

ANALYSIS OF TRAFFIC NOISE IN URBAN AREA

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ABSTRACT

This paper studies the problem of noise pollution on the roads of the campus of Institute of Engineering & Technology Lucknow, India. Due to the continuous redevelopment process conducted on the masterplan of the institute, the noise levels have significantly impacted the education environment. The purpose of this paper was thus to study the sources caused and maximized the noise levels at the campus and also formulate a prediction model, identified the guidelines used for designing or developing future campus masterplans. Then, the noise levels were measured based on three variables: skid number, vehicle speed, and distance from the classrooms at seven selected points of the main ring road surrounding the institute campus. Finally, the finding has shown that the classrooms' locations of the new urban additions, built in the last two decades, were laid out in the prohibited distance of road-traffic noise. In addition to that, it has confirmed that students studying in these classrooms are exposed to noise levels beyond the legislative norms and codes. Further, studying the alternatives used to improve the performance of the education environment in the existing campus of Institute of Engineering & Technology , Lucknow can be considered in the future research directions.

1. INTRODUCTION

The recent decades have been witness to emergence of environmental pollution as a substantial and significant global problem. Noise pollution is the set of undesirable sounds (called noise) produced by the industry, machinery and equipment and propagating through the environment. Those noises that are within the human's hearing threshold could become very annoying and potentially detrimental (Moudon, 2009). Exposure to excessive noise can seriously damage the animal and human hearing and is an important factor reducing the health and life quality of residents of large cities.

Other studies have found a relationship between the noise pollution produced by road traffic and the increase in blood pressure and heart attacks in adults and decrease in learning and memorization capability of children living within 100 m of primary highways with noise levels of higher than 70 dB.

Some studies have reported that the level of stress and irritability increases with the increase of noise pollution. In a study by Murthy et al. (2007) carried out in Banepa, the main cause of noise pollution was found to be the traffic of motorized vehicles. In a study by Seto et al. (2000) traffic of vehicles was reported as the main cause of noise in the urban environment; this study also reported that a tenfold increase in the traffic increase the urban noise by 6.7 dB. In a study by Patak et al. on the city of Varanasi, it was found that noise level is so high that 85% of the people are irritated by traffic noise and about 90% of resident's express noise as the main cause of headache, high blood pressure, dizziness and fatigue.

The purpose of this study was to provide a map of noise pollution in Lucknow, a city of roughly 28.2 lakhs, and to compare the level of noise pollution in different parts of the city. For this purpose, the sound level was measured at selected hours and days of the week. Then, using Mini- Tab16, the model were prepared. In addition, with the aid of statistical analyses, the noise pollution levels of different Locations of campus were compared.

Noise, commonly defined as unwanted sound, is an environmental phenomenon to which humans are exposed before birth and throughout life. Whether a sound is unwanted depends on when and where it occurs, what the listener is doing when it occurs, characteristics of the sound (loudness, pitch and duration, speech or music content, irregularity), and how intrusive it is above background sound levels. Noise can also be considered an environmental pollutant, a waste product generated in conjunction with various human activities. Under the latter definition, noise is any sound that can produce an undesired effect in an individual, and that may interfere with social ends of an individual or group.

These social ends include all activities such as communication, work, rest, sleep and others. As waste, the humans produce two general types of pollutants. The general public has become well aware of the first type – the mass residuals associated with air and water pollution – that remains in the environment for extended period of time. However, only recently has attention been focused on the second general type of pollution, the energy residuals such as the waste heat from manufacturing processes that creates thermal pollution of streams .

2. RESEARCH OBJECTIVES

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

- To study the problem of noise pollution on the campus road IET Lucknow, India.
- To study the sources caused noise level in IET Campus.
- To measure the noise based on three variable- vehicle speed, Distance and Skid Number from the IET at seven selected points of the main ring road.
- Studying the alternatives used to improve the performance of the educational environment in the existing campus can be considered in the future research directions.

3. METHODOLOGY

To achieve the objectives stated in this research, seven locations at the ring road of IET campus were selected to study the effect of three variables, including skid number, vehicle speed, and distance of the noise meter to the location, in influencing the noise levels.

3.1 Locations Selection

The locations were selected based on the change in surface texture, the nearby distance of classroom halls, and avoiding the presence of any speed reduction factor (such as bumps, pedestrian crossings, or bus stations).

Location 1 was selected to examine the new buildings, the classroom hall of the Biosciences Department, added to the education zone. It is located close to the campus ring road.

Locations 2, 3, and 4 were chosen to investigate the noise levels of classroom halls of other departments in departments. These buildings were initially dedicated to be classrooms in the masterplan of IET Lucknow.

Location 5 was studied to assess the performance of noise levels in relation to the building of the Library of College of Engineering.

Locations 6 and 7 were selected because there are wide open areas around them, and they might be subjected for the new developments of IET campus in the future.

3.2 Data Measuring And Analysis

The three variables have been examined at the selected seven locations to estimate the noise levels at each; . Breaking Distance Formula was used at each location to measure the skid number which is considered as one of the factors affecting the noise level.

A speed gun (Bushnell 101911) was used to measure the spot speed of vehicles passing each location. The gun was pointed in the direction of the moving vehicle, and the gun was set to measure the speed in km/hr. It sends signals to the moving objects and can capture any object moving in a speed more than 16 km/hr. Seven controlled speeds were used 30, 40, 50, 60, 70, 80, and 90 km/hr. at different distances from the sound level meter.

The third variable, the distance of the sound level meter to the location, was applied and five distances were considered in this research which are 0.5, 3, 7, 14, and 20 meters. Obviously, the closest the point to the noise source the highest the noise level measurement recorded.



Figure 1: (b) measuring vehicle speed; (c) noise level meter

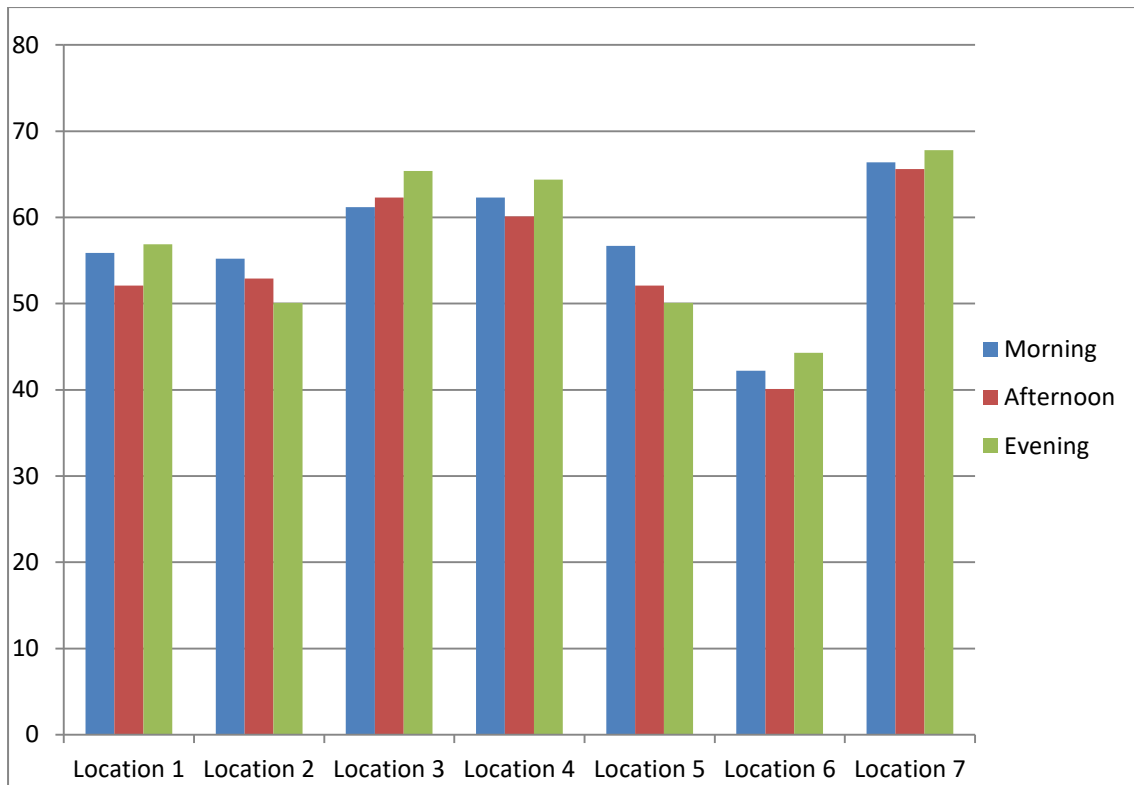


Figure 2: Weekly Average Noise Level for three studied hour

4. Data Analysis

Instrumentation used in this study for the environmental noise measurements consisted of a precision-grade sound-level meter (according to IEC 651, ANSI S1.4 type 2 class standard) one 1/2-in. condenser microphone and 0.33-octave filter with frequency range and measuring level range of 31.5 Hz–8 kHz and 35–130 dB, respectively.

This procedure was carried out for morning (7:00–9:00 a.m.), afternoon (2:00–4:00 p.m.) and evening (6:00–8:00 p.m.) measurements. A total of 7 locations were assessed for noise pollution level.

These noise measures are defined as follows-

$$L_{Aeq} = 10 \log_{10} \frac{1}{N} \left[\sum_{i=1}^{i=k} \left(\text{Antilog} \frac{L_{Ai}}{10} n_i \right) \right]$$

Where:

N = the total number of samples taken

Leq = the noise level in dBA of the kth sample

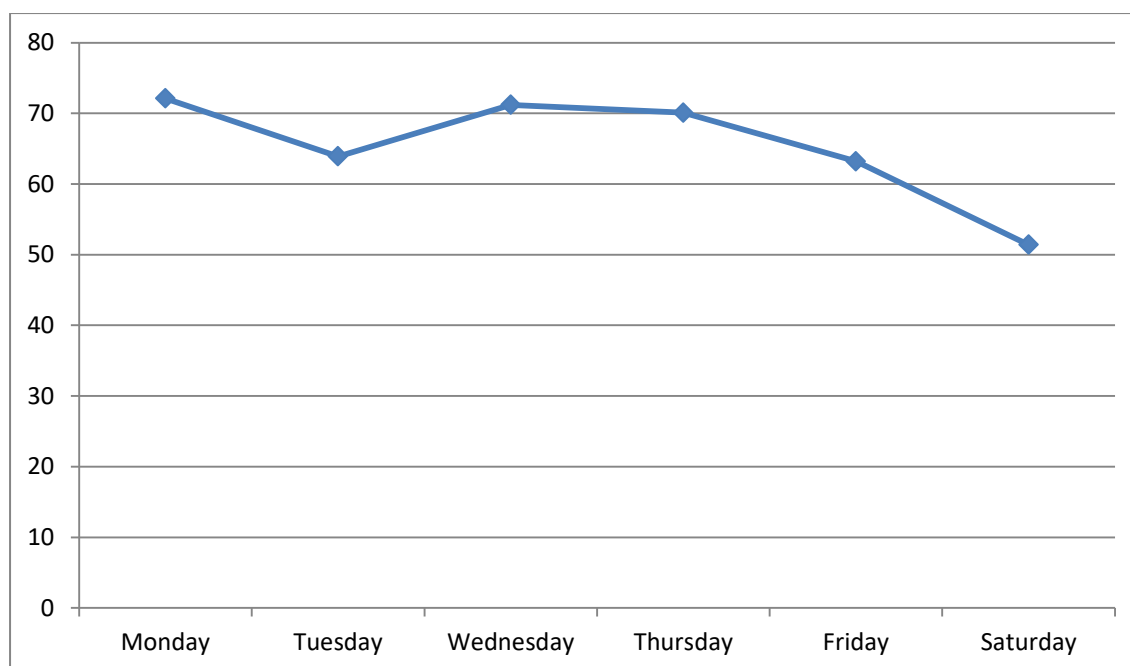


Figure 3: Average Noise Intensity during a week

5. Result And Discussion

The noise pollution in Lucknow city was investigated in this study. The eastern areas of Lucknow city had the highest noise pollution due to a large number of vehicles that were travelled through the streets.

The highest noise pollution in IET institute was measured on Monday and Tuesday (about 71 dB). The noise pollution was slightly reduced to 60 dB On Wednesday and Thursday and it was sharply reduced to 55.8 dB on Friday.

More than 23 percent of recorded noise levels in the college of Arts had values between 61 and 63 dBA. About 22 percent of readings in the college of education had levels ranging between 56 and 58 dBA. In the college of Administration more than 32 percent of readings had noise level varied between 53 and 57 dBA, whereas 18 percent of levels in the college of mathematics and programming science had noise pressure between 57 to 59 dBA. In the college of Dentistry more than 26 percent of readings possess noise pressure level ranging between 55 to 57 dBA.

The disarray sudden action inside the hall such as chair trail, scream or any other action is usually caused sudden impact noise. From this viewpoint the library of the college of education has the higher confusion level followed by the library of the college of administration.

It has been found that five of the examined locations (colored by green in the map) were avoided the road-traffic noise and considering the noise guideline levels that would cause serious annoyance and study disturbance.

In contrast, the rest two locations (colored by red in the map) were very vulnerable to the road-traffic noise. It should be mentioned here that the two locations were developed or modified to be classroom halls by campus designers and engineers who ignored the prohibited limits of traffic noise and land use plan.

6. References

1. Coulson, Jonathan, Paul Roberts, and Isabelle Taylor. *University planning and architecture: The search for perfection*. Routledge, 2015.
2. Sommerhoff, Jorge, Manuel Recuero, and Enrique Suárez. "Community Noise Survey of the City of Valdivia, Chile." *Applied Acoustics* 65, no. 7 (July 2004): 643–656. doi:10.1016/j.apacoust.2004.01.003.
3. Georgiadou, E., K. Kourtidis, and I. Ziomas. "Exploratory traffic noise measurements at five main streets of Thessaloniki, Greece." *Global Nest International Journal* 6, no. 1 (2004): 53-61.
4. Piccolo, A., D. Plutino, and G. Cannistraro. "Evaluation and Analysis of the Environmental Noise of Messina, Italy." *Applied Acoustics* 66, no. 4 (April 2005): 447–465. doi:10.1016/j.apacoust.2004.07.005.
5. Otutu, Oseji Julius. "Investigation of environmental noise within campus 2, Delta State University, Abraka, Nigeria." *IJRRAS* 6, no. 2 (2011): 223-228.

6. Zannin, Paulo Henrique Trombetta, and Carolina Reich Marcon. "Objective and Subjective Evaluation of the Acoustic Comfort in Classrooms." *Applied Ergonomics* 38, no. 5 (September 2007): 675–680. doi:10.1016/j.apergo.2006.10.001.
7. Guedes, Italo C. Montalvão, Stelamaris R. Bertoli, and Paulo H.T. Zannin. "Influence of Urban Shapes on Environmental Noise: A Case Study in Aracaju — Brazil." *Science of the Total Environment* 412–413 (December 2011): 66–76. doi:10.1016/j.scitotenv.2011.10.018.
8. Meng, Qi, and Jian Kang. "Effect of Sound-Related Activities on Human Behaviours and Acoustic Comfort in Urban Open Spaces." *Science of the Total Environment* 573 (December 2016): 481–493. doi:10.1016/j.scitotenv.2016.08.130.

