A STUDY OF NOISE IN VARANASI CITY, UTTAR PRADESH (INDIA) Rohit Patel^{*1}, Dr. Govind Pandey²

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The current study point out that Varanasi city is suffering from very soaring level of noise pollution as compare to standard given by Central Pollution Control Board (CPCB), New Delhi. From this study it was observed that the places which must be quiet are also in the grip of noise. The main causes of high noise level in Varanasi city are traffic, population, and indiscipline among the public because of not following Noise Act along with the rules and regulations made by the government. Due to this purpose present study was made at various locations of silent zone, residential zone and commercial zone with Sound Level Meter to calculate the day and night sound level. Varanasi city is one of the famous city of Uttar Pradesh (U.P), so an effort has been made in the city of Varanasi to calculate noise level at these locations and also remedial measures which must be taken to reduce this noise pollution in the city.

INTRODUCTION

People have huge misconception between sound and noise both are interrelated, sound is a form of energy which is emitted by vibrating bodies and travel in definite medium which received by the nerves creates a sensation of hearing. Noise is defined as unwanted sound and is a waste energy. The word noise is derived from Latin word "nausea" implying 'unwanted sound' or 'sound that is loud, unpleasant and unexpected'. Noise produces direct and cumulative adverse effects that weaken health and that degrade residential, social, working, and learning environment with corresponding real (economic) and intangible (well-being) losses. Noise in big cities is considered by World Health Organization (WHO) to be the third most hazardous type of pollution, right after air and water pollution (WHO, 2005). Generally , high exposure to noise level can cause feeling of annoyance and irritation , damage to auditory mechanism , number of health related issues like physiological disorder , psychological disorder , disturbance to daily activities and performances , hypertensions and schematic heart diseases. It interferes with sleep, concentration, communication, recreation, vegetation, animals and birds. The noise pollution is 'slow and subtle killer', but very little effort has been made to rectify it.

Increasing number of vehicles, musical instruments, industries urbanization, population explosion are considered as main causes of noise pollution but indiscipline among the public is more responsible for ambient noise overall. It is more severe and widespread than ever before, and it will continue to increase in magnitude unless everyone is aware about its effects. Thus may not be seem to be, but it definitely disturbs our whole system and often we become a part of it knowingly or unknowingly. Varanasi, being an important city in Eastern UP, happens to be the focal point of major business, commercial, industrial and other activities in the region

SITE DESCRIPTION

Varanasi also known as Benares, Banaras, or Kashi, is a city on the bank of Ganges in Uttar Pradesh, North India, 320 km south-east of the state capital, Lucknow, 121 km east of Allahabad. The spiritual capital of India, it is the holiest of the seven sacred cities (sapta puri) in Hinduism and Jainism, and played an important role in the development of Buddhism. Varanasi lies along National Highway 2, which connect it to Kolkata, Kanpur, Agra, and Delhi, and is served by Varanasi Junction and Lal Bahadur Shastri International Airport.

2.1 Geography

Varanasi is located at the eastern part of the state of UttarPradesh .It is located at an elevation of 80.71 meters (264.8 ft) in the centre of the Ganges Valley of North India. Varanasi having longitude and latitude 82.9739^oE and 25.3176^oN respectively having total area 1550 sq km with population 3,682,194.

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2.2 Climate

Varanasi experiences a humid subtropical climate (Koppen climate classification Cwa) with large variations between summer and winter temperatures. The dry summer starts in April and lasts until June, followed by the monsoon season from July to October. The temperature ranges between 22 and 46° C (72 and 115° F) in the summer. Winters in Varanasi see very large diurnal variations, with warm days and down-right cold night. Cold wave from the Himalayan region cause temperature to deep across the city in the winter from December to February and temperature below 5° C (41° F) are uncommon. The average annual rainfall is 1,110mm (44in). Fog is common in the winter, while hot dry winds, called loo, blow in summers. In recent years the water level of the Ganges has decreased significantly; upstream dams, unregulated water extraction, and dwindling glacial sources due to global warming may be to blame.

2.3 Notable Landmarks

Apart from the 19 archeological sites identified by the Archeological Survey of India, some of prominent places of interest are the Aghor Peeth, the Alamgeer Mosque, the Ashoka Pillar, the Bharat Kaala Bhawan (Art Museum), the Bharat Mata Temple, the Central University for Tibetan Studies, the Dhanvantari Temple, the Durga Temple, the Jantar Mantar, the Kashi Vishwanath Temple, the Sankat Mochan Hanuman Temple, the Mahatma Gandhi Kashi Vidyapith, the New vishwanath Temple on the BHU campus, the Ramnagar Fort, the Riverfront Ghats, the Tulsi Manas Temple.

I. TABLE 1: GENERAL INFORMATION ABOUT VARANASI					
A. TOTAL AREA	<i>B.</i> 1535 SQ. KM				
C. TOTAL POPULATION	D. 3,682,194				
E. URBAN POPULATION	F. 1260570				
G. RURAL POPULATION	Н. 1878100				
I. LITERACY	J. 77.05%				

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K. MALE LITERACY	<i>L</i> . 85.12%
M. FEMALE LITERACY	<i>N</i> . 77.05%
O. VEHICLE REGISTRATION	<i>P</i> . UP 65
<i>Q</i> . TELEPHONE CODE	<i>R</i> . 0542
S. TIME ZONE	<i>T</i> . IST (UTC+5:30)
U. SEX RATIO	<i>V</i> . 926

PERMISSIBLE STANDARDS

The increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological well being of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise. In no case ambient noise level should exceed following limits.

TABLE 2:	NOISE	LEVEL S	TANDA	RDS IN SO	OME CO	DUNTRIE	S AND V	VHO
	INDU	STRIAL	СОММ	ERCIAL	RESID	ENTIAL	SILEN	T ZONE
COUNTRY	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
AUSTRALIA	65	55	55	45	45	35	45	35
INDIA	75	70	65	55	55	45	50	40
JAPAN	60	50	60	50	50	40	45	35
US	70	60	60	50	55	45	45	35
WHO	65	65	55	55	55	45	45	35

Note:

- ✓ Day time shall mean from 6.00 a.m. to 10.00 p.m.
- ✓ Night time shall mean from 10.00 p.m. to 6.00 a.m.
- ✓ 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.

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- Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.
- ✓ dB (A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.
- \checkmark Leq: It is energy mean of the noise level over a specified period.

SEVERAL LEGISTATVE POINTS

The increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological well being of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise. 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.

- A. Restrictions on the use of horns, sound emitting construction equipments and bursting of fire crackers:
 - No horn shall be used in silence zones or during night time in residential areas except during a public emergency.
 - Sound emitting fire crackers shall not be burst in silence zone or during night time.
 - Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.
- B. Restrictions on the use of loud speakers / public address system and sound producing instruments:
 - A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.
 - A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.
 - Notwithstanding anything contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address system and the like during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all during a calendar year. The concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.
 - The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower
 - The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB (A) the ambient noise standards specified for the area in which it is used.

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C. Complaints to be made to the authority:

- A person may, if the noise level exceeds the ambient noise standards by 10 dB (A) or more given in the corresponding columns against any area/ zone or, if there is a violation of any provision of these rules regarding restrictions imposed during night time, make a complaint to the authority.
- > The authority shall act on the complaint and take action against the violator in accordance with the provisions of these rules and any other law in force.

D. Consequences of any violation in silence zone / area:

Whoever, in any place covered under the silence zone / area commits any of the following offence, he shall be liable for penalty under the provisions of the Act.

- > Whoever, plays any music or uses any sound amplifiers,
- Whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument, or
- > Whoever, exhibits any mimetic, musical or other performances of a nature to attract crowds.
- > Whoever, bursts sound emitting fire crackers; or
- Whoever, uses a loud speaker or a public address system.

INSTRUMENT & METHODOLOGY

Noise level is being measured by a digital electronic instrument called Noise Level meter (Make Bruel and Kjaer, Denmark 2232). Type 2232 is an instrument for making community noise surveys and less demanding acoustic measurements the meter is robust, compact and lightweight (460 g), and is suitable for environmental health inspectors and other personnel concerned with maintaining acceptable noise levels in industrial and residential locations. Its basic parts include a microphone, amplifier, weighting network and a display reading in decibel (1/10th part of "bel", unit of sound). The reading was taken in such a way that following two conditions should be fulfilled.

- 1. Instrument was 1.2 to 1.5merte above the ground level.
- 2. Instrument was 1 metre away from chest



Figure- 2: Bruel kjaer 2232

The data has been collected for overall 10 h on the respective day at the selected sites. The time being selected the most prior ones: around 5 a.m. to 6 a.m., 8 a.m. to 9 a.m., 9 a.m. to 10 a.m., 10 a.m. to 11 a.m., 2 p.m. to 3 p.m., 3 p.m. to 4 p.m., 5 p.m. to 6 p.m., 7 p.m. to 8 p.m. and 10 p.m to 11 p.m. The time has been selected so as to cover most part of the day, from pleasant mornings followed by noisy day to silent night. The reading have been taken at the given hours for 10 min duration at fixed intervals of 15 sec, so as to gives near about 40 readings for each observation hours. Later on, calculations have been done using following formula.

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w. $Leq = 10 \times Log \sum_{i=1}^{n} 10^{Li/10} \times ti$

Where,

n = total no of sound samples

 $L=_i$ noise level of any ith samp

 t_i = time duration of i^{th} sample expressed as fraction of total time sample

RESULTS & DISCUSSION

These noise levels are recorded in different areas of Varanasi city comprising of different zones which are silent zone, residential zone and commercial zone respectively. The ranges of noise level in all these areas of Varanasi are much higher than the permissible limit as per the standards in each zone.

CASE 1: SILENT ZONE

Permissible noise limits of the silent zone are 50 dB in the day time and 40 dB in the night time. But noise levels at all the areas were found to exceed and major reason behind this is transportation and neighborhood noise.

- Noisiest observation site is Dindayal Hospital area with night noise 188.67% of the permissible limit and the day noise also very high 157.10% of the permissible limit.
- Least noisy site is Sunbeam Varuna School with noise 151.38% of permissible limit in the day time and SS Public School with 155.68% of the permissible limit in the night time but still it is not avoidable.

CASE 2: RESIDENTIAL ZONE

Permissible noise limits of the residential zone are 55 dB in the day time and 45 dB in the night time. The major sources are mainly domestic, loudspeakers and automobiles.

Noisiest site is Khajuri with night noise of 199.11% of permissible limit while Babatpur area is least noisy in day as well as night time but still not under permissible limit.

CASE 3: COMMERCIAL ZONE

Permissible noise limits of the Commercial zone are 65 dB in the day time and 55 dB in the night time. Generator, traffic jamming, disruptive behavior and over commercialization were major causes for the high noise pollution.

Noisiest area is Godaulia with day noise level of 161.57% of permissible limit while Rathyatra has minimum value in day time, 122.58% of permissible limit.

		Table 3: Res	ult of Silent Zor	ie		
S.		Ranges of Noise Lev	vel (in dB)	Compari	son of Max.	Whether
No.				Noise Lev	el with CPCB	in Limit?
	Site	Limit (in %) (Yes/				
		In Day Hours	In Night	Day	Night Hours	
			Hours	Hours	(40dB)	
				(50dB)		
1	BHU CAMPUS	82.22-88.67	40.19-68.94	177.34	172.35	No
2	SAMPURNANAND	70.17-77.73	48.66-69.97	155.46	174.93	No
3	DINDAYAL	69.87-78.55	47.52-75.47	157.10	188.67	No
	1		1			

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	HOSPITAL					
4	MGKVP	74.62-85.68	37.81-70.43	171.36	176.08	No
	UNIVERSITY					
5	SUNBEAM	51.97-75.69	38.78-70.81	151.38	177.03	No
	VARUNA					
6	GNES SCHOOL	64.73-81.07	52.57-74.27	162.14	185.67	No
7	SS PUBLIC	56.46-79.54	35.40-62.27	159.08	155.68	No
	SCHOOL					

Note: %=(Max. Leq/Permissible Noise Limit) ×100; Day hour is 6 am to 10 pm; Night hour is 10pm to 6 am.



		Table 4: Resu	lt of Residenti	al Zone		
S. No.		Ranges of No	oise Level (in	Comparison of	Whether	
	Site	dB)		Level with Cl	in Limit?	
				%)		(Yes/No)
		In Day	In Night	Day Hours	Night Hours	
		Hours	Hours	(55dB)	(45dB)	
1	BABATPUR	51.20-72.86	37.81-50.33	132.47	111.84	No
2	SHIVPUR	54.09-73.71	36.29-55.14	134.02	122.53	No
3	SIKRAUL	69.52-76.99	35.95-56.69	139.47	125.98	No
4	CHANDMARI	74.27-85.75	59.57-80.29	155.90	178.42	No
5	KHAJURI	71.46-	55.28-88.25	182.67	199.11	No
		100.47				
6	RAJA TALAAB	54.69-90.70	38.43-78.24	164.90	173.87	No
7	BHAGWANPUR	68.46-85.28	39.36-80.56	155.05	179.02	No
Note: %=(am.	Max. Leq/Permissible	Noise Limit) ×1	00; Day hour is	s 6 am to 10 pm	i; Night hour is 1	0pm to 6

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S. No.	<u>.</u>	Ranges of Noise Level (in dB)		Comparison Level with C	Whether in Limit?	
	Site	In Day Hours	In Night Hours	Day Hours (65dB)	Night Hours (55dB)	(Yes/No)
1	ARDALI BAZAR	86.22-96.45	68.62- 72.24	148.38	131.35	No
2	NADESAR	70.88-91.63	52.99- 78.26	140.96	142.29	No
3	SIGRA	77.38-90.88	58.73- 80.78	139.82	146.87	No
4	GODAULIA	88.27- 105.02	65.84- 73.82	161.57	134.22	No
5	MAHMOORGANJ	78.35-90.82	40.18- 75.74	139.72	137.71	No
6	RATHYATRA	67.43-79.68	37.81- 68.43	122.58	124.42	No
7	MALDAHIYA	75.43-87.89	46.89- 77.67	135.22	141.22	No
8	DLW	55.96-80.75	36.52- 76.24	124.23	138.62	No

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CONCLUSION & CONTROL MEASURES

The study revealed that noise level reached an alarming level in Varanasi city. All selected areas of the city have a higher level of noise than the prescribed limits of CPCB. The usage of more number of personal vehicles and inadequate public transport leading to frequent traffic jams is one of the major source of noise. The noise in all the areas of Varanasi city is severely higher and therefore suitable remedial measures need to be adopted immediately in the city before it is too late. Here are some control measures.

- Reducing the noise levels from domestic sectors, the domestic noise coming from radio, tape recorders, television sets, mixers, washing machines, cooking operations can be minimized by their selective and judicious operation. By usage of carpets or any absorbing material, the noise generated from felling of items in house can be minimized.
- Maintenance of automobiles, regular servicing and tuning of vehicles will reduce the noise levels. Fixing of silencers to automobiles, two wheelers etc., will reduce the noise levels.
- Control over vibrations, the vibrations of materials may be controlled using proper foundations, rubber padding etc. to reduce the noise levels caused by vibrations
- > Speaking at low voices enough for communication reduces the excess noise levels.
- Prohibition on usage of loud speakers, by not permitting the usage of loudspeakers in the habitant zones except for important meetings / functions. Now-a-days, the urban Administration of the metro cities in India is becoming strict on usage of loudspeakers.
- Selection of machinery, optimum selection of machinery tools or equipment reduces excess noise levels. For example selection of chairs or selection of certain machinery/equipment which generate less noise (Sound) due to its superior technology etc. is also an important factor in noise minimization strategy.

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- Maintenance of machines, proper lubrication and maintenance of machines, vehicles etc. will reduce noise levels. For example, it is a common experience that, many parts of a vehicle will become loose while on a uneven path of journey. If these loose parts are not properly fitted, they will generate noise and cause annoyance to the driver/passenger. Similarly is the case of machines. Proper handling and regular maintenance is essential not only for noise control but also to improve the life of machine.
- Apart from the above authorized 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.
- More research and development seems to be needed in this area, followed by more and more surveys along with more scientific methods of noise control shall be employed.

Generally ignored, noise pollution adversely affects the human being leading to annoyance, loss of concentration, loss of hearing, physiological effects (like breathing amplitude, blood pressure, heart-beat rate, pulse rate, blood cholesterol level), sleeplessness 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 and contributes to its control. It is crucial time and everyone should play his part in restriction of the noise pollution.

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