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Case Study

TRAFFIC NOISE POLLUTION IN INDORE CITY: A CASE STUDY

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Noise pollution is excessive, displeasing human, animal or machine-created environmental noise that disrupts the activity or balance of human life. Unplanned development, lack of management at squares and sudden increase in the number of vehicles in Indore city, has led to major traffic mismanagement. Continuous exposure to noise may lead to temporary or permanent hearing loss. In addition, it may also induce other temporary or permanent physiological effects.

Keywords: Data collection, Noise, Public survey, Traffic

INTRODUCTION

The sound level above 50 decibel (dB) is considered to be the noise.

Continuous exposure may lead to temporary or permanent hearing loss. In addition to it, continuous exposure to noise may also induce other temporary or permanent physiological effects. Research shows that the onset of a loud noise will cause a startle response, characterized by muscle contractions, blink, and head-jerk movement. Also, larger and slower breathing movements, small changes in heart rate, dilation of pupils and a moderate reduction in the diameter of blood vessels in the peripheral regions occur (Burns, 1982). Results of various research also indicate that exposure to high noise levels (such as 95 dBA or more) acts as a stressor which over a long period may produce pathological side-effects and may therefore constitute a health hazard (Janson *et al*., 1996).

The most common frequency weighting in current use is "A-weighting" providing results often denoted as dB (A). This system yields a single-number rating of the noise, representing noise levels in a manner similar to the subjective impression of the human ear. The same unit is used throughout the data collection.

The objectives of the study were:

1. To Monitor the Noise Pollution Level (dB-A) due to Traffic in the Indore City at strategic locations.
2. To collect statistical data regarding public opinion regarding noise pollution its and health effects on their health.

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From the collected data of noise pollution, following parameters were calculated:

1. L_{10} (in dB - A): The noise level exceeded for 10% of the time over the study period.
2. L_{50} (in dB - A): The noise level exceeded for 50% of the time over the study period.
3. L_{90} (in dB - A): The noise level exceeded for 90% of the time over the study period.
4. L_{eq}: Equivalent Continuous Sound Levels: The L_{eq} is an 'A' weighted average measure of sound pressure levels over a given period of time.

   $L_{eq} = ((L_{10} - L_{90})^2 / 56) + L_{50}$
5. Traffic Noise Index (TNI): TNI is the A-weighted sound level sampled at numerous discrete intervals over the study period. TNI is a weighted combination of L10 and L90. It describes the noise level and fluctuant characteristic. It has good relativity with subjective response of public and can be used to evaluate disturbance of a mass of traffic volume to public. Value of 74 dB (A) is defined as threshold limit for outdoor noise level. TNI was calculated using the equation:

   $TNI = 4 \times (L_{10} - L_{90}) + (L_{90} - 30)$ (dB)
6. Noise Pollution Index (NPI): In order to predict the physical attribute of traffic noise and subjective response of people, noise pollution index, NPI is calculated from this equation:

   $NPI = (L_{eq} / L_b) \times 100$ (L_b is baseline value and taken as 75 dBA for high annoyance outdoors).

Indore City is a historical city situated on the banks of River Khan and Saraswati (22° 44' North, 75° 50' East). It's a nerve centre - of the economic activities of the state. Commercial capital of central India with a population is 18.37 lakhs.

MATERIALS AND METHODS

The noise metering was done using "Extech 407732 Type 2 Digital Sound Level Meter". The noise levels were recorded using a video camera as it was not possible to manually record the readings. This video later on helped in noting the readings. The sensor of the instrument was pointed towards the main noise source direction. Measurements were taken in decibel scale with A weighting. GPS location of the observation points were noted and the stations were marked on Google Maps. Due to this, it was ensured that all the strategic locations were covered. A total of 188 strategic locations were chosen throughout the Indore city.

Observations at each location were taken in 3 parts to cover the part of the day when traffic density was highest.

These times were selected in such a way to cover each variation in noise level as far as possible.

a. Morning hours: Time from 9-11 AM was selected for morning observation. The traffic at this time is of people going to their work places.

b. Afternoon hours: Time from 12.30 – 2.30 PM was selected for afternoon observation. This time was selected to consider movement of persons for lunch hours and mainly school buses.

c. Evening hours: Time from 6-8 PM was

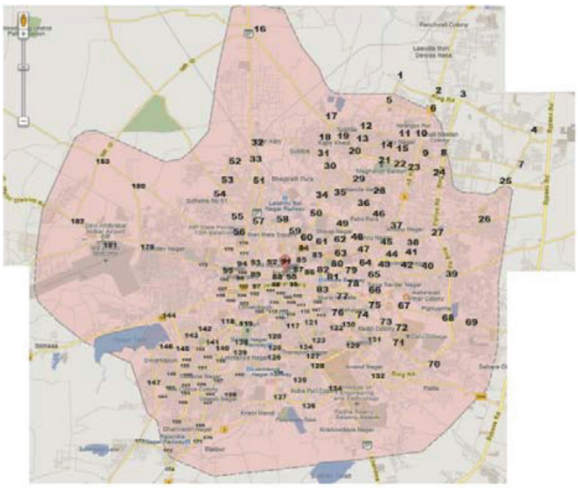
selected for evening noise observation. This is the time when service class people go back to home and also time of daily market related house hold purposes.

Nature of noise level is very fluctuating due to a number of factors. To accommodate this fluctuation, noise level at 10 s interval was recorded for 5 min at each location during each interval of time. This has yielded 3 sets of observations for each location.

From the data collected, L_{10}, L_{50}, L_{90}, L_{eq}, TNI and NPI was calculated.

A set of 17 questions was made; these included questions related to literacy level, age, work area, annoyance level and awareness of noise pollution and it's health effects. These questions were asked to several people working near the road and a leaflet of the questionnaire was distributed randomly throughout the city.

Figure 1: A Map Showing the Location of 188 Stations Througout Indore City



A map showing the location of 188 stations throughout Indore City.

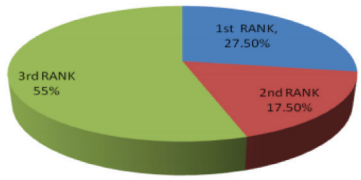
RESULTS

All of the 188 observation stations were found to be exceeding the limits of noise pollution as mentioned in IS: 4954 – 1968 (Reaffirmed 2006).

Public opinion survey through questionnaire was conducted. Based on the replies the following analysis is presented:

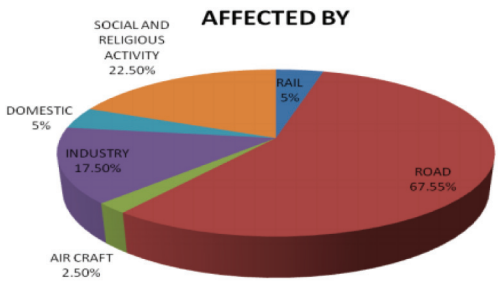
1. Priority of Noise Pollution and Literacy Level:

Figure 2: Noise Rank



2. Priority of Noise Pollution and age: The people of upper (above 60 years) and lower (below 25 years) age groups rank noise pollution higher than the middle age group people. This might be due to more sensitivity.
3. Priority of noise pollution as ranked by Males and Females: Male respondents rank noise pollution high. This is possible due to less exposure of females to the noisy outdoor environment.

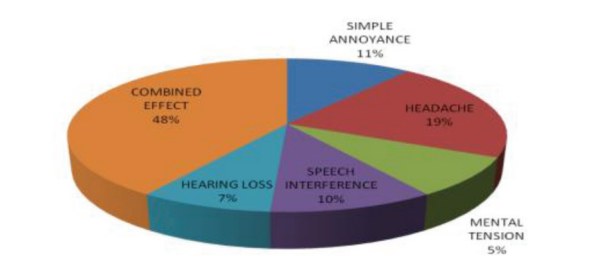
Figure 3: Affected By



4. Exposure to various type of noise sources: Highest numbers of people (67.55%) are exposed to high noise level due to traffic

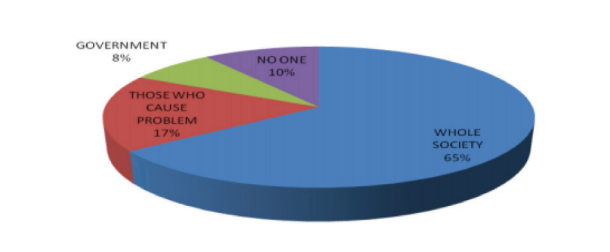
5. Noise and its effects:

Figure 4: How it Effects You



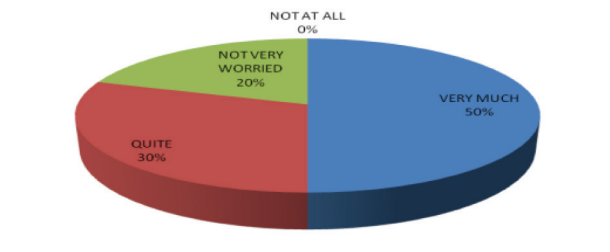
6. Responsibility of noise pollution:

Figure 5: Who is Responsible



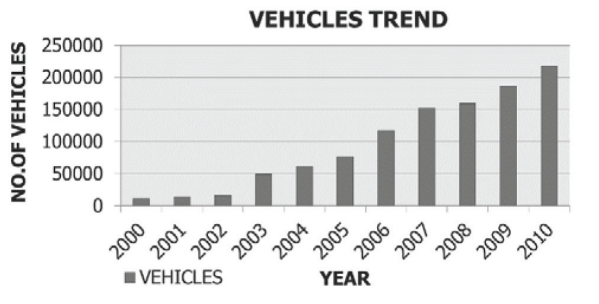
7. Awareness of health hazards:

Figure 6: How much you are Worried



As per the previous studies conducted in Indore city, number of vehicles registered in Indore city in 2010 was found to be 10,61,118. This data is directly related to the noise pollution generated by the traffic and the large volume of vehicles added with improper traffic management is the main reason of high noise pollution. The statistical data of Number of Vehicles in the Indore City is as follows: (Lashkari *et al.,* 2012)

Figure 7: Vehicles Trend



Moreover in a recent study conducted by a leading newspaper, it was found that in Indore city, there are 631 vehicles on every 1000 people. This increase in the number of vehicles and lack of foresight has led to chaos on the major roads. This has led to frequent jams and thus further increasing air and noise pollution.

Due to the construction work on the roads, BRTS project work and lack of proper diversions to the city traffic, the traffic is flowing in an unorganized and haphazard manner, further leading to the use of horns and mainly pressure horns. Also, because of lack of adequate number of traffic personnel at observation stations, mismanaged traffic signal durations, people often broke rules by driving wrong sides, breaking signals which often lead to traffic jams. Such a situation causes people to blow more horns. It was also found that wherever the traffic flow was smooth, the noise pollution levels were quite low.

CONCLUSION

As, all of the 188 observation stations were found to be exceeding the limits of noise pollution, Indore city is in dire need of properly

managed traffic system. Awareness has to be raised at district level to tackle the problem at grass root level.

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