STATUS OF NOISE IN YESHWANTHPUR CIRCLE (BANGALORE NORTH) BASED ON ON-SITE DATA RECORDINGS AND ANALYSIS

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Abstract

The most unbearable environmental pollutant in the present day condition is the noise. It is definitely an unwanted sound. In the present day, noise levels have gone up in almost all the places, which is proved as health hazard, causing harmful physical and physiological problems.

Bangalore is the fastest growing city in Asia. Many manufacturing industries and multi- national companies for software development are making their bases in Bangalore, because of favorable environment. Rapid urbanization of Bangalore city have increased the human population, industries and vehicular population, which are the major sources of noise. Hence, it was felt necessary to carry out the proposed study to assess the noise levels in the selected part of Bangalore.

The survey area covers a distance of 15Kms around the periphery of M.S. Ramaiah Institute of Technology. In north of Bangalore this area was chosen to assess the present noise levels and compare with the permissible limits of sound pressure level. The selected area was covered by locating 15 stations on the boundary. Noise level measurements were made at respective stations. The sound level reading were recorded for fifteen days. The daytime survey was conducted for eight days followed by night time survey for next seven days.

During day time survey was conducted from morning 6AM to 10PM. (for about 5 to 10 minutes at each location). A week after that noise levels were measured at the same locations during night time from 10PM to 6PM at peak and non peak hours.

The noise measurements were carried out using sound level meter (SLM) Lutron-4011.

All Leq values are compared to the permissible limits and a detailed study was carried out. In the commercial area all the locations were mostly affected. The silent zone was also affected with noise pollution during day time due to the construction activities in the residential areas and also huge increase in population. The noise pollution can be reduced by several methods such as by diversion of traffic flow, provision of smooth road surface, control of speed breakers, banning of horns, plantation of tree and also some legal measures to avoid further worsening of problems.

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1. INTRODUCTION

Noise is a word used to describe which humans consider to contain little information or which they actually find unpleasant. The word “noise” is derived from the Latin word “nausea”, meaning seasickness. Noise is among the most pervasive pollutants today. Noise from road traffic, jet planes, construction equipment, manufacturing processes, irrigation pumps, loud speakers, etc are audible litter that broadcast into the air, which breaks the silence of the environment.

Noise has gained such an intensity that it grates on everyone's nerves. Surveys of complaints and physical measurements, all show noise pollution to be one of the major hazards of modern life, especially in urban areas - areas which are the most industrialized and motorized. It is the ubiquitous accessory of mechanical age we live in. Noise spreads both horizontally and vertically and vertically and thus tranquility of most cities is shattered.

Noise is the general word used to refer to unmusical, confused or inharmonious loud sounds, which are unpleasant or unexpected. The origin of noise is in human activities or as a part of environmental phenomena. Noise control advocates are unable to develop the same kind of consistency that has developed to support the cause of clean air, preservation of forests.

The World Health Organization (WHO) has brought out a document named as “Community noise” in assessing the noise-inducted effects, the global criterion is human health. The established definition of WHO says “health is a state of complete physical, mental and social well being and not merely the absence of the disease of infirmity”. This is a wide

conceptualization, which explicitly covers impacts of such disturbance and impairment of human activities and related annoyance reactions.

Almost all noise effects are undesirable, yet in many cases a conscious decision needs to be taken for prescribing the standards. As per the "The Noise Pollution (Regulation and Control) Rules, 2000" based on land use category a city/ town has been classified into four zones\ areas, viz,. Industrial zone, Commercial zone, Residential zone and Silent zone

2. CASE STUDY

2.1 Statement of the Problem

The significant increase in urban population, due to the growth of industrial and commercial activities has resulted in the city roads getting over crowded with vehicular traffic. Since the number of vehicles increase is 2272239 in 2005 to 2880426, the increase has been disproportionate to infrastructure facilities like roads. The result of this is the increase in noise levels causing noise pollution, affecting the environment and the human beings in general.

The Noise pollution regulation and control rules has stringent noise level standards prescribed for the different zones. Since the growth of the city was fast and uneven, several zones are entrapped in one another causing noise pollution a big threat to each one of these zones.

Noise levels were recorded at fifteen locations covering a periphery of about 15 kilometers around M.S. Ramaiah Institute of Technology. This is to conduct a detailed study on the extent of city traffic is responsible in causing a noise pollution.

This problem consists of:

1. Collecting the data on noise levels in the urban districts of Bangalore, categorized under different zones,
2. Providing recommendations for future changes,
3. Assessing probable factors contributing to the prevailing noise levels,
4. Providing data for further corrective and remedial measures,
5. Studying efficacy of existing legislation,
6. Planning for future is assisted to overcome the existing problems.

2.2 Objectives of the Present Study

Main objectives of the present study are:

1. To measure the noise levels in the chosen areas from urban districts of Bangalore.
2. To compare existing noise levels with standards to assess noise pollution in the chosen areas.
3. To locate the problematic areas having noise levels higher than prescribed limits.
4. To provide recommendations for preventing and controlling the noise pollution.
5. An attempt to apply GIS and GPS techniques for analyzing noise measurements

2.3 Scope of the Present Study

Bangalore is the fastest growing city in Asia. The rapid urbanization and industrialization of Bangalore city have increased the human population, industries and vehicular population, which are the major source of noise. The noises from the automobiles are a big concern now, as it is affecting the human life. The sampling stations for noise measurements were selected in urban areas of Bangalore. This is to know the prevailing noise levels for determining:

1. A base line data from which future changes can be made,
2. Important factors contributing to noise levels that can be controlled by concerned authorities,
3. The efficacy of existing legislation for noise abatement.

2.4 Limitations of the Present Study

The current study had been done with certain external constraints resulting in the following limitations:

1. The survey of noise level measurements were done in the months of winter hence noise intensities in different seasons could not be ascertained.
2. In the month of December for a few days, some schools were closed and hence on those days the noise originated from all school vehicles could not be accounted.
3. Absence of base lie data, specifically in residential zone was a major limitation.
4. Judicial interpretation and application of noise pollution rules was not available.

3. FIELD STUDIES

3.1 Sampling Stations

The sampling stations are listed in the table and are highlighted in the map below:

Station	Station ID
Ayyappa Temple	S1
CNR Circle	S2
Divanarapalya	S3
ISRO Circle	S4
Maha Bazar	S5
Mattikere Bus Stand	S6
New BEL Road Circle (Service	S7
Petrol Bunk	S8
Ramaiah College	S9
Ramaiah Hospital Entrance	S10
Reliance Fresh	S11
Sadashivanagara Police Station	S12
Sundaranagara Park	S13
Toll Gate Circle	S14
Yeshwanthapura Circle	S15

3.2 Measurement and Recording of Data

In the first week samples were collected at each sampling station during the day time from morning 6AM to 10PM. In the second week samples were collected during night time from 10PM to 6AM. At all sampling stations10 minutes were spent to record the sound level. To complete each cycle connecting all fifteen locations the time taken was approximately 2 to 3 hours depending on the peak and non peak hour traffic. The night time recording was also done by spending the same amount of time as in the mornings (5 to 10minutes). Number of cycles completed during each night varied due to change in traffic levels. The noise levels were recorded continuously to obtain maximum noise level and minimum noise levels.

3.3 Specimen Calculations

Specimen calculations based on readings taken at Sampling Station S15 – Yeshwanthpur Circle on Friday, 21-Dec-2007 at 06:00 AM are shown. The set of readings that constitute the base data are shown in the table below:

3.3.1 Equivalent Sound Level (L_{eq})

Equivalent sound level can be defined as the constant noise level over a given time period that produces the same amount of –weighted energy as fluctuating level over the same time frame.

<---------- READINGS ---------->									
66.8	66.9	71.2	70.1	70.7	72.0	67.9	68.9	67.6	74.1	75.6

$L_{eq} = 10\log_{10}\sum_{i=1}^{i=n} f_i 10^{[illegible]}$ where f_i is the fraction of time the constant level l_i is present.

For the set of readings above, f_i is taken as:

$$f_i = \frac{\text{Steady Duration}}{\text{Total Time}} = \frac{10}{90}$$

i.e., L_{eq} = 71.2 dB

3.3.2 Noise Pollution Levels (L_{NP})

It was found by researchers that L_{eq}, the equivalent continuous sound levels on an energy basis, was an insufficient descriptor of the annoyance caused by fluctuating noise. Robinson included another noise pollution level NPL or L_{NP}, which he defined as:

$$L_{np} = L_{eq} + K\,\sigma$$

Where,
L_{np} = noise pollution level, L_{eq} = equivalent sound level, K = constant = 2.56 and,
σ = Standard deviation of the sound levels.

For the chosen specimen data set, the formula translates to:

$$L_{np} = 72.4 + 2.56 \text{ X } 1.43 = 76.1 \text{ (rounded)}$$

Where, σ = 1.4 is the Standard Deviation of L_{eq} for the entire day's readings and,
L_{EQN} = 72.4 is the entire day's normalized L_{eq}

3.3.3 Day Night Average Sound Levels (L_{DN})

Day night average sound level L_{DN}, is one of the general objectives techniques of evaluation of annoyance caused by noise. Here the extent of annoyance caused due to various noise sources is evaluated in the form of an index. In this method equivalent continuous sound level is measured for 24hours and to accommodate the nocturnal discomfort and inconvenience, a penalty of 10dB is applied to night - time levels.

This scale was suggested for community noise assessment by US environmental protection Agency as an improvement on basic L_{eq} to take in to account the increased annoyance, caused during time of comfort in the night. This index is supposed to be a better indicator for psychological disturbance

$$L_{DN} = 10\log_{10}\left[\frac{1}{24}\left(\sum_{i=1}^{15} 10^{\frac{L_{Di}}{10}} + \sum_{i=1}^{9} 10^{\frac{L_{Ni}+10}{10}}\right)\right]$$

Where, L_{Di} = Equivalent sound levels during day hours and, L_{Ni} = Equivalent sound levels during night hours.

For the chosen specimen data set, the individual L_{eq} calculations tabulate to 71.2, 73.2, 72.0, 70.1 and 74.2 respectively for the 5 cycles of readings during the day. The average of these readings is 72.2 and corresponds to the L_{DN} for the day. The formula has been normalized for the number of cycles of readings. i.e., L_{DN} = 72.2 dB

4. ANALYSIS AND DISCUSSIONS

The study provides:

1. Measurements of noise levels in the chosen ares from urban districts of Bangalore.
2. Comparison of existing noise levels with standards and an assessment of the noise pollution in the chosen areas.
3. Location of problematic areas having noise levels higher than prescribed limits.
4. Recommendations for preventing and controlling the noise pollution
5. A study with respect to the efficacy of existing legislation
6. Plans for future to overcome the existing problems.

Analysis and discussions related to data recorded at Sampling Station S15 – Yeshwanthpur Circle, are detailed in this paper. The detailed report deals with analysis and discussions related to the above for each sampling station, followed by the respective graphs and tables. In the graphs and tables, the parameters used and their description are:
LPER: Noise Level Permissible as per stipulation, Lmin: Minimum noise levels;
Lmax: Maximum noise levels; Leqdn: Equivalent sound pressure level for Day-Night;
Leqn: Equivalent sound pressure level for Night; LNP: Noise Pollution Level for the day

4.1 Station S15 – Yeshwanthpur Circle

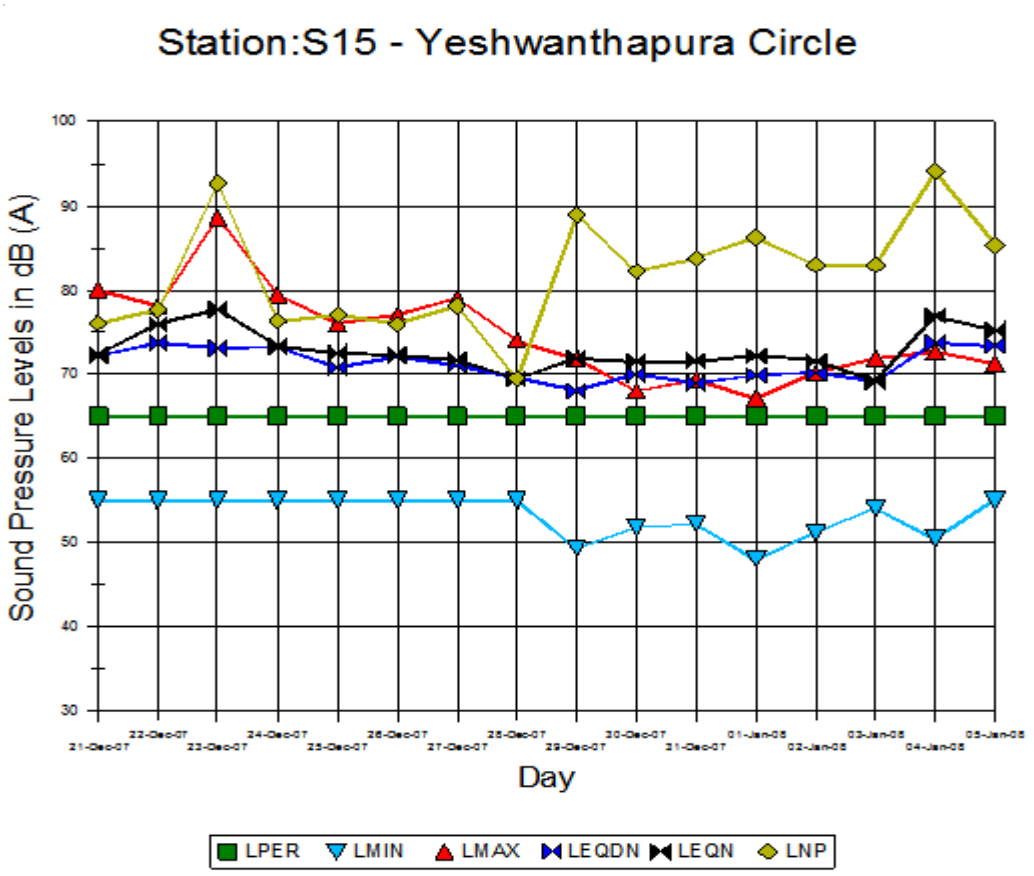
Yeshwanthpur circle is a commercial zone. It is a hub of commercial activities as the market is located close by. The circle is always crowded with heavy vehicles to lighter vehicles. Construction work for an over-bridge is in progress. Lmin at this station was observed to be ranging from 51.8dB to 55.0dBduring daytime. Lmin was as low as 49.3dB on Saturday, Lmin was observed to be ranging from 48.0dB to 55.0dB during nighttime. Lmax was observed from 71.8 to 88.6dB for daytime except for a day, when it was 68dB. Lmax was observed from 67.1dB to 72.6dB for the night.

Leqdn (equivalent sound level for day and night) levels were found to be ranging from 67.9dB as the lowest and to 73.8dB as the highest. Highest value of Leqdn was obtained on Saturday, 22-Dec-07, as there was political procession moving in the same route. The lowest values of Leqdn were measured on Sunday, 06-Jan-08. Leqn values are ranging from 69.2dB to 76.9dB.

The Permissible Leq (equivalent sound level) is 65dB. Observed Leqn's at this station have always remained more than the permissible values allowed for the commercial zone. The observed Leqdn's at this station have always remained more than the permissible values allowed for commercial zone.

LNP (Noise pollution level) was found to be as low as 69.5 dB to as high as 94.0 dB.

The over-bridge that is in the process of construction should definitely be a solution to reduce the traffic flow and hence reduce the noise pollution too. Noise level trends graph and data based on measurements at this station are shown in the Table and Figure below respectively.



Date	L_{PER}	L_{MIN}	L_{MAX}	L_{EQDN}	L_{EQN}	L_{NP}
21-Dec-07	**65.0**	**55.0**	**80.0**	**72.2**	**72.4**	**76.1**
22-Dec-07	65.0	55.0	78.0	73.8	75.9	77.6
23-Dec-07	**65.0**	**55.0**	**88.6**	**73.1**	**77.7**	**92.6**
24-Dec-07	65.0	55.0	79.4	73.2	73.4	76.3
25-Dec-07	**65.0**	**55.0**	**76.0**	**70.7**	**72.5**	**77.1**
26-Dec-07	65.0	55.0	77.0	72.1	72.3	75.9
27-Dec-07	**65.0**	**55.0**	**79.0**	**71.1**	**71.7**	**78.1**
28-Dec-07	65.0	55.0	74.0	69.5	69.5	69.5
29-Dec-07	**65.0**	**49.3**	**71.8**	**68.0**	**71.9**	**88.9**
30-Dec-07	65.0	51.8	68.0	70.0	71.5	82.2
31-Dec-07	**65.0**	**52.2**	**69.3**	**68.9**	**71.5**	**83.8**
01-Jan-08	65.0	48.0	67.1	69.9	72.2	86.2
02-Jan-08	**65.0**	**51.2**	**70.1**	**70.1**	**71.6**	**83.0**
03-Jan-08	65.0	54.1	71.8	69.0	69.2	83.0
04-Jan-08	**65.0**	**50.4**	**72.6**	**73.7**	**76.9**	**94.0**
05-Jan-08	65.0	55.0	71.2	73.4	75.2	85.4
06-Jan-08	**65.0**	**50.0**	**67.0**	**67.9**	**69.9**	**81.3**

5. CONCLUSIONS

5.1 Observations and Analysis

Noise is a social problem and takes its origin from social, political and cultural activities. Sampling stations were selected to give a clear representation of zones such as industrial, commercial, residential and silent zones. The periphery of the surveyed area measures upto about 15 kilometers. Since the data collection has been over a period of 15 days and covers general holidays, holidays for schools, working days for schools and commercial establishments, and also during day and night, it can be concluded that the data samples are good from a statistical perspective. Given the wide variety of sampling stations selected, the results can be used as a good indication of the general noise levels across the city. The survey provides a good sample size that has provided statistical results and analysis that can be used for guiding control measures to be implemented to reduce the problems associated with noise pollution.

From the tabulated observations and the analysis, it can be concluded that noise levels in most of the areas have exceeded the stipulated noise levels for the corresponding zones.

5.2 Recommendations

5.2.1 Strategies for Effective Reduction of Noise Pollution

Following are the various strategies which can be adopted for effective reduction of noise pollution in the chosen geographic area:

1. Divert long distance traffic particularly heavy goods vehicles to an area clearly earmarked for such purpose thereby reducing the present suffering from the volume of traffic.
2. Create new roads and traffic schemes.
3. Close coordination between local planning authorities and highway authorities;
4. Locate and design hospitals, schools etc., to be away from the high traffic density zones so that they are not exposed to excessive or unacceptable levels of traffic noise.
5. Use barriers or insulation techniques to reduce the effects of noise.
6. Channelize traffic to relieve minor residential roads from heavy traffic.
7. Plan major roads through areas where a high noise level already exists and thus an increase would not matter.

5.2.2 Political Will

On the political front, the first problem is the lack of sufficient will to control noise pollution on the part of many political and community leaders. This is attributable to the fact that many local political leaders are so tied up to their local industrial economics that they fear and resist what they believe, perhaps quite truly, would be costly step in pollution control. And even when they begin to respond to pressure from the public about pollution problems, noise pollution will still be very low down in their list. A second characteristic problem for pollution control seems from the fact that while legal controls are politically compartmentalized, pollution respects no political jurisdiction and may affect larger areas, over running municipal state and even national boundaries.

5.2.3 Public Awareness

Public awareness needs to be created on the detrimental effects of noise. The two most common effects of excessive noise are nerve deafness and acoustic (or blast) trauma. The first occurs when the hearing mechanism is damaged by prolonged exposure to noise to the extent that the sensory nerve function is depressed and there is some degree of permanent hearing loss. Acoustic or blast trauma occurs when the eardrum is ruptured. There is some relationship between exposure to excessive noise and incidence of heart disease, cardio-vascular dysfunction, migraine headaches, gastro-intestinal disorders, allergies and other endocrine and metabolic disorders.

5.2.4 Vehicle Manufacturers and Users

Manufacturers of motor vehicles should aim at achieving some reduction of noise of their vehicles. It would not be difficult to do so, as data on spectral distribution and overall noise levels of different vehicles are available as also the effect of vehicle speed, gear ratio, acceleration and exhaust system on the noise levels of the respective vehicles. Owners of vehicles can by proper maintenance and care of different units, maintain noise levels at least as near the levels as that of new vehicles.

5.2.5 Holistic Measures

While framing the rules, technical inputs must be obtained from experts in the field of noise control regarding the limits to be prescribed and the form of administration required to control the hazard of noise pollution. Various strategies can be adopted for effective control of noise pollution. With the current trends of urbanization, population growth, increasing number of automobiles, appropriate remedial and control measures involving all walks of life and areas such as education, engineering, legislation, administration, social and legal areas are to be taken on priority on noise issues. By adopting suitable control measures, the situation could be bettered thus positively improving social health of the society.

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