natural sounds are needed to be addressed more than only the loudness of unwanted sounds, viz. adding fountain sound reduced the loudness of road traffic noise only if the traffic noise had low temporal variability. Conversely, adding bird sound enhanced soundscape pleasantness and eventfulness significantly more than by adding fountain sounds.

Goswami et al. (2011) assessed the noise levels at five places on the way from Vyasa Vihar Campus to Gyan Vigyan Vihar Campus of Fakir Mohan University, Balasore, and Orissa. The sources of noise found at the studied sites were predominantly motor vehicular traffic. The noise levels of all the five locations were observed to exceed the permissible limits during the day time. The questionnaire based survey revealed that about 43% respondents were more vulnerable to noise pollution than water or air pollution in the study area and 59% of the respondents considered the road traffic noise as the unwanted noise to which they would most like to get rid of.

Heydecker and Addison (2011) developed the relationship between speed and density to analyse the flow of traffic under the operation of variable speed limits. The statistical

analysis of the data revealed that zero speed induced jam density in traffic rather than vice versa. Further an approach to develop a model for the traffic was suggested. It was concluded that use of speed of vehicles as explanatory variable upon which occupancy and traffic flow were considered to depend was justified when traffic was subjected to speed control.

Kumar et al. (2011) developed a noise prediction model for an existing busy highway for Indian conditions considering parameters like traffic flow and percentage of heavy vehicles as inputs of the model. Data collected was analysed and compared with the values predicted by calixto model which resulted in a good R^2 value (0.92738) for observed L_{eq} . Versus calculated L_{eq} .

Makarewicz and Galuszka (2011) developed a method for calculation of the annual average sound level of the road traffic noise taking into account characteristics like the speed-flow diagram, the average speed of freely cruising vehicles, capacity of the traffic flow, traffic speed at the traffic flow capacity, and the slope of the decreasing traffic speed versus traffic flow. It was concluded that strong traffic congestion couldn't be ignored in noise prediction as it could reduce the annual average sound levels.

Manatakis (2011) carried out statistical modelling of road traffic noise in urban areas of Patras, Greece, using multiple regression models. The study revealed that modelling of traffic noise and suggesting noise control measurements needed pre requisites in the form of certain traffic parameters.

Patil et al. (2011) carried out subjective analysis of the annoyance and other impacts on the quality of life caused due to traffic noise among residents around the major arterials in Intermediate City Amravati, Maharashtra. About 500 respondents were questioned with the help of questionnaire for their perceptions and attitudes towards road traffic noise and the health effects of noise pollution. The study revealed that significant number of individuals were aware of the interference caused by traffic noise with daily activities and awareness regarding the health impacts.

Rahmani et al. (2011) assessed the level of noise pollution in the Mashhad city, Iran and developed traffic noise level prediction model for the same. The model so developed was based on genetic algorithm for the noise level reduction by redesigning of its flow or some

other means. The study showed that noise pollution level was exceeding the acceptable limits as set by the Environmental Protection Agency of Iran policies. Two prediction models were developed using the variables like traffic flow, composition, and speed. First model called TID (time-independent) did not take into consideration the direct effect of time for its calculation while the second one, TD (time-dependent), was the modified form of the first model that considered the direct time effect. These models were later used to estimate measured data very well, with some improvements for the TD model. The models were found to be accurate within $\pm 1\%$ range.

Singal (2011) measured noise levels in the urban areas of India and some other congested cities of the world and found that the road transport noise was the predominant source of noise in an urban area. The study revealed that about 25% of the people in the urban areas were exposed to noise levels between 55 - 65 dBA, 40 - 45% of the people were exposed to noise levels between 65 - 75 dBA and about 15 - 20% of the people were exposed to noise levels above 75 dBA.

Tanvir and Rahman (2011) developed a mathematical model for interrupted flow traffic noise for a road network in Dhaka city taking into consideration different traffic characteristics, geometric dimensions of road sections and noise levels at the selected locations. The separate models were developed for acceleration and deceleration lanes of the roads and their statistical goodness of fit was also determined. The collected data using the models was then compared to globally accepted traffic noise models and goodness of fit for measured and predicted values was also studied. It was found that with increase in decelerating lane speed noise level tends to decline.

Chowdhury et al. (2012) while analysing the day time traffic noise level in Kolkata revealed that annoyance due to road traffic noise was observed more during non-peak traffic hour as compared to the peak hour. Wider roads were found to be less noisy because of multiple traffic management options, but it was suggested that flyovers should be constructed with proper noise mitigation measures.

Hunashal and Patil (2012) assessed noise pollution indices in Kolhapur city for five critical zones viz. Educational, Commercial-cum-residential, Industrial-cum-residential, Recreational and Silence zone. Various noise pollution indices like L₁₀, L₅₀, L₉₀, noise climate (NC), equivalent continuous noise level (L_{eq}), noise pollution level (L_{NP}) and

noise exposure index (NEI) were calculated for all the zones. Results clearly showed highest L_{eq} of 72.25 dBA in industrial-cum-residential zone followed by 64.47 dBA in commercial-cum-residential zone, 63.71 dBA in educational zone, 53.26 dBA in recreational zone and 42.84 dBA in silence zone. For educational zone, L_{eq} observed was above the statutory limits as prescribed by the standards, while for other zones it was considerably below the prescribed limits.

Salhab and Amro (2012) evaluated vehicular noise level in Hebron city located at the south of Palestine. The equivalent level noise (L_{eq}) was observed during three time periods of the day viz. 7-8 am (peak traffic hours), 14-15 pm (peak traffic hours), and 17-18 pm (non-peak traffic hours) in June 2012 at two selected areas with high population density, heavy traffic flow, commercial and residential buildings. The study revealed that the maximum average noise level measured was 83.05 dB(A) from 14 to 15 pm, while the minimum average measured noise level was 74.4 dB(A) from 17 to 18 pm. The results emphasized on implementation of strategies and giving greater priority to control the noise levels in regard of high (L_{Aeq}) compared with international legislations.

Selvi and Ramachandraiah (2012) developed a modified traffic noise model for Chennai city considering the horn noise and road width correction. A passenger car noise unit (PCNU) was used to take into account the base noise level to which the corrections were applied. It was observed that horn noise events occurring around 16 per minute would raise the level of L_{eq} by 12 dB(A).

Subramani et al. (2012) constructed a mathematical model for vehicular noise of Coimbatore city (Tamilnadu) and observed that L_{eq} . Level of vehicular noise was based on various physical parameters like traffic flow rate (Q), Average speed of vehicle in km/hr. (V), Atmospheric temperature in °C (T_a), Surface temperature in °C (T_s), and Relative humidity (H) in %. Regression analysis was used for prediction of noise levels and the value of R^2 observed ranged from 0.1 to 0.7.

Gaganija et al. (2012) carried out noise level measurements in Morogoro municipality of Dar es Salaam, the business capital of Tanzania and observed that the noise levels were exceeding the acceptable limit of 55 dBA as prescribed by the government for day time

noise limits in residential-commercial areas. About 200 respondents were surveyed for their response towards traffic noise problem. The study revealed that the main isolated noise source was traffic (51%) and street noise (29%). About 45% of the respondents considered the noise in their street as “high” and for 77% of the respondents’ noise was more bothering during daytime. The main sufferings due to exposure to noise were reported to be headache, hearing problem, sleeplessness, difficulty to concentrate and conversation disruption.

Govind and Soni (2012) predicted Traffic noise levels along National Highway 28 passing near Gorakhpur city using Federal Highway Administration (FHWA) model taking into account parameters like traffic volume and speed data of different selected sites. A plot between observed and predicted values lied within a range of $\pm 10\%$ with reference to the observed noise levels. FHWA model thus proved to be successful tool for predicting the noise using traffic parameters with fair degree of accuracy.

Renterghem et al. (2012) numerically assessed road traffic noise propagation through a vegetation belt of limited depth (15 m) containing trees arranged periodically along a road by means of 3D finite-difference time-domain (FDTD) calculations. It was observed that with increase in tree stem diameter and decrease in spacing between them, insertion loss of traffic noise was more pronounced for each type of planting scheme considered (simple cubic, rectangular, triangular and face-centred cubic). For rectangular type of plantation scheme, the spacing parallel to the road axis was the important parameter that determined the acoustic performance. Significant noise reduction was also observed to occur for a tree spacing of less than 3 m and a tree with stem diameter of more than 0.11 m. The shrubs with typical above-ground biomass were observed to scatter noise to a level of about 2 dBA in case of a light vehicle at 70 km/h. The effect of the presence of tree stems, shrubs and tree crowns was observed to be approximately additive. Induction of some (pseudo) randomness in stem centre location, tree diameter, and by omitting a limited number of rows with trees hardly affect the insertion loss. All these observations suggested that vegetation belts have the ability to compete to a classical thin noise barrier (on grassland) with a height of 1–1.5 m (in a non- refracting atmosphere) when noise reduction performance is considered.

Bande et al. (2013) reviewed the literature regarding levels of road traffic noise in India. Various other aspects related to the noise menace like harmful effects of noise pollution,

classification of noise, sources of noise pollution, noise standards, and noise indicators were also covered in the study.

Bande and Nawathe (2013) while studying traffic noise levels on express highway of Amravati city revealed that the sound level was exceeding the permissible limit for all the locations except for Badnera highway. Variation of sound from 60dB to 110dB was reported which resulted in moderate to very severe effects on human health such as, poor concentrations, stress, cardiovascular illness and many more. Further various remedial measures were also suggested for reduction in the noise levels.

Guarnaccia (2013) presented a set of advanced tools for modelling of noise that were used for the prediction of non-conventional situations, such as road intersections, traffic jams, extreme traffic flow, etc., where the standard TNMs (Traffic noise models) failed. The main aim was to implement a dynamical approach in prediction of the traffic noise, i.e. to include the dependence of noise emission on various kinematical parameters like speed, position and eventually acceleration.

Keerthana et al. (2013) while analysing the noise pollution in Tirupur city of Tamilnadu concluded that higher levels of noise were produced mainly by vehicles like rickshaws, buses, wagons and trucks etc. The noise pollution in the city was observed to be because of congested traffic area, unplanned road network, reduced one way traffic, construction of silence zone in the main area of the city and unplanned urban sprawl etc.

Mondal (2013) evaluated noise pollution levels in Burdwan town, West Bengal. The study revealed that noise level at all the measurement points exceeded the limits as prescribed by Noise (Regulation and Control) Rules, 2000. Cars and Jeeps were found to be the major source of noise pollution in the town. Equivalent noise level, background noise level and dominant noise sources were also studied during different times of the day viz. morning, afternoon and evening time. A health survey based on questionnaire was also carried out among local inhabitants which showed that 81% respondents were irritated with air-horn along with other symptoms (headache 66%; mental stress 12%; annoyance 77%; and sleep loss 33%).

Pachiappan and Govindraj (2013) developed a multiple linear regression noise prediction model for traffic noise at Salem- Cochin National highway using different characteristic parameters like traffic volume, spot speed of each type of vehicle, noise

levels, atmospheric temperature, pavement surface temperature and relative humidity. The predicted model showed statistically a very low percent of error. The influence of various parameters on noise levels was also observed during the study.

Patel et al. (2013) while studying noise pollution in Navsari city of South Gujarat, India observed that with industrialization and urbanization numbers of vehicles also increased significantly in this city. The registered vehicles in Navsari city recorded 371 % growth, mopeds and scooters registered 357 % increase and motor cars showed 515 % increase over the previous decade as per the records of Regional Transport Office (RTO). Study also revealed that noise pollution level in the study area showed variation between maximum of 107 dB and minimum of 32.1 dB. The higher L_{eq} values clearly showed that noise pollution levels were exceeding the prescribed limits (Ministry of Environment and Forestry and CPCB) in all locations except within the Agricultural University campus where limited number of vehicles was allowed to enter and a good share of vegetation was helpful in absorbing the higher noise levels.

Rominder et al. (2013) prepared a methodology for noise barrier design for traffic noise reduction in Delhi. Data used for designing included traffic volume, traffic speed, road geometrics and ambient noise levels for the intersections. The idea was later used by Public Works Department (PWD), Delhi, India for the busy Britannia chowk flyover and efficient results were observed.

Swain and Goswami (2013) assessed the noise levels at 12 major intersection points of Baripada town during four different specified times of the day (7-10 a.m., 11 a.m.-2 p.m., 3-6 p.m., 7-10 p.m.). The equivalent noise levels at all the sites were found to exceed the permissible limits (70 dB during day time). Various noise descriptors like L_{10} , L_{50} , L_{90} , L_{eq} , TNI (Traffic Noise Index), L_{NP} (Noise Pollution Level) and NC (Noise climate) were determined to assess the extent of noise pollution due to heavy traffic in this town. The study revealed that even the minimum L_{eq} and L_{NP} values were exceeding the values of 70.9 dB and 88.4 dB, respectively. Further Chi-square (χ^2) test was applied for investigating the level of significance. The results revealed that the noise levels of different sites did not differ significantly at the peak hour. Comparison of predicted and measured equivalent noise level gave significant results.

Tandel and Macwan (2013) carried out study to generate a noise prediction model and analyse various parameters that affect road traffic noise. The study revealed that present noise levels at all the three major arterial roads of Surat, India exceeded the limits prescribed by CPCB. Noise mitigation measures for the study sites were also suggested.

Vij and Agrawal (2013) discussed noise prediction models of U.S.A. and U.K. (FHWA and CORTON) in Indian context along with the research efforts on noise pollution. Various noise prediction methods used in different countries were also discussed and recommendations to curb the ever increasing problem of higher noise levels were also stated during the study.

Halim and Abdullah (2014) carried out study to assess the relationship between noise levels and total number of vehicles on the road at two types of highways in Malaysia; high traffic flow highway (Sungai Besi Expressway) and low traffic flow highway (Duke Highway). Highway with high traffic flow was observed to exhibit higher noise levels during the study. It was also observed that when the total number of vehicles gives rise to some particular value of noise, that level remained stabilized.

Kaushal and Rampal (2014) carried out study to determine the traffic noise level (L_{eq}) at five major crossings of NH1 A highway of Jammu city during three time periods of the day viz. Morning (8-10hrs.), noon (12-2 hrs.) and evening (6-8 hrs.) for three seasons i.e. rainy, summer and winter season. Also traffic flow rate for the selected sites was also assessed during the study. The study concluded that the noise levels were higher during the rainy season when compared to winter and summer season for the given selected sites and all the sites exhibited positive correlation between traffic flow rate and observed L_{eq} values during all the seasons.

Raman and Chhipa (2014) assessed the levels of environmental noise and its impact on residents of Jaipur city. Results showed that sound levels exceeded the prescribed limits as prescribed by Central Pollution Control Board (CPCB). Various ways for reduction in noise levels in the city were recommended during the study. Other reasons found for higher noise levels were lesser plantation nearby roadside, public entertainment and use of heavy machineries.

Shalini and Kumar (2014) assessed the status of noise levels at heavy traffic locations of Varanasi city and developed a model for the same to predict the noise levels.

Noise levels at all selected locations were found to be much higher (70–90 dB (A)) than the prescribed limits. Federal Highway Administration Agency (FHWA) model was used for predicting the noise levels. The calculated noise levels were then compared with the observed noise levels for checking the validity of the model. It was found that the results obtained by FHWA model were very near to the observed noise levels.

Khaki et al. (2015) carried out noise emission studies in Tehran by using SMM1 noise emission model and used parameters like road pavement, distance from road and traffic volume in the study. It was observed that fresh and new Asphalt pavements minimised noise pollution by 2 to 3dB effectively because of more porosity. The distance from road and noise levels showed inverse relationship.

Oliveira et al. (2015) applied different mathematical models for the determination of traffic noise in Belém, Brazil, having diversified geometry and intense traffic in all its extension. The results of the mathematical models showed approximately close values with measured values, revealing that the mathematical models could be used effectively for analysis of noise levels.

Oluwasegun et al. (2015) surveyed about 32 different locations in Ikeja metropolis, the capital city of lagos state to found out status of road traffic noise pollution and its impacts on the local residents. At all the selected study locations car noise (97.9%) was observed the most dominant source that bothered the residents of Ikeja, followed by motorcycles (92.7%), and Lorries (75%). The results of social surveys (questionnaires) revealed that 72.9% respondents were moderately bothered by motorcycles, 62.5% were moderately bothered by cars, 42.2% respondents were more moderately and 20.8% respondents were severely bothered by Lorries. Physical surveys

(measurements) showed that observed range varied from 67.5 to 89.7 at all the selected locations which exceeded the safety levels given by World Health Organisation (WHO).

Saransh and Kazal (2015) studied the noise profile of Rohtak on different hours of the day (morning, noon & evening) and observed that sound pressure level at different sites was within the permissible limit. The noise level measured during evening time

exceeded the levels during morning and noon hours because of high volume of traffic experienced during the evening hours.

Eludoyin (2016) studied the sources, effects and the mitigating strategies of neighbourhood noise in Ile- Ife. The study revealed that transportation (95% and 100% respectively) was the major source of noise in the commercial/ high density residential areas. Further the perception of residents towards the effects of noise pollution was also studied and it was found that 70% of the residents living in low-medium density areas considered neighbourhood noise as a noise source and 65% were found to be annoyed by it. In the institutional type of environment, 90% respondents considered noise as a problem and 85% were annoyed by it, while in commercial/ high density areas, 85% respondents considered noise as a problem and were also annoyed by it. The major cause of annoyance in the commercial/high density area was found to be transportation (77.8%) and Environment disruption (66.6%).

Kaushal and Rampal (2016) assessed the attitudinal response of the residents of Jammu city towards Traffic noise. About 900 respondents (150 males and 150 females from each site) of the study area were interviewed using a Questionnaire. The study area was divided into three sites: Site I (crossings on the main highway NH1A), Site II (crossings on the roads connecting the highway) and site III (crossings with light vehicular traffic). Data when compiled concluded that all the respondents ranked traffic noise as major source of Noise and gender wise differences towards traffic noise was observed to be insignificant ($p > 0.05$).

Kumar et al. (2016) while assessing the level of noise pollution at four main junctions of Vishakhapatnam suggested that the noise abatement rules and regulations should be implemented strictly and a policy for controlling vehicular movements on the roads like developing special tracks for the public transport facilities like 3 wheelers should be followed effectively in order to curb the problem of noise pollution in the study area. They also suggested that development of green belts in the city would help in reduction of noise levels to a greater extent. Also the length and width of the roads should be reframed in the city with the rising levels of traffic.

Reddy et al. (2016) measured traffic noise levels at Leela Mahal circle, Tirupati town and observed that the traffic flow and volume were higher during the peak periods i.e. exceeding the range of 70 dB(A) as suggested in Indian guidelines of Noise Pollution Act (1972). Various existing mathematical models for prediction of noise levels were used to validate the results obtained during the study. The correlation existed between the predicted values as obtained by modelling and the measured values were found to vary in the range of -0.1 to 0.7 which was less than the required 0.95-0.1 values so none of the existing model was considered to be suitable for the prediction of traffic noise levels. The study concluded that all such models needed to be modified in some aspects so as to use them efficiently.

Weyde et al. (2017) studied the nocturnal exposure of children to noise as well as the effect of noise on sleep duration of children in Norway. The study revealed a statistically significant association between road traffic noises and sleep problems in girls of the study area.

Scholars Journal of Engineering and Technology (SJET) ISSN 2321-435X Sch. J. Eng. Tech., 2013; 1(3):154-168 ©Scholars Academic and Scientific Publisher (An International Publisher for Academic and Scientific Resources) www.saspublisher.com An Analysis of noise pollution in Tirupur city Keerthana1 , Gobinath.R2 , Neelima Singhvi3 , Chitravel.V3 , Saranya.S3 , Kannan.T3

Noise Pollution-Sources, Effects and Control Narendra Singh & S. C. Davar ,Pages 181-187 | Published online: 24 Oct 2017

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Noise is associated with every type of human activities, machinery, office equipment, traffic, aircraft, television and radio, loading and unloading operations, vehicle repair activities and vibrations (White, 1975; Comb and Taylor, 1978).

Vehicular traffic is the major source of noise is now a well documented fact in Indian cities (Pancholy et al., 1967; Prabhu and Chakraborty, 1978; Cohn and Meroy, 1982; Roy et al, 1984; Rao et al, 1987; Ravindranath et al , 1989; Pandya and Dharmadhikari, 2002; Banerjee and

Chakraborty, 2006; Datta et al, 2006; Kisku et al, 2006; Goswami, 2009 , Goswami et al, 2011; Thakur, 2006, Kankal and Gaikwad, 2011.).

Therefore, an at-tempt has been made to study traffic noise pollution and noise caused due to bursting of fire crackers dur-ing Diwali Night in Mumbai city. The noise levels ex-ceeded the standards except at the industrial areas in Mumbai (Maharashtra Pollution Control Board, 2009).

CHAPTER
3

METHODOLOGY

3.1. Measurement of Traffic Noise:

Noise Levels have been recorded by means of a Precision Noise Level Meter of make 'Bruel and Kjaer, Denmark (2232)'. The basic parts of a sound level meter include a microphone, amplifier, weighting networks and a display reading in decibel (one-tenth part of "bel", unit of sound). The noise levels will measured with the help of a portable precision digital sound level meter (Model- SL-4010), Lutron. This instrument is primarily designed for community noise surveys. A large digital display gives a single value indication of the maximum 'A' weighted RMS (root mean square) sound pressure level measured during the previous second. It is equipped with high sensitivity Bruel and Kjaer prepolarized multi-function acoustic calibrator model 4226 condenser Measurements from 30 dB(A) to 135 dB(A) can be carried out with this instrument. Noise levels at different spots will recorded in the day and night time.



Fig. 3.1 Precision Noise Level Meter

This equipment has been designed to meet the measurement requirement of safety engineers, health, industrial safety offices and sound quality control in various environment, which include factory, office, traffic, family, and audio system. Measuring

Range: 35~130dBA * Accuracy: ± 2 dB * Frequency Range: 31.5HZ-8.5KHZ * Linearity
Range: 50dB

3.2. AREA OF THE STUDY

- Dr. Shyama Prasad Mukherjee Hospital, Hazratganj (D1)
- Samudayik Swasthya Kendra, Chinahat (D2)
- Balrampur Hospital, Golaganj (D3)
- Raam Manohar Hospital, Gomati Nagar (D4)
- Lok Bandhu Raj Narayan Hospital, Kanpur Road (D5)
- Rani Laxmi Bai Hospital, Rajajipuram (D6)
- Samudayik Swasthya Kendra, Bakshi Ka Talab (D7)
- Samudayik Swasthya Kendra, Mohanlalganj (D8)
- Samudayik Swasthya Kendra, gosaiganj. (D9)
- Prathamik Swasthya Kendra, Jugaur (D10)



Fig. 3.2 Dr. Shyama Prasad Mukherjee Hospital, Hazratganj (D1)



Fig. 3.3 Lok Bandhu Raj Narayan Hospital, Kanpur Road (D5)



Fig. 3.4 Balrampur Hospital, Golagunj (D3)



Fig. 3.5 Raam Manohar Hospital ,Gomati Nagar (D4)

○ **Permissible Standards**

The aim of enlightened governmental controls should be to protect citizens from the adverse effects of airborne pollution, including those produced by noise. People have the right to choose the nature of their acoustical environment; it should not be imposed by others. Central Pollution Control Board (CPCB) has requested to all State Pollution Control Board (SPCB) and Pollution Control Committees (PCC) for providing information on the identified authority for implementation of THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 in their respective state.

Table 3.1. : CPCB Noise Level Standards in India

Area Code	Category of Area	Limit in dB(A)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silent Zone	50	40

Note: (Noise levels are in dB)

1. Day time shall mean from 6.00 a.m. to 10.00 p.m; 2. Night time shall mean from 10.00 p.m. to 6.00 a.m.; 3. Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority; 4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority; 5. A “decibel” is a unit in which noise is measured.

Noise levels have been recorded by means of a Precision Noise Level Meter of Make ‘Bruel and Kjaer, Denmark (2232)’. The basic parts of a sound level meter include a microphone, amplifier, weighting networks and a display reading in decibel (one-tenth part of “bel”, unit of sound). The data has been collected for overall 6 h on the respective day at the selected sites. The time being selected the most prior ones: around **18:00 - 19:00 hrs (Day)**, **19:00 - 20:00 hrs(Day)**, **20:00 - 21:00 hrs(Day)**, **21:00 - 22:00 hrs(Day)**, **22:00 - 23:00 hrs(Day)**, **23:00 - 24:00 hrs(Night)**. The time has been selected so as to cover most part of the day, from calm mornings, rush hours, pleasant evening, to silent nights, as they should be respectively. Possibly, the readings have been taken from at least 1.5 m above the ground level, at the concerned hours for 10 min duration at fixed intervals of 15 s, so that gives about 40 readings for each observation hour.

RESULTS AND DISCUSSION

The results of noise monitoring has been summarized in Table 4.1 to 4.7

Table 4.1: Noise levels at different locations on 25-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	75.2	74.8	77.2	76.4	79.3	73.1	75.8	76.2	74.3	79.1
19:00 - 20:00 hrs(Day)	77	77.8	78.4	84.2	78.6	77.2	76.7	76.3	74.1	77.1
20:00 - 21:00 hrs(Day)	78.6	79.5	80.2	81.7	87.89	77.6	77.5	79.4	80.9	85.79
21:00 - 22:0 0 hrs(Day)	74.8	73.9	79.6	81.6	83.7	73.8	72.9	78.7	81.1	81.2
22:00 - 23:00 hrs(Night)	66.29	72.3	74.4	68.4	82.78	65.9	71.3	72.3	68.0	80.70
23: 00 - 24:00 hrs(Night)	57.8	53.7	52.2	70.3	72.8	58.1	53.9	53.2	71.3	73.8

Figure 4.1: Noise levels at different locations on 25-01-2020

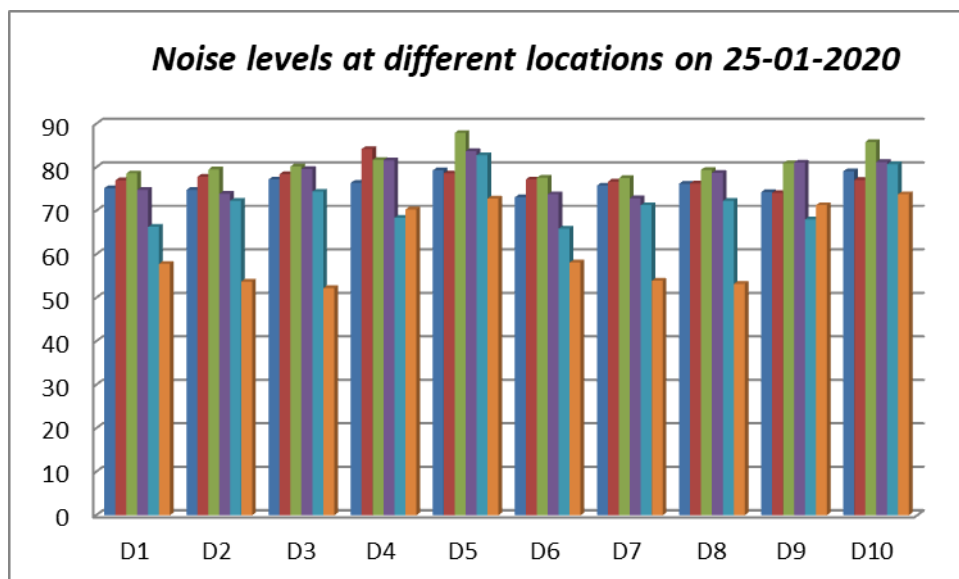


Table 4.2: Noise levels at different locations on 26-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	74.9	75.4	73.9	80.1	77.8	71.9	74.4	72.9	80.2	76.6
19:00 - 20:00 hrs(Day)	69.1	71.7	72.9	84.2	82.3	68.2	70.7	73.9	82.2	81.3
20:00 - 21:00 hrs(Day)	75.6	86.56	79.8	73.2	77.9	75.6	85.56	78.8	74.1	77.4
21:00 - 22:0 0 hrs(Day)	76.9	77.7	77.1	78.46	75.1	74.9	76.5	76.1	77.46	75.1
22:00 - 23:00 hrs(Night)	69.82	74	73.5	68.4	62	68.82	74.2	73.5	69.9	62.9
23: 00 - 24:00 hrs(Night)	57.5	50.3	53	69.2	57.73	58.4	51.3	53.7	69.4	58.79

Figure 4.2: Noise levels at different locations on 26-01-2020

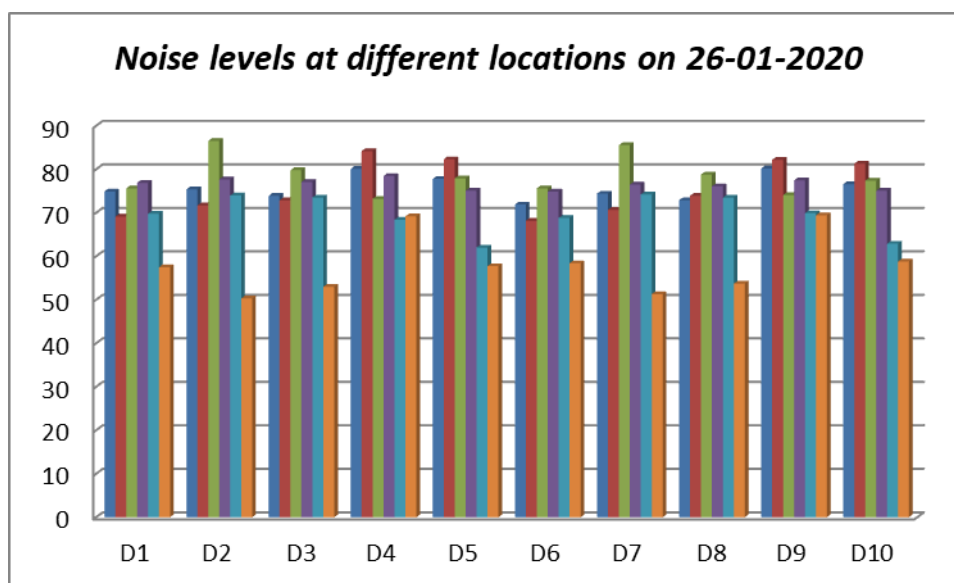


Table 4.3: Noise levels at different locations on 27-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	75	71.9	71.8	85.1	76.7	76	72.8	72.8	84.1	77.7
19:00 - 20:00 hrs(Day)	75.2	77.7	78.1	81.5	83.3	77.4	75.7	76.1	82.8	84.3
20:00 - 21:00 hrs(Day)	75.9	76.4	70.17	85.4	82.5	75.9	77.4	72.27	86.4	83.4
21:00 - 22:0 0 hrs(Day)	90.63	79	87.89	85.95	87.7	91.63	79.5	86.59	86.55	85.3
22:00 - 23:00 hrs(Night)	64.26	74.4	70.14	68.2	65.6	64.26	75.4	71.15	67.2	66.6
23: 00 - 24:00 hrs(Night)	59.3	57.6	41.8	67.9	57.9	55.3	58.6	43.4	67.9	56.8

Figure 4.3: Noise levels at different locations on 27-01-2020

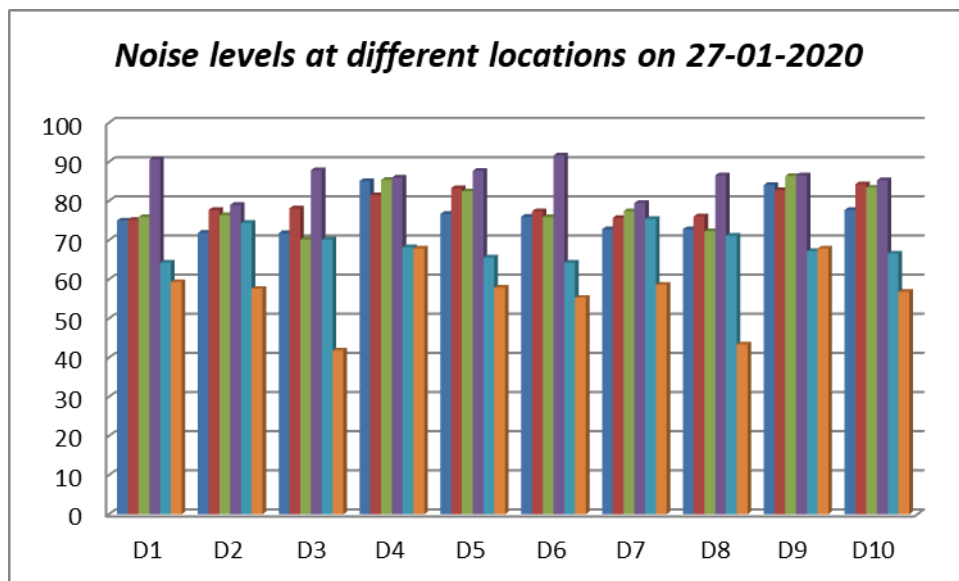


Table 4.4: Noise levels at different locations on 28-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	79	78.6	74.8	82.1	87.6	79.2	77.4	75.8	81.6	86.5
19:00 - 20:00 hrs(Day)	78.4	71.5	79.2	84.8	77.9	76.4	72.5	78.3	83.8	76.5
20:00 - 21:00 hrs(Day)	71.4	75.5	75.5	74.8	78.1	72.4	74.3	74.3	73.9	77.5
21:00 - 22:0 0 hrs(Day)	79.4	70. 35	76.3	79.4	77	79.1	69. 30	75.3	78.2	76.5
22:00 - 23:00 hrs(Night)	64.2	73.35	70.8	72.24	65.4	63.2	72.30	69.8	71.22	66.5
23: 00 - 24:00 hrs(Night)	69.5	59.8	36.87	67.4	61.7	68.5	58.9	35.9	66.4	60.55

Figure 4.4: Noise levels at different locations on 28-01-2020

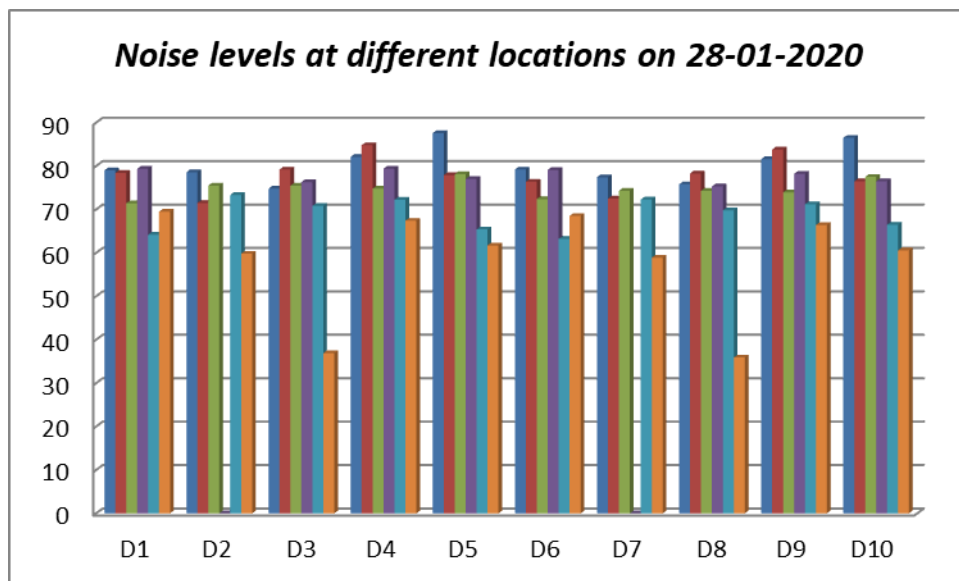


Table 4.5: Noise levels at different locations on 29-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	79.3	78.8	79	85.4	87.2	78.5	77.5	78	84.4	86.5
19:00 - 20:00 hrs(Day)	78.6	78	78.4	81.7	80.1	77.5	76.9	77.2	80.5	82.1
20:00 - 21:00 hrs(Day)	88.1	88.2	71.4	84.3	84.2	87.5	83.2	71.2	83.3	83.2
21:00 - 22:0 0 hrs(Day)	83.7	88.5	79.4	85	83.2	82.5	86.4	78.4	84.5	82.2
22:00 - 23:00 hrs(Night)	69.5	69.8	74.2	64.8	58.4	68.4	69.5	74.2	63.9	57.9
23: 00 - 24:00 hrs(Night)	62.8	50.2	44.5	65.7	68.4	61.7	50.1	43.4	65.7	67.1

Figure 4.5: Noise levels at different locations on 29-01-2020

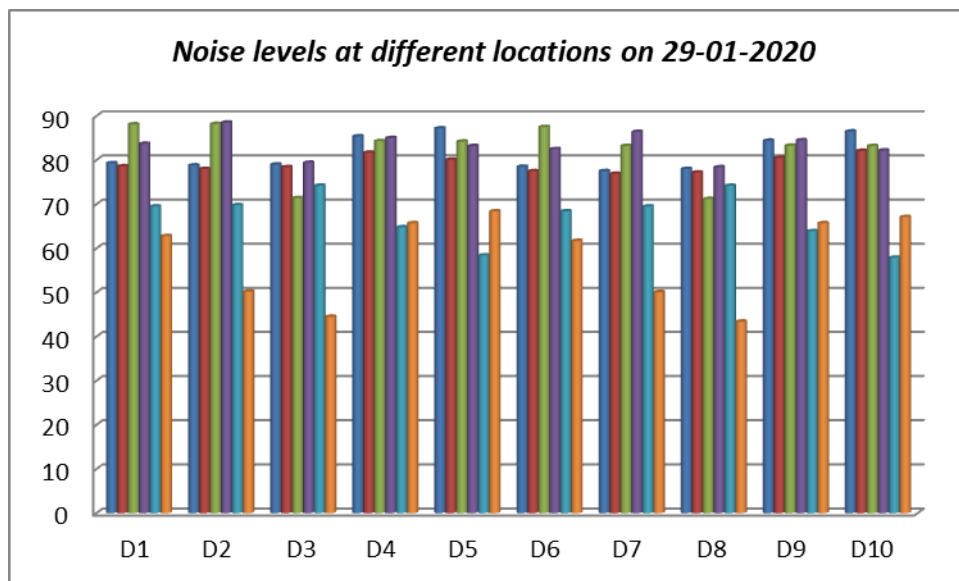


Table 4.6: Noise levels at different locations on 30-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	79.3	88.8	79	85.4	87.2	77.2	87.6	78.5	84.4	86.3
19:00 - 20:00 hrs(Day)	78.6	81	78.4	81.7	80.1	76.5	80.6	77.4	82.5	81.5
20:00 - 21:00 hrs(Day)	88.1	80.2	71.4	84.3	84.2	87.2	79.2	72.3	83.3	83.5
21:00 - 22:0 0 hrs(Day)	83.7	78.5	79.4	85	83.2	84.7	76.5	72.2	84.5	82.5
22:00 - 23:00 hrs(Night)	69.5	69.8	74.2	64.8	78.4	68.9	67.7	73.2	63.6	77.4
23: 00 - 24:00 hrs(Night)	72.8	60.2	59.5	65.7	68.4	71.8	60.1	59.2	64.6	67.5

Figure 4.6: Noise levels at different locations on 30-01-2020

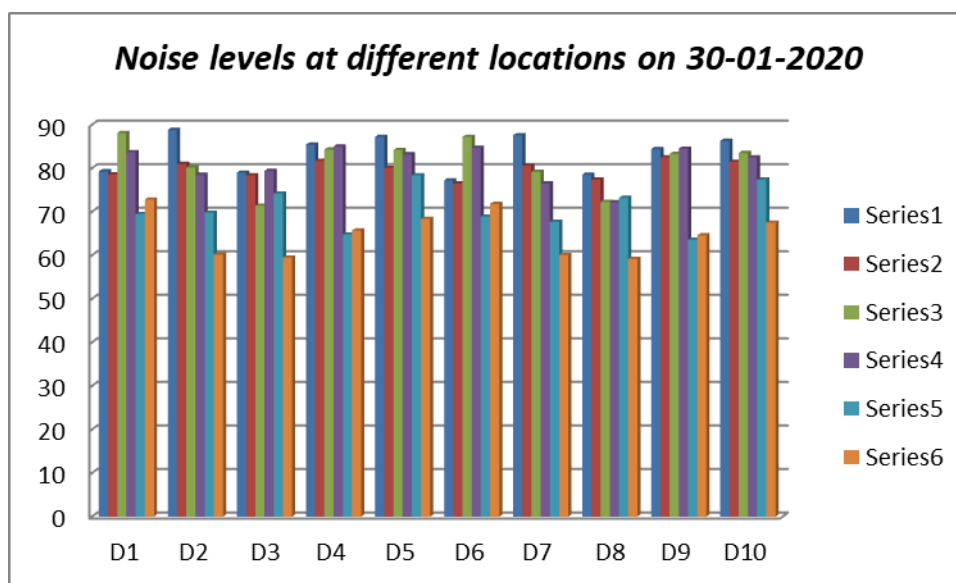
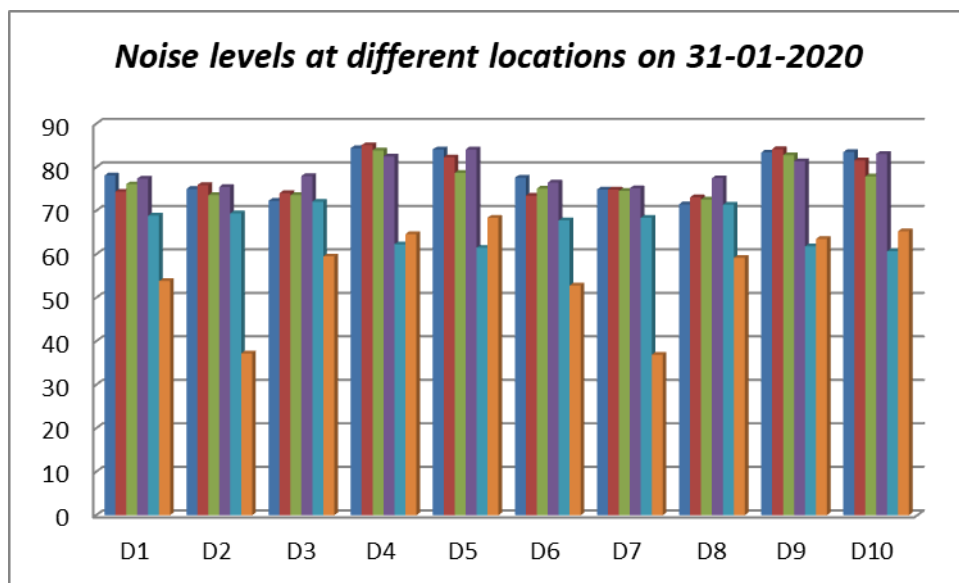


Table 4.7: Noise levels at different locations on 31-01-2020

Time	Sound Levels Leq dB (A)									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
18:00 - 19: 00 hrs (Day)	78.1	75	72.3	84.4	84.1	77.6	74.9	71.5	83.4	83.5
19:00 - 20:00 hrs(Day)	74.4	75.9	74.1	85.1	82.3	73.5	74.9	73.1	84.2	81.6
20:00 - 21:00 hrs(Day)	76.1	73.6	73.6	83.9	78.7	75.1	74.6	72.6	82.8	77.9
21:00 - 22:0 0 hrs(Day)	77.4	75.5	78	82.5	84.1	76.5	75.2	77.5	81.4	83.1
22:00 - 23:00 hrs(Night)	68.9	69.4	72.1	62.3	61.5	67.8	68.4	71.4	61.8	60.7
23: 00 - 24:00 hrs(Night)	53.84	37.18	59.5	64.62	68.4	52.82	36.9	59.2	63.55	65.3

Figure 4.7: Noise levels at different locations on 31-01-2020



The noise was recorded in different area of Lucknow city categorized. It is revealed that the range of noise levels in all the areas were much higher than the permissible values as per standards.

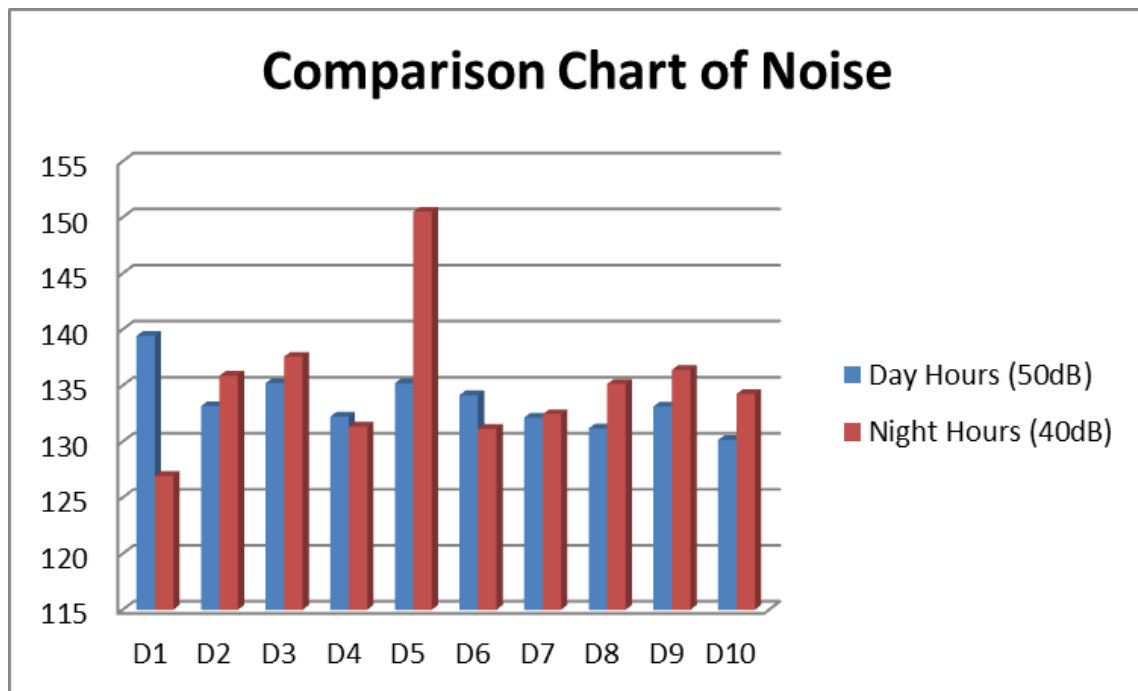
The permissible noise limits of the silent zone are 50 dB in the day time and 55 dB in the night time. Generator, traffic congestion, indiscipline and over commercialization were basically responsible for the high noise pollution.

Table 4.8: Results of different Zone						
S.No.	Site	Range of Noise Levels (in dB)		Comparison* of Max. Noise level with CP CB limit (in %)		Whether in limit? (Yes/No)
		Day Hours	Night Hours	Day Hours (50dB)	Ni ght Hours (40dB)	
1	Dr. Shyama Prasad Mukherjee Hospital, Hazratganj	74.26-90.63	53.84- 69.82	139.43	126.95	No
2	Saamudaayik Swasthya Kendra, Chinahat	70.35-86.56	37.18- 74.74	133.17	135.89	No
3	Balrampur Hospital, Golaganj	70.17-87.89	36.87- 75.67	135.22	137.58	No
4	Raam Manohar Hospital, Gomati Nagar	74.46-85.95	64.62- 72.24	132.23	131.35	No
5	Lok Bandhu Raj Narayan Hospital, Kanpur Road	74.30-87.89	57.73- 82.78	135.21	150.51	No
6	Rani Laxmi Bai Hospital,	68.2-91.63	52.82-71.8	134.15	131.15	No

	Rajajipuram					
7	Samudayik Swasthya Kendra, Bakshi Ka Talab	69.30-87.6	36.9-74.02	132.15	132.45	No
8	Samudayik Swasthya Kendra, Mohanlalganj	71.5-86.59	35.9-74.2	131.18	135.15	No
9	Samudayik Swasthya Kendra, gosaiganj.	73.9-86.55	61.8-71.3	133.14	136.40	No
10	Prathamik Swasthya Kendra, Jugaur	75.1-86.5	57.9-80.70	134.15	134.25	No

Note: % = (Max. L_{eq} /Permissible Noise Limit)*100; Day Hours are reckoned from 6 am to 10 pm; Night Hours are reckoned from 10 pm to 6 am.

Figure 4.8: Results of different Zone



**CHAPTER
5**

CONCLUSION AND RECOMMENDATIONS

During the study period it was found that all the values of noise level at all the selected sites was high than the prescribed limit of CPCB. The noise in all the areas of Lucknow city is drastically higher and therefore suitable control measures need to be adopted urgently in the city before it is too late. Here are some recommendations.

1. There should be no submergence of the silent zone with the other zones to avoid the interference of noise pollution by any means.
2. The residential areas should be guarded by the noise barriers like green belt development to enhance the sustainable development, turn down global warming and coherently reduce the noise pollution.
3. The commercialization of the residential areas should be immediately barred to avoid the chaos in the city.
4. The commercial areas apart from being separated from the other zones must be kept under the CPCB guidelines. Strict penalty should be put on the persons responsible for noise from generator. Traffic should be handled in a proper way by providing parking space and broadening the roads without affecting the eco-system.
5. The unlawful use of loudspeakers by the persons in disguise of religious aspects or other reasons without permission should be heavily penalized.
6. A committee can be organized to maintain the peaceful environment in the city, with the anonymous public complain system and penalize whosoever against it.
7. Apart from the above official measures, proper awareness must be spread among the people, about the negative impacts of noise pollution and the legislative rules, through schools, engineering and other educational institutions. This can be further supported by other communication means of entertainment like radio, etc., thus teaching people to be in discipline the first thing being taught to a child.

8. Technically, the noise pollution can be controlled by advancing the automobile horn system and public traffic system by using sensors, etc.
9. More research and development seems to be needed in this area, followed by more and more surveys.

Often neglected, noise pollution adversely affects the human being leading to irritation, loss of concentration, loss of hearing, etc. Intentionally or unintentionally, each one of us contributes to noise pollution, because most of our day-to-day activities generate some noise. Hence, controlling the noise pollution is impossible unless each one of us is aware about it. It is high time and everyone should play his part in curbing the noise pollution, which is otherwise agreeably or disagreeably a Slow Poison.

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APPENDICES



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