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Measurement of Noise level of Bharuch city

Jini Sunil

Lecturer, Department of Environment Engineering, Shri K. J. Polytechnic, Bharuch, Gujarat, India

ABSTRACT: Noise pollution is underrated mostly due to the fact that it can neither be seen, smelled nor touched. But the effects of Noise pollution on human health has been profound and WHO (World Health Organisation) has recognized it has the third hazardous threat to earth after air and water pollution. Noise pollution of urban area is increasing day by day due to increase in vehicular traffic and industrialization. To study the effect of noise pollution or for that matter any pollution the first step is to quantify the pollutant. So an attempt has been made through this paper to publish the results of a survey conducted to measure the noise level in Bharuch city of Gujarat state in India.

KEYWORDS: Noise Pollution, Regulatory guideline for noise pollution, Noise Survey

I. INTRODUCTION

Pollutant is a term used to denote a substance introduced into our natural environment that has a potential to cause harm to the living and non living constituents of our ecology. The pollutant may be a chemical substance when introduced into air causing air pollution, when introduced into water causing water pollution or when introduced into land causing land pollution or issues of solid waste management. The pollutant may also be in the form of energy causing noise pollution, thermal pollution or radiation pollution. Noise pollution is underrated mostly due to the fact that it can neither be seen, smelled nor touched. But the effects of Noise pollution on human health has been profound and WHO (World Health Organisation) has recognized it has the third hazardous threat to earth after air and water pollution. Noise pollution of urban area is increasing day by day due to increase in vehicular traffic and industrialization. To study the effect of noise pollution or for that matter any pollution the first step is to quantify the pollutant. So an attempt has been made through this paper to publish the results of a survey conducted to measure the noise level in Bharuch city of Gujarat state.

Bharuch city is situated on the banks of river Narmada in western part of Gujarat covering an area of nearly 35 square kilometer. It is house to many industries and is known as chemical hub of Gujarat state with a population of 168729 according to 2011 census. The increasing industrialization and increasing population has added to the noise level of the city.

II. RELATED WORK

Let us get familiarized with noise pollution first. Any unwanted sound may be termed as noise. So to understand noise we have to first understand what is sound. Sound is energy in the form of wave emitted by a vibrating body. It is a longitudinal wave and requires a medium to travel. The medium may be liquid, solid or gas. But sound cannot propagate in vacuum. Sound can be characterized as loud, soft, high pitched or low pitched. Amplitude decides whether the sound is loud or soft. Frequency of sound decides whether it is high pitched or low pitched.

Sound can be measured in Hertz or decibels. Hertz measures the frequency of sound and precisely it is a measure of number of cycles per second. If the frequency of sound is increased we get high pitched sound and if frequency is decreased we get low pitched sound. A sound wave with high frequency has shorter wavelength and a sound wave with low frequency has longer wavelength. Intensity of sound can be termed as the amount of energy transmitted in unit time through unit area. In other words it is power transmitted per unit area. Sound intensity is often specified as ratio. Unit of intensity is bel which is named after the famous scientist Alexander Graham Bell. Human ears are so sensitive that it can detect a sound as small as one tenth of a bel. Therefore sound is measured in decibel. A decibel is 10 times the logarithm to the base 10, of ratio of intensity of sound wave to a reference intensity. So the unit decibel is a relative

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unit and not an absolute one. Intensity of sound wave depends on pressure. And sound has to be measured against a reference intensity or pressure. Generally sound in air is measured with a reference pressure higher than 20 micro pascals and 1 micro pascal for underwater sound. So same value of dB measured under water will be different from that measured in air. Human beings can hear sound with a frequency between 20 Hz to 20000 Hz. Sounds of frequencies less than 20 HZ are called infrasonic sound and greater than 20,000HZ are the ultrasonic. It is observed that continuous exposure to noise levels more than 70 dB can lead to permanent hearing damage.

III. REGULATORY GUIDELINES

Paying heed to the effect of noise pollution on human health and psychological well being of people it became necessary to regulate the noise levels from various sources like industrial activity, construction activity, fire crackers, sound producing instruments, loud speakers and public addressing systems. The central government framed Noise Pollution (Regulation and Control) rules in year 2000. Under these rules the state government was given the powers to categorize the areas into industrial, commercial, residential or silence zones for the purpose of implementation of noise standards for different areas.

Indian standard for ambient noise levels are listed in the below table:-

Sr. No	Area category	Limit in dB (A) Leq	
		Day Time	Night Time
1	Industrial area	75	70
2	Commercial area	65	55
3	Residential area	55	45
4	Silence area	50	40

Table 3.1 standard for ambient noise levels

* 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.

Leq: It is energy mean of the noise level over a specified period.

Source: CPCB Noise rules 2000

IV. HEALTH EFFECTS OF NOISE

Listed below are some of the health effects of Noise Pollution

- Annoyance: A person subjected to irregular noise for a long period will become annoyed.
- Physiological effects: loud sounds will cause breathing, heart beat and pulse rate to increase.
- Deafness: A person subjected to loud noise for a longer duration will suffer hearing loss and in the long run may become deaf.
- Loss of concentration: A person will not be able to concentrate properly on his work if he is subjected to noise and thus his performance and workmanship gets affected.
- Insomnia: A person subjected to noise will have a restless mind and will suffer from inability to sleep leading to the disease called insomnia.

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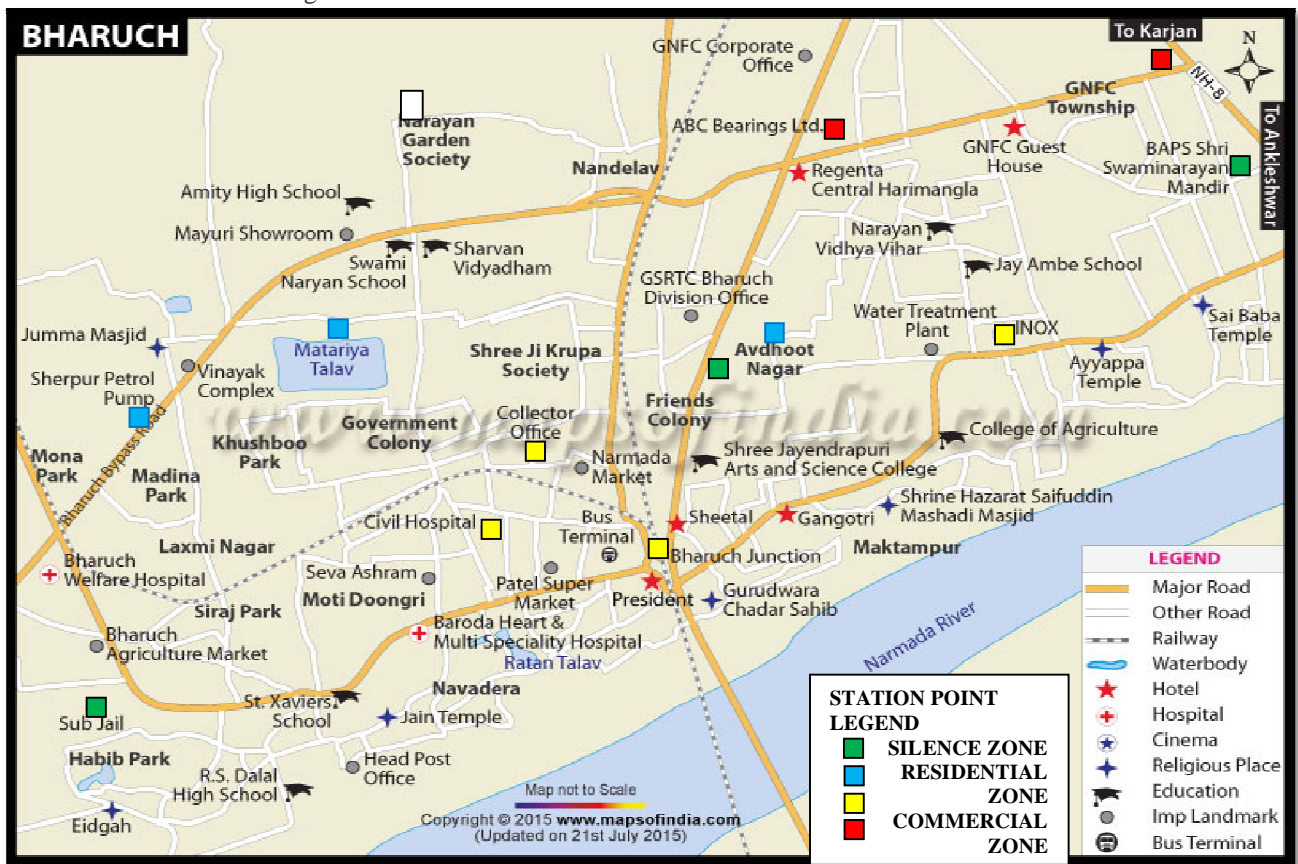
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V. METHODOLOGY OF NOISE SURVEY

A survey was conducted to measure the noise level of Bharuch city. For this purpose survey stations were first identified according to various zones like residential, commercial, industrial and silence zone. Total of 12 stations were identified as shown in the figure.



The location of different station points are depicted in the below table

Sr. No.	Zone	Station Point	Position in latitude and longitude
1	Silence	Shree K.J. Polytechnic college	N=21.714075 E=73.003485
2	Silence	Sub Jail	N=21.695414 E=72.967629
3	Silence	BAPS Zadeshwar	N=21.725716 E=73.032475
4	Residential	Avdhoot Nagar	N=21.715018 E=73.006554
5	Residential	Sherpura Petrol pump	N=21.711404 E=72.970848
6	Residential	Matariya Talav	N=21.716128

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			E=72.982178
7	Commercial	Collector Office	N=21.709181 E=72.990804
8	Commercial	Civil Hospital	N=21.703678 E=72.990621
9	Commercial	Railway Station	N=21.704157 E=72.999376
10	Commercial	INOX Cinema	N=21.715550 E=73.018227
11	Industrial	ABC Enclave	N=21.727560 E=73.008453
12	Industrial	GNFC	N=21.730879 E=73.028076

Table 5.1 Geographical location of station points

An android application named “noise meter” 3.8.2 was used for the survey after calibrating the application with sound meter AZ8928 available at an environment consultancy laboratory located in Bharuch. Readings were taken at these stations during day time and night time and for a working day and holiday for a period ranging from August to October 2016. The readings are as follows

Day Reading Table:- Readings were taken at daytime on a working day for all 12 stations and minimum, maximum and average readings were noted for dB, Peak dB and Leq. Table 5.2 denotes the readings taken and corresponding observations.

SR NO.	MONITORING STATION	DATA									REMARKS
		dB			Peak dB			Leq			(Within permissible limit or not as per regulatory guidelines)
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	
1	K.J.Polytechnic	43.6	70	52.7	56.3	86.3	67.1	49.9	62.6	54.2	Over perm. limit
2	Sub Jail	36	74	47	53.1	90.3	66.2	55.4	55.47	47.9	Within perm. limit
3	Baps Zadeshwar	55.9	70.3	63.3	68.3	90.2	77	66.1	67.7	63.8	Over perm. limit
4	Avdhoot Nagar	28.6	76.9	57	47.1	90.3	73.8	60.2	54.2	60.2	Over perm. limit
5	Sherpura Petrol Pump	53.1	77.8	65.3	68.6	96.3	81.6	65.8	69.6	66.8	Over perm. limit
6	Matariya Talav	41.4	70.4	45.5	54	90.3	59.7	44.7	53.4	47.6	Within perm. limit
7	Collector Office	49.8	72.8	55.9	64	90.3	72.0	59.6	61.8	58.8	Within

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											perm. limit
8	Civil Hospital	45.6	72.9	53.7	60.3	90.3	69.7	54.9	58.8	55.2	Within perm. limit
9	Railway Station	47.8	79.9	59.9	61.3	90.3	74	63.4	65.8	63.6	Within perm. limit
10	INOX Cinema	49.2	70.8	61	61.4	90.4	76.2	57.7	67.4	62.8	Within perm. limit
11	ABC Enclave	53.2	70.6	60.9	66.3	90.1	74.4	59.4	64.5	61.6	Within perm. limit
12	GNFC	50.9	69.1	57	62.9	83.1	70.4	57.6	62.9	58.6	Within perm. limit

Table 5.2 Noise level reading of Day

Holiday Reading Table :- Readings were taken at daytime on a holiday for all 12 stations and minimum, maximum and average readings were noted for dB, Peak dB and Leq. Table 5.3 denotes the readings taken and corresponding observations.

Sr No	Monitoring Station	Data's									REMARKS
		dB			Peak dB			Leq			(Within permissible limit or not as per regulatory guidelines)
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	
1	K.J. Polytechnic	42.3	68	46.9	62.9	90.3	61.2	45.3	50.8	48	Within perm. limit
2	Sub Jail	33	66	40.7	46.9	90.3	57.0	41.6	51.8	43.0	Within perm. limit
3	Baps Zadeshwar	19.5	63.7	45.9	41.6	90.3	64.9	23.8	58.8	51.4	Over perm. limit
4	Avdhoot Nagar	40.7	14.6	54.2	55.6	71.2	61.5	55.0	64.9	56.6	Over perm. limit
5	Sherpura Petrol Pump	49.6	70.5	61.4	61.3	85.7	74.8	61.1	65.8	63.0	Over perm. limit
6	Matariya Talav	36.9	77.4	50.1	51.5	90.2	67.6	41.5	64.5	55.4	Over perm. limit
7	Collector Office	45.4	75.3	53.0	59.6	90.3	69.7	51.4	60.5	55.0	Within perm. limit
8	Civil Hospital	47.1	87.1	61.4	59.4	87.1	68.8	55.0	61.9	55.9	Within perm. limit
9	Railway Station	41.8	75.9	61.4	55.5	90.3	71.7	54.1	62.2	58.1	Within perm. limit
10	INOX Cinema	41.6	83.1	57.3	55.3	90.3	73.7	51.1	61.3	61.6	Within perm. limit

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11	ABC Enclave	47.2	70.9	56	59.8	87.5	69.3	54.7	64.6	57.2	Within perm. limit
12	GNFC	40.8	79.7	52.8	59.4	90.2	69.8	57.3	69.1	56.0	Within perm. limit

Table 5.3 Noise level reading of Holiday

Night Reading Table:- Readings were taken at night for all 12 stations and minimum, maximum and average readings were noted for dB, Peak dB and Leq. Table 5.4 denotes the readings taken and corresponding observations.

Sr No	Monitoring Station	Data's									Remarks (Within permissible limit or not as per regulatory guidelines)
		dB			Peak dB			Leq			
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	
1	K.J. Polytechnic	42.5	68	52.4	55.6	90.3	67.8	50.4	65.9	54.6	Over perm. limit
2	Sub Jail	56.5	79.2	69.1	69.8	90.2	83.6	64.6	73	65.5	Over perm. limit
3	Baps Zadeshwar	39.6	77	58.1	53.1	90.3	74.5	55.1	68.4	61.1	Over perm. limit
4	Avdhoot Nagar	42.8	86.1	50.6	56.8	91.5	66.6	45.5	68.13	58.5	Over perm. limit
5	Sherpura Petrol Pump	52.2	71.8	64.6	65.1	87.2	77.8	62.5	71	65.8	Over perm. limit
6	Matariya Talav	35.9	72.4	50.9	49.2	90.3	66.4	50.4	64.6	53.6	Over perm. limit
7	Collector Office	41.4	70.5	56.6	54	88	72.5	51	62.8	58.9	Over perm. limit
8	Civil Hospital	42.3	75.5	55.3	57.1	90.3	70.6	51.4	62	58	Over perm. limit
9	Railway Station	44.6	83.8	56.3	57.4	90.3	71.5	76.3	90.3	62.8	Over perm. limit
10	INOX Cinema	45	72.3	48.6	58.7	87.8	64.7	47.9	58.1	50.3	Within perm. limit
11	ABC Enclave	48.4	80.7	60.1	61.9	90.3	75.8	64.7	71.8	68.0	Within perm. limit
12	GNFC	35.1	76.3	40.5	48.3	90.1	57.05	45.4	58.1	45.1	Within perm. limit

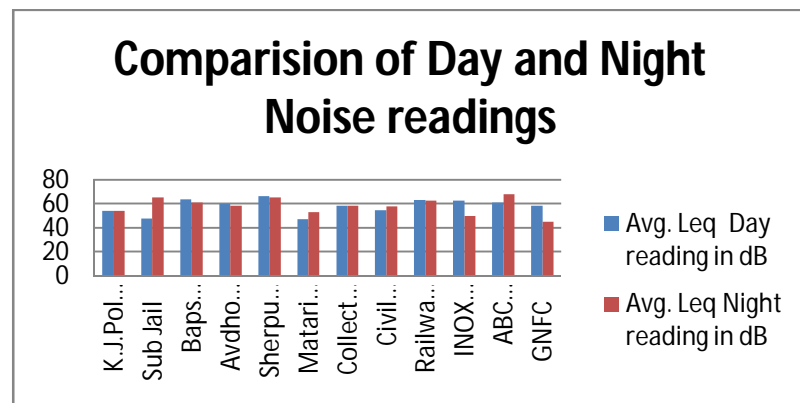
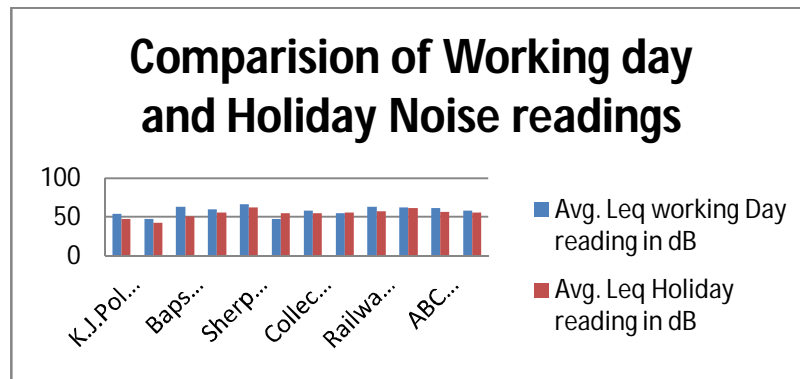
Table 5.4 Noise level reading of Night

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VI. CONCLUSION

The noise level in K.J. Polytechnic was almost similar during night and day. During night conversations of watchmen and vehicles horns from adjoining national highway were source of noise. This area comes under silence zone and noise level of day is over permissible limit. Also noise levels of night are greater than permissible limit

The noise level of day in Sub jail is higher at night in comparison to day. During day the noise was low as there was noises of just normal communication of peoples and routine activities of jail but during night time the noise level was high as the shift of policemen on duty was changing so noise also increased and provision of food to prisoners was reason for increased noise levels. The prayers sung on loud speakers in nearby mosque were also reason for increased noise level. This area comes under silence zone. The noise level during day is within permissible limit and the noise levels of night level are above permissible limit.

BAPS Zadeshwar also comes under silence zone but the traffic on adjoining National Highway is the main source of noise in this area. The noise levels of day and night both are above permissible limit.

Avadhootnagar and Sherpura petrol pump comes under residential zone and the noise levels of both day and night are above permissible limit.

The noise level of day was lower than that of night level at Matariya Talav due to adjoining park and playground. During day time no visitors were sited at park but during night hours the park was full of visitors which were reason for increased noise levels.

Collector office comes under commercial zone. The noise level of day and night at the Collector was almost similar. The noise level of day is within the permissible limit and that of night are above the permissible limit due to traffic on adjoining road.

Civil hospital comes under commercial zone. The noise level of day is within the permissible limit and that of night are above the permissible limit due to hospital activities.

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Railway station comes under commercial zone. The noise level of day is within the permissible limit but that of night are above the permissible limit due to trains.

Inox cinema comes under commercial zone. The noise levels of both day and night are within permissible limit.

ABC enclave comes under industrial zone. The noise levels of both day and night are within the permissible limit.

GNFC comes under industrial zone. The noise levels of both day and night are within the permissible limit.

So from the above observations it can be concluded that the silence zone and residential areas are being subjected to noise which is more than permissible limits. So the people living in the nearby areas will have health problems arising due to long term exposure to noise. Mitigative measures must be taken to counter this effect which can be in the form of noise reduction at source or interruption of transmission path of noise or by using personal ear protection. So this survey helped to identify the areas not confirming to permissible noise levels but more research and survey needs to be conducted to identify the source of noise and to suggest required mitigative measures.

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