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Noise Pollution Analysis during Chhath Puja in Gorakhpur City

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Abstract—Noise pollution beyond a level is harmful. Recently noise pollution has been well recognized as one of the major trepidations that impact the quality of life in urban areas across the globe. The present work, shares the assessed data regarding noise levels in the commercial areas of Gorakhpur city during Chhath puja which is celebrated by major people in Hindu Religion in Uttar Pradesh and Bihar. Selected points as per their purpose were sampled in commercial zone in order to cover the whole commercialized and populated area of the city. The observation sites were selected at ten different locations in commercial areas of Gorakhpur city and Energy Equivalent noises (Leq) for hourly observations for noise were made at these sites. The relative standing of noise with respect to regulatory norms was looked into and the range of minimum and maximum values of Leq was also workout. It is found that the noise levels are generated by traffic volume and congestion, generators and people on roads. It is also seen that, on many sites, significant increase in noise is observed whole day as because of public holiday. Maximum people were in the market for shopping and after 2 p.m. people were in chaos to arrive at Chhath ghats and other establishments and commercial activity picks up. Due to Chhath puja daily traffic volume in the market was larger than the normal days. It is suggested that implementation of speed limit to vehicles on road, provision of silencers and sound proof generators, traffic diversion, phasing out of old noisy vehicles, declaration of no horn zone and provision of noise barriers, wherever feasible, along with tree plantation may be considered for reduction of noise.

Keywords— Noise Pollution, Sound Level meter, Equivalent Noise Level, Physiological Effects, Environmental Noise

I. INTRODUCTION

A. Background

Sound is the vibration in the air that reaches our ear, where noise is unwanted or excessive sound. In developing country like India, faces several environmental pollutions. These environmental problems include air, water, and noise pollution. Out of all, noise pollution is one of a major concern for people residing in city areas. The factor contributing high noise levels are increase in population and increase in the traffic volume. Traffic noise acts as a new headache for people living near highways.

B. Importance Of Study

Gorakhpur is a city located along the banks of Rapti river, in Uttar Pradesh. It is located nearby the Nepal border, 273 kilometres east of the state capital Lucknow. It is the administrative headquarter of Gorakhpur District and Gorakhpur Division. The city is home to the Gorakshanath Temple. Gorakhpur district lies between latitude 26°46'N and longitude 83°22'E. The district covers an area of 7,483.8 square kilometres (2,889.5 sq mi). Two National Highway (NH-28 & NH-29) is passing through Gorakhpur which runs from Gorakhpur to Lucknow and Gorakhpur to Varanasi respectively. From civic point of view various township projects are under construction. GDA (Gorakhpur Development Authority) is running various projects for the modernization of the city. GIDA (Gorakhpur Industrial Development Area) is the industrial area having various industries. A large volume of traffic is controlled by the city because of its importance and road network. So this will give rise to a high traffic noise, which needs to be take care of.

C. Environmental Noise

Noise is characterized as unwanted sound. Encompassing noise or environmental noise is unwanted or unsafe open air sounds made by human practises, including noise emitted by transport (e.g. street traffic, air traffic) and noise from locales of modern action.

Environmental noise pollution is a danger to the human-kind. It is more serious, and it will keep on increasing in size and seriousness by virtue of present societal patterns to be specific population development what's more urbanization. Its seriousness will increase, in connection with the increment in the utilization of dynamically all the more capable, changed, and exceedingly portable wellsprings of noise.

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D. Noise Pollution

The words that are continually heard in the media and scholastic rounds are "climate change and global warming". These words are connected with studies focused around carbon dioxide discharges and over the top high temperature. As per man made considering, for the most part, people don't accept that the noise sways upon the earth. They accept that honestly normal air poisons have more compelling results for the planet rather than noise.

E. Causes Of Traffic Noise

Noise comes from many sources: one of significant source is from transportation. Noise comes from three sources (a) the friction between vehicle tyres and road (b) the engine and (exhaust). The level of highway traffic noise depends on:

- 1) Speed of the traffic
- 2) Traffic volume

F. Effects Of Noise On Human Beings

- 1) *Physical Effects of Noise:* Noise of a high intensity volume will cause either temporary or permanent damage to our hearing. The science behind these injuries is well understood. High volume of sound will give rise to noise-induced hearing deficits that can be experienced in various situations. Considering the significant variations in human ear sensitivity to noisy environment, it could cause hearing impairment, and this hazardous nature of noisy. Environment is termed as "damage risk". The risk is considered negligible when the equivalent sound level is less than 75dB for an exposure period of 8 hours.
- 2) *Physiological Effects:* Noise may cause temporary stress reactions (increasing the heart rate and blood pressure), and produce negative effects on our coordination system and respiratory systems. Noise can cause persistent increase in blood pressure after a long term exposure to noise. A few studies were made on general population comparing the physiological behavior of those living in noisy street to those living in Quiet Street. The result shows that there is an increase in blood pressure in those people living in noisy street.

II. OBJECTIVE

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

To quantify the levels of noise pollution in Gorakhpur.

To compare the result with WHO standards for noise specification.

To draw the noise profile of different places of Gorakhpur at various hours of the day.

A. Study Framework

In any case, this study finds out the level of noise pollution and, also, talks about the effect of traffic noise on the inhabitants of Gorakhpur region. Later writing about noise pollution will be inspected.

- 1) *Chapter 1:* Introduction is pointed at briefing the spectator about the setting of the study. Furthermore this part gives an issue proclamation and records the objectives to be accomplished all around the study.
- 2) *Chapter 2:* Literature Review gives a short demonstration about noise/environmental noise pollution. It additionally incorporates past and current writing with respect to noise pollution.
- 3) *Chapter 3:* Present study: Noise pollution in Gorakhpur is highlighted/ researched. Likewise recognized are the measuring techniques that were utilized throughout the noise review that was directed in Gorakhpur.

III. PROJECT METHODOLOGY

This chapter explains how the noise assessment in Gorakhpur city was conducted. In the present study, the noise levels have been recorded with the help of Precision Noise Level Meter of make 'Bruel and Kjaer, Denmark (2232)'. The data have been collected for overall 14 hours for noise measurement which includes both day and night time for noise measurement on the respective days at the selected sites. The time interval of 5:00-6:00 a.m. was selected for night time whereas hourly samples were taken from 8:00 a.m. to 12:00 a.m. and 2:00 p.m. to 10:00 p.m. during day time. The time intervals are so selected as to cover most part of the day, from calm mornings, rush hours, pleasant evening, to silent nights, as they should be respectively. As far as possible, outdoor measurements have been taken from at least 1.5 m above the ground level and at least 3.5 m from reflecting surfaces, and indoor measurements were made at least 1.5 m above the floor, at least 1 m from walls and 1.5 m from the windows at the concerned hours for 10 minute duration at fixed intervals of 15 seconds. So about 20 readings are taken using the formula for each observation hour

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Illustrations of the instruments used during noise readings and the specific measuring points are also provided.

A. Measuring Instrument

Precision Sound Level Meter Type 2232 is an inexpensive instrument for primarily making community noise surveys and less demanding acoustic measurements, but nevertheless offers the accuracy and quality associated with a precision-grade sound level meter. Its excellent ergonomic design and ease of operation enable even the inexperienced user to carry out reliable measurements quickly and effectively. The handy convenience of a Type 1 precision sound level meter which can be carried around in a pocket will be appreciated by all users. A large, easily read digital display gives a single value indication of the maximum A weighted sound level measured during the previous second, thereby eliminating meter reading errors. Type 2232 is robust, compact and lightweight (460 g), and is the ideal tool for environmental health inspectors and other personnel concerned with maintaining acceptable noise levels in industrial and residential locations, for instance police officers checking vehicle noise.

B. Study Area

Gorakhpur is a city located along the banks of Rapti river in the **eastern** part of the Indian state of **Uttar Pradesh**. It is located near the Nepal border, 273 kilometres east of the state capital Lucknow. Gorakhpur district lies between latitude 26°46'N and longitude 83°22'E. The district covers an area of 7,483.8 square kilometres (2,889.5 sq mi). It is bounded by Maharajganj district to the north, Kushinagar and Deoria districts in the east, (Rajesultanpur) Ambedkar Nagar, Azamgarh, and Mau districts to the south, and Sant Kabir Nagar district to the west. The district is part of Gorakhpur division. According to the 2011 census, Gorakhpur district has a population of 4,436,275, roughly equal to the nation of Croatia or the US state of Kentucky. This gives it a ranking of 40th in India (out of a total of 640). The district has a population density of 1,336 inhabitants per square kilometer (3,460/sq mi), Its population growth rate over the decade 2001–2011 was 17.69%. Gorakhpur has a sex ratio of 944 females for every 1000 males, and a literacy rate of 73.25%.

The following location are marked where, the noise are to be observed.

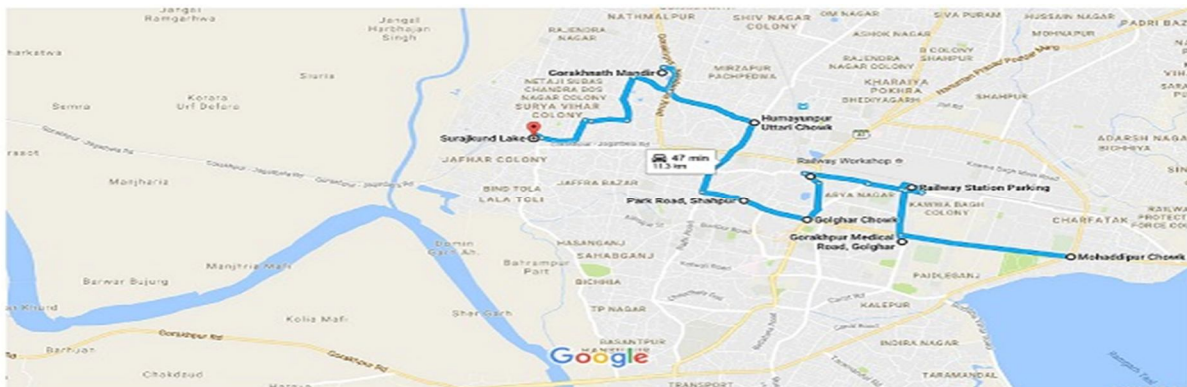


Fig. 1 Location Map

C. Data Collection

- 1) The noise at the specified locations is noted for duration of ten minutes.
- 2) In the specified locations sound level was taken either at the separator or on bank of the road.
- 3) The sound pressure level at a specified location was noted for 3 times during the day (e.g. morning, noon, evening) and during night time at (5 a.m. to 6 a.m.)
- 4) A weighted scale is chosen in the sound level meter.

D. Measurement of Noise Pollution

The intensity of sound is measured in sound pressure levels (SPL) and common unit of measurement is decibel dB. Noise level is measured in the A weighted SPL abbreviated dB (A). This scale resembles the audible response of human ear. A weighted scale covers (sound frequencies from 800 to 3000 Hz).

If sound levels are measured in terms of pressure then sound pressure level (SPL) is given by-

$$L_p = 20 \log_{10} \left(\frac{P}{P_0} \right) \text{ dB(A)}$$

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Here, L_p is measured against a standard reference pressure, $P_0 = 2 \times 10^{-5} \text{ N/m}^2$ which is equivalent to zero decibels.

L_{eq} Concept (equivalent noise level)

L_{eq} is that statistical value of sound pressure level that can be equated to any fluctuating noise level. Thus, L_{eq} is defined as the constant noise level which over a given time expands the same amount of energy as is expanded by fluctuating levels over the same time, this value is expressed by the equation-

$$L_{eq} = 10 \log \sum_{i=1}^n (10)^{\frac{l_i}{10}} * t_i$$

E. Limitations of noise pollution level as per set by CPCB

TABLE I
 AMBIENT NOISE STANDARDS.

Area Code	Category of Area/Zone	Limits in dB*	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

IV. CALCULATIONS

Calculations are done as formula described above

TABLE II
 CALCULATIONS OF DATA READINGS

SN	SAMPLING STATION	DATE	DAY TIME OBSERVED Leq dB(A)				NIGHT TIME OBSERVED Leq dB(A)		DIFFERENCE BETWEEN MINIMUM NOISE LEVEL AND MAXIMUM NOISE LEVEL dB(A)	ACCEPTED NOISE LEVEL dB(A)	DIFFERENCE BETWEEN ACCEPTABLE NOISE LEVEL AND MAXIMUM NOISE LEVEL dB(A)
			Maximum Observed Leq dB(A)		Minimum Observed Leq dB(A)		Observed Leq dB(A)				
			Time	Leq	Time	Leq	Time	Leq			
1	MOHADDIPUR CHOWK	6/11/2016	15-16	81.43	21-22	74.29	5-6	61.83	19.6	65	16.43
2	BUS STATION	6/11/2016	14-15	83.08	21-22	72.53	5-6	71.22	10.58	65	18.08
3	RAILWAY STATION	6/11/2016	15-16	82.67	21-22	68.94	5-6	65.89	13.73	65	17.67
4	DHARAMS HALA BAZAR	6/11/2016	18-18	83.49	21-22	71.78	5-6	60.33	11.71	65	18.49
5	GOLGHAR CHOWK	6/11/2016	18-19	85.31	21-22	75.52	5-6	62.81	9.81	65	20.31
6	VIJAY CHOWK	6/11/2016	18-19	83.91	21-22	74.08	5-6	61.09	9.83	65	18.91

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7	TARANG CROSSING	6/11/20 16	17- 18	82.44	21-22	71.9 3	5-6	59.98	10.51	65	17.44
8	HUMAYUP UR	6/11/20 16	17- 18	81.78	21-22	68.3 1	5-6	59.83	13.47	65	16.78
9	GORAKHN ATH	6/11/20 16	10- 11	85.12	21-22	70.5 7	5-6	64.20	14.55	65	20.12
10	SURAJ KUND	6/11/20 16	16- 17	82.32	21-22	62.4 9	5-6	57.76	19.83	55	17.32

V. RESULT AND DISCUSSION

Result shows that at every station of measurement the noise level is much higher than the standard limits as per set by CPCB (Central Pollution Control Board). Hence effective measures are urgency in these areas of Gorakhpur city. As data recorded on date 06/11/2016 was a holiday, on the occasion of Chhath puja. Thus the noise level recorded was more than that of normal days. But the exceeded noise levels were too much higher hence urgent and effective measures must be taken for the control of noise pollution in Gorakhpur city.

Noise in recent years has emerged as one of the important pollutants of environment. In fact, it needs some legislation for its control like the Air Pollution act and Water Pollution Act but no legislation for it has yet been enacted despite the fact problem of noise is, in no way, less delicate than the problem of air and water pollution. No doubt, there are some central and state enactments which directly or indirectly relate to the problem of noise; however, there is no specific legislation in India as in some other countries to meet the growing challenges of noise pollution on national level.

Noise of dhol, dhapli, bigul and shankh has been in the root of our Indian Culture. There is hardly any religious ceremony or festival in India being performed without any noise. But due to the rapid growth of urbanization and industrialization, noise has become a serious challenge to the quality of life of the people in most of the industrialized countries. Noise has rather become a permanent feature in the normal life of the people. The noise carries its adverse effects on human health, animals and birds by way of causing various health hazards. Thus noise is poised to challenge to human survival.

A new problem of noise pollution emerged in recent years in India is an outcome of the indiscriminate use of loudspeakers. Its indiscriminate use from religious places and in performance of religious ceremonies and discourses sometimes makes it so difficult for the people to enjoy their basic freedoms with all human dignity. No doubt in India, enactments for environmental protection exist, but the gravity of the problem of noise pollution has not yet been realized by the Government. However, noise has been included within Section 2 of the *Air Pollution Act* and further under section 6(b) of the *Environment Protection Act* enabling the Central Government to enact the rules for the control of noise pollution. In pursuance thereof the Government notified *Ambient Air Quality Standards* in respect of noise. The Central Pollution Control Board has also approved Noise Standards for different sources of noise, which have not yet been notified by the Government.

Motor Vehicle Act, 1939 Under the Motor Vehicles Act, State governments are competent to make rules for the upkeep of the motor vehicles and control of noise produced by them. The rules framed under the Act have empowered certain executive officers to take appropriate action against the persons violating the rules. These rules prohibit the use of certain types of horns⁹ and also provides that at certain places like hospitals, schools etc., horns cannot be used. Similarly, all vehicles are required to use silencers so that the level of noise can be reduced at source.

Article 51-A (G) reads: "It shall be the duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wild life and to have a compassion for living creatures." It will not be possible to produce any tangible results by merely passing of laws, constituting boards and fixing noise levels. The acceptance and effectiveness of all these measures depend, in the first place, on public awareness of the detrimental effects of noise and various remedies available to control it. People's involvement and active co-operation is essential for the success of any or all the programmes directed towards securing pollution-free environment. For seeking and securing public co-operation, to make natural environment a people's movement, the following measures will prove effective:

- A. Education of dangerous consequences of noise pollution through mass media like cinema, Radio, television and public relation departments of the Government.
- B. Making the people award of the various legal and other remedies available to them for the control of noise pollution.

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- C. Involving the people actively in the environmental protection movement through educational and social organizations.
- D. Encouraging and financing the social organizations engaged in the protection of the environment.

VI. CONCLUSION AND RECOMMENDATION

The analysis of data has revealed that the observed noise levels along all the highway corridors of namely SH-01 and SH-81 Gorakhpur city are alarmingly high. Hence the steps need to be taken for the control of noise by the prescribed authority. For traffic regulation purposes directed towards noise control, the restrictions on traffic flow and speed can be planned especially along the noisy highway corridors that are located in the vicinity of cities and urban areas, using the outcome of this study. Improvement in pavement surface may also be helpful in reducing the noise. Noise barriers like vegetation along the roads can be quite useful for the areas located in the neighborhood on the two sides. They are probable the single most effective weapon in retrofitting an existing roadway, and commonly, can reduce adjacent land use sound levels by up to ten decibel or so. In view of the same, the outcome of the study may be of immense help in traffic planning and environmental assessment of the highway projects especially with respect to traffic noise. It is recommended that traffic noise assessment should be taken up along all the highway of the country on priority with a view to ascertain the status of noise pollution in the adjoining areas and the effect on human health.

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